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Computer-Aided Design AND APPLICATIONS

Application of Image Restoration Technology in the Score Analysis of Folk music

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Abstract. The development of modern folk music cannot be separated from computer-aided design. In the current teaching of ethnic music design, it is necessary to integrate teaching resources and expand ethnic music theory through technical means. Traditional music teaching methods cannot conduct digital teaching like computer-aided teaching. In order to continuously improve the teaching quality and provide assistance for more ethnic music majors to learn music. This article expounds several application problems of computer assisted folk music practice. In this paper, image restoration technology is used to study the scores of folk music, thereby playing a clear role in the relationship between various parts of folk music. Research shows that the method used in this article has the highest accuracy, with an average accuracy of 76.59%. Through the analysis of image restoration technology, it provides a reference for scholars to study and create folk music scores, and can have a deeper understanding of its development.

Keywords: image restoration technology; folk music; music score; cad music teaching
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1 INTRODUCTION

The production of printed music score recognition system can convert a large number of printed music scores into computer-readable data forms. This is similar to the existing engineering drawings and circuit diagrams automatically imported. Once the music score is stored electronically, it can be processed arbitrarily by some music software. For example, the printing of sales outlets for music structure analysis, the production of new music scores, and the production of braille music scores or large-scale music scores. In electronic publishing and many music studies, it is necessary to convert the original music score into computer-readable data [1]. It

effectively reduces the amount of data and is not affected by image bending and tilting. Common music scores are composed of five spectral lines. Although these five spectral lines should be parallel, horizontal, equispaced, uniform in thickness and continuous, this is not usually the case. The spectral line will be slightly inclined, bent, discontinuous and uneven in thickness, resulting in many simple spectral line positioning methods (such as projection method) that are not ideal. Score refers to the score of each musical instrument or each part recorded separately. Using information technology to develop students' knowledge and experience. Maba [2] uses computer-assisted music practice to evaluate the performance effect in real time and give timely feedback to help the performer adjust the performance method and music performance in time.

Xu and Zhao [3] introduced a personalized learning performance method. Computer-aided music practice can provide personalized practice mode and difficulty level according to learners' level and needs, and help learners learn and improve more efficiently. Diversified practice modes are also important contents of computer-aided music practice. Computer-aided can provide a variety of practice modes, such as playing mode, speed practice mode, skill practice mode, etc., to help learners comprehensively improve their performance skills. Gudek [4] believes that traditional music learning and practice require a large amount of time and money, while computer-assisted music practice can save costs and make music learning more popular and convenient, and the standard sampling is used as the purpose sampling in the data collection process of the study. Image restoration solution is an ill posed inverse process. The restored image is very sensitive to noise and model error. In image blind restoration, the target image and fuzzy kernel are approximate, and there are few exact solutions. At the same time, image processing technology and mathematical methods are inseparable. The continuous updating of image processing technology requires more complete mathematical methods, which promotes the development of the mathematical field. Therefore, it has very important research value to combine the image restoration technology with the folk music score image restoration.

Generally speaking, the influence of computer aided design strategy on education is better than other educational means. The use of music computer software can improve students' interest in learning and stimulate students' motivation for learning. Computer-aided design provides teaching means such as music cognition, skills and feelings, because most computer-aided design software provides cognitive systems related to music symbols and harmony analysis of music works. Students can use computers to learn various cognitive activities such as music analysis and modulation. In addition, by listening to the series of tunes, rhythms and chords, students are given the opportunity to practice the tone dictation, rhythm dictation and harmony dictation, thus developing their musical sense ability. The main research object of this paper is the folk music score image. When the music score image files are filed, sorted and numbered by image restoration technology, they shall be numbered volume by volume, piece by piece and page by page according to the requirements of the art collection scope, classification standard and arrangement sequence of the unit. Music score is a very important part of orchestra art. Generally, it is given a separate serial number and arranged separately. Through the image restoration technology in the image restoration research. It is found that if we can introduce the quality evaluation of folk music score image into the image restoration framework. A new active image restoration will be formed. Because no additional hardware is required, it is easy to integrate into the existing imaging system, which will greatly expand the application range of folk music score image restoration. Through the analysis of image restoration technology, it can provide reference for scholars to study and create folk music scores, and can have a deeper understanding of its development. As well as many ethnic music learners, when learning and studying different ethnic music scores, they can also make more comparison, analysis and integration with them.

The innovation of this paper

(1) In this paper, a computer aided automatic image restoration model of music score is established. In digital image processing, we often use constrained least squares image restoration method to restore degraded images. The image quality estimation is performed on the input image. If the quality of the image itself can meet the requirements, no restoration processing is

performed. The image with poor image quality is subjected to image restoration processing, and the restored image is output after image quality evaluation. If the image quality is improved after restoration, the restored image is output, otherwise the original image is output.

(2) The classification of folk music scores is analyzed. Folk music has an irreplaceable position. In production and life, music can be used as one of the forms of communication. In folk activities and sacrificial ceremonies, music is the best form of praying and helping. Therefore, while the music of the original ethnic group is historical at the beginning, the score occupies a very important position in it, and the folk music score also integrates the characteristics of the times.

The first section describes the background of computer-aided music teaching and points out its necessity. Section 2 provides appropriate analysis and teaching of the study of folk music scores. The classification model of music score under the guidance of computer is pointed out. Section 3 puts forward the research methods and studies the computer-assisted music score image restoration. Section 4 analyzes and summarizes the experimental results. Section 5 summarizes the full text. Computer-aided music practice can interact with learners, provide music theoretical knowledge, skill guidance, performance evaluation and other services, so that learners can better understand and master music skills.

2 RELATED WORK

Computer-aided music teaching has been applied in the field of music education in China since the end of the last century to promote the modernization of education with educational informatization. Using computer technology to change the traditional education mode has become a trend. With the rapid development of high technology, the CAI system has been continuously optimized and improved. The use of computer-assisted music teaching has been affirmed by the national higher music colleges and departments, and is still being promoted and popularized. In the solfeggio and ear training class, the rhythm and intonation of the solfeggio content produced by the computer are very accurate, and can be played at will according to the teachers' wishes and the students' proficiency. Its speed, tone and timbre can be changed at will. It avoids the monotonous training style and limited hearing materials that are often encountered when teaching with piano as a teaching aid. After using computers as teaching aids, ear training is no longer a single timbre. Teachers can use different timbres to play the same melody, thus strengthening students' ability to distinguish musical instruments and laying a good auditory foundation for their future participation in various singing, performance, ensemble and concerto. Music score is the carrier of recording music with symbols, the most precious wealth of the orchestra, and an important object in the collection of art archives. As an important medium in carrying forward national culture, Chinese folk music uses the art of "national language" and "native language" to achieve inheritance in its development, and promote the great prosperity and development of culture in the process of inheritance. Therefore, the following contents are some relevant conclusions drawn by scholars from some researches on folk music scores.

Ge et al. [5] studied the learning method based on feature analysis and the principle, method and technology of music classification. This paper proves the existing feature-based analysis algorithms, and attempts to apply feature-based analysis integration to music classification research. At last, a lot of numerical experiments and performance tests are carried out on the algorithm. Ng et al. [6] analyzed the teaching efficiency under different student states and summarized the content analysis content of different music structure. It also summarizes the framework of the network music teaching structure assisted by computer. Xu [7] has made extensive achievements in computer-assisted music practice and has been widely used in music learning and education. Including school music education, music training institutions, and personal music practice. Computer-assisted music practice can make music learning more efficient, convenient and personalized, and provide better learning and practice experience for music learners. Mabini et al. [8] believe that music score software can display notes, rhythm, instrument fingering and other information to help learners understand music score more intuitively. Music

score software can play music to help learners better understand the style, rhythm and performance skills. Let learners freely edit music scores, add notes, modify music, and improve learners' creativity and autonomy. Onofre and Ferry [9] conducted an experiment and found that music score software can evaluate learners' performance. It includes intonation, rhythm, speed and other aspects to help learners adjust their performance methods and improve their performance level in time. At the same time, it records the learning process: music score software can record the learning process and achievements of learners, including performance records, music score editing records, etc., to help learners better master music skills and progress. Yang et al. [10] found that music score software can help learners better learn and master music skills, and improve learning efficiency and level. In the field of music learning and education, music score software has become an important auxiliary tool. This provides learners with a more convenient, efficient and personalized learning experience. Used semiotics theory to study the performance text, music score text and diachronic and synchronic construction of traditional musi. Proposed that due to the appearance of music score, the relay of folk music process disappeared, and the beautiful melody of folk music creators was accurately recorded in the form of notes, thus making folk music move towards a wider space and region. People can "interpret" the music score whenever and wherever. The analysis and explanation of semiotics and artistic semantics on the inheritance and oral spread of Chinese folk songs and songs and dances, as well as the social and cultural functions of folk songs and dances. A scholar who made a preliminary exploratory study of music score in the context of social culture carried by folk songs, the creation and performance of folk songs, and the process of audience evaluation, aiming at the interactive relationship between Chinese traditional folk music and social and cultural functions.

3 METHOD

3.1 Principle and Model of Computer-Aided Music Score Image Restoration Technology

With the development of computer technology, music teaching has been greatly affected. The quality of music teaching will be greatly improved by using music computer aided system for music teaching. At the same time, the new digital teaching mode has been adopted to improve the teaching methods and methods of music. Computer-aided teaching refers to all kinds of teaching activities carried out by students in the form of dialogue. CAD courseware uses hypertext structure to organize information and provides students with multiple learning ways. It has rich information resources and can expand students' knowledge. The visual performance demonstration has promoted the comprehensive teaching level of teachers. It is impossible for the school to match all instruments, which makes the introduction of the characteristics and classification of instruments abstract and boring, and animation can be made to demonstrate the performance method or edit some of the performer's performance skills. In order to deepen the students' impression, exercise questions can also be made to show the students several instruments learned in this lesson. Please choose. Make full use of modern teaching technology, change the traditional teaching mode, and build an environment conducive to students' learning. Give full play to the main role of students and let CAD play a greater role in music education. Therefore, some additional prior knowledge and some other additional constraints on the solution are required. The image restoration model can be processed by continuous mathematics or discrete mathematics. Different mathematical models are used to restore different degraded images. Its realization can be multiplied in the spatial domain or in the frequency domain. The general model of image degradation is shown in Figure 1.

The degradation map $L(x,y)$ generated after the input image $w(x,y)$ passes through a degradation system or a degradation operator $K(x,y)$ can be expressed as

$$L(x,y)=K[w(x,y)] \tag{3.1}$$

If the influence of noise is considered, the degraded image can be expressed as

$$L(x,y)=K[w(x,y)]+S(x,y) \tag{3.2}$$

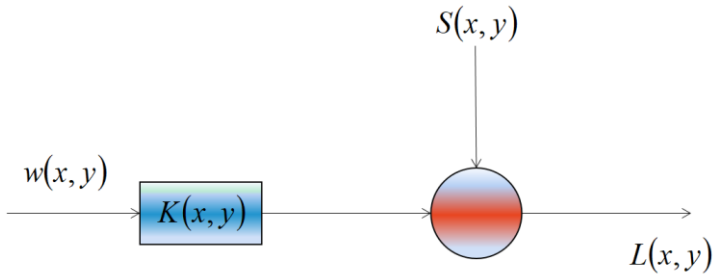

Figure 1: General model of image degradation.

Degraded images are formed by the degradation of the imaging system plus additional noise For a continuous image $w(x,y)$, we can express it by the following formula

$$w(x,y) = f(\alpha,\beta)\delta\, dad\beta \tag{3.3}$$

Here, the δ function represents the impulse function of a point pulse in space From this, we can get

$$L(x,y) = K[w(x,y)]dad\beta \tag{43.}$$

When the degenerate operator K represents a linear and spatially invariant system, the degenerated output of the input image $w(x,y)$ is expressed as

$$L(x,y) = K[w(x,y)] + nab^2 \tag{3.5}$$

The image with poor image quality is subjected to image restoration processing, and the restored image is output after image quality evaluation. If the image quality is improved after restoration, the restored image is output, otherwise the original image is output. The automatic image restoration model for image quality analysis is shown in Figure 2.

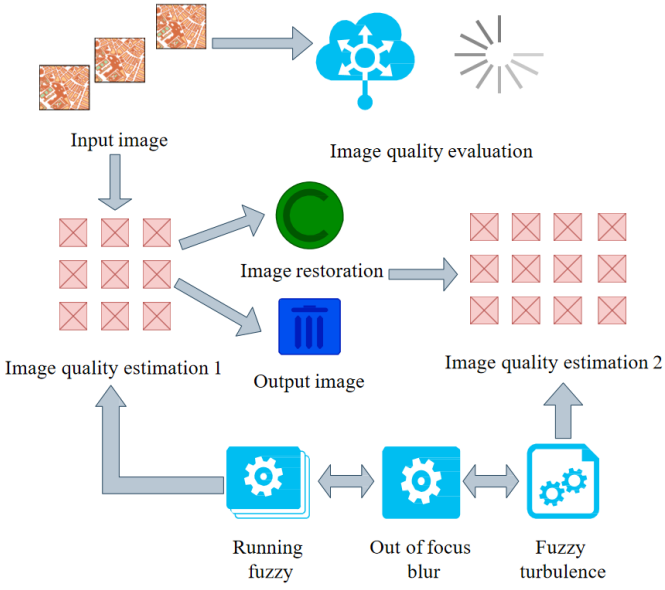

Figure 2: Automatic image restoration model.

Due to the introduction of the image quality evaluation process, the validity of the image restoration results is guaranteed, at least the restored output image will not deteriorate. It should be pointed out here that the methods used in "image quality estimation L" and "image quality estimation 2" in the figure are not consistent in this design. Because of the morbidness of the restoration process itself, the restored image often contains amplified noise, and even the structure of the image and noise will change, so the corresponding evaluation methods are different.

Image blurring process based on

$$g(x,y)=h(x,y)+n(x,y) \tag{3.6}$$

Where $g(x,y)$ represents the fuzzy observation image; $h(x,y)$ represents the point spread function, and it is linearly shift-invariant.

The fuzzy kernel, which is smaller than the support domain of the image, is transformed by Fourier transform.

$$G(u,v)=H(u,v)+N(u,v) \tag{3.7}$$

In which $G(\cdot)$, $H(\cdot)$ and $n(\cdot)$ represent the Fourier transform of $g(\cdot)$, $h(\cdot)$ and $n(\cdot)$, respectively. After derivation, Wiener filtering is as follows

$$F(u,v)=\left[\frac{H(u,v)}{\frac{1}{H(u,v)}\cdot G(u,v)}\right] \tag{3.8}$$

Assuming that the image noise is white noise, it is often replaced by constant.

The vector expression of the recovery error thus obtained is as follows

$$en=\hat{f}-f=\frac{H^T n}{H^T H+KI} \tag{3.9}$$

Type in bold indicates its corresponding vector form.

One K share is a very small value, so the formula becomes

$$err=\hat{f}-f\approx\frac{H^T n}{H^T H+KI} \tag{3.10}$$

$$\|err\|\approx\left|\frac{H^T n}{H^T H+KI}\right| \tag{3.11}$$

3.2 Classification of Folk Music Scores

The folk music form is an activity in which all people participate. In the process of performing music and dance, people exchange feelings and ideas with each other to achieve the goal of integration. Therefore, when it comes to folk music, it will definitely be a collective activity that everyone in the ethnic group must participate in. The life of aborigines is inseparable from music, and the score of folk music occupies an important position in folk music, involving many aspects of life. From the present situation of ethnomusicology research, it can be seen that the concept of ethnomusicology analysis is to place the structure of music products in a specific social, historical and cultural context, and observe the generation process of music products and their musical metaphors, rather than just the self-discipline analysis of static music text structure. More emphasis is placed on the logical framework of musical melody structure and the layout of harmony function, the shift and transformation of mode and tonality, and less attention is paid to the structure of folk music score and the generation of text meaning. Therefore, according to the folk customs of the aborigines, the scores of folk music can be divided into three categories: music for sacrifice, folk music and dance, and music for celebration.

① Folk music and dance music

The music adopts a single melody notation of pentatonic scale, and starts singing in the second half of the beat. Three-tone rhythm constantly appears in the music, which makes the music produce jumping and fluctuating rhythm. The music uses the triple beat rhythm to add to the joyful atmosphere. Polyphony adopts single melody and obstinate bass, which makes it the main melody in jumping and has a stable bass part as the beat. Use flute, piano and percussion as accompaniment instruments.

② Celebrate music and dance.

The music is performed according to the pentatonic scale structure, and the singing form is monophonic singing. The melody of the music is steady and rhythmic, and the decorative sound in the music adds tactfulness to the whole music. Three consecutive dotted beats enhance the rhythm of the music, and the connection of two half notes in the second half of the music makes the song have a double ending feeling, and it will have a radical auditory effect, expressing a feeling of expectation and excitement.

③ Ritual music and dance music.

In the hearts of the aborigines, what can occupy the same position as these myths and legends is their traditional beliefs, and these contents are the themes of the music creation of the aborigines' sacrificial rites and dances. Due to the differences in systems, folk customs, beliefs and customs of various ethnic groups and tribes, their ritual music and dance forms will produce various phenomena, and at the same time, the ritual music and dance music will also follow the changes.

4 RESULTS ANALYSIS AND DISCUSSION

In order to reflect the advantages of the automatic image restoration model established in this chapter on the convergence rate of the pictures of the folk music score, the models in document, document and the model in this paper are adopted for research. The comparison of the iteration times and the time taken for each model to reach the optimal peak signal-to-noise ratio is shown in Figure 3 and Table 1. From the experimental data, it can be seen that the repair model studied in this chapter can reach a high peak signal-to-noise ratio with a smaller number of iterations than other classical models.

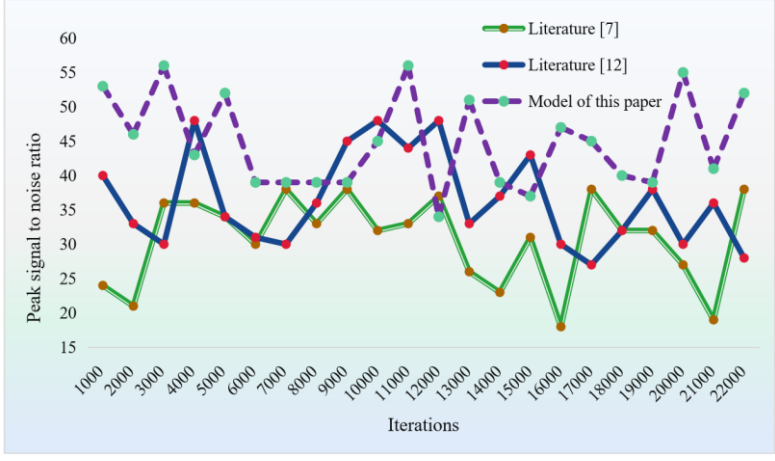

Figure 3: Comparison of convergence rates of various repair models.

Figure sequence	*The model of reference*	*The model in reference*	*Model of this paper*
Peak signal to noise ratio	16.15	32.15	35.52

Iterations	60000	80000
Convergence time	940	325

Table 1: Peak signal-to-noise ratio and iteration times of repair results.

Through the above two experiments, it can be seen that the inpainting model established in this section applies the local block energy operator to the design of diffusion coefficient, which can greatly reduce the inpainting time while taking into account the quality of the inpainted image. It is superior to other models in subjective vision and objective quality evaluation analysis, which proves the effectiveness of this model.

In order to further verify the effectiveness of the image restoration technology studied in this paper in folk music scores, tests are conducted on noisy images in image databases LIVE and CSIQ. Among them, there are 148 Gaussian noisy images in LIVE database and 156 noisy images in CSIQ database, and the images in each database have subjective scores. The larger Pearson correlation coefficient is, the smaller indicating the better performance of the algorithm. At the same time, Spielman rank correlation coefficient measures the monotonicity of the algorithm, and the larger the value of Spielman rank correlation coefficient, the better the performance of the algorithm.

Image database	*Pearson correlation coefficient*	*Spearman rank correlation coefficient*	*Measure subjective and objective quality scores*
LIVE	0.9221	0.9199	10.5775
CSIQ	0.8985	0.8548	0.1132

Table 2: Experimental results of denoising image quality evaluation methods in live and csiq image libraries.

It can be seen from Table 2 that the image restoration methods studied in this chapter are based on the image database live, on csiq image database are slightly smaller than the test results of live image database, which are 0.89 and 0.85 respectively, indicating that the image restoration method in this paper has a good evaluation effect on noisy images. The change of subjective and objective quality scores of the non-reference image restoration method studied in this experiment in the databases live and csiq. The experimental results are shown in Figure 4.

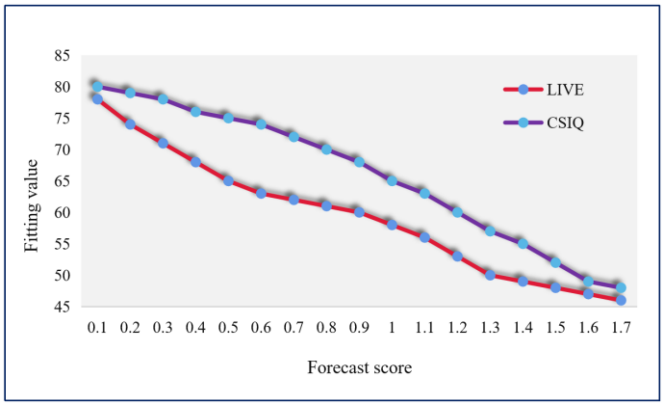

Figure 4: Changes of subjective and objective scores of image restoration methods on the database.

As can be seen from Figure 4, this method has a good denoised image score, and it is well clustered around the change range, so it shows that the result of this image restoration method is in high consistency with the subjective evaluation score.

According to the data in Figure 5, Figure 6 and Table 3, the representation of objective quality evaluation indicators is consistent with the results of subjective visual analysis. That is, when the noise intensity is 40, the hybrid model are slightly lower than those of the denoised model. However, when the noise intensity is 90 and 120, that is, the noise intensity is medium and strong, the hybrid model is higher than those of other denoising models, which indicates that it has a remarkable effect compared with the classical model in objective quality evaluation.

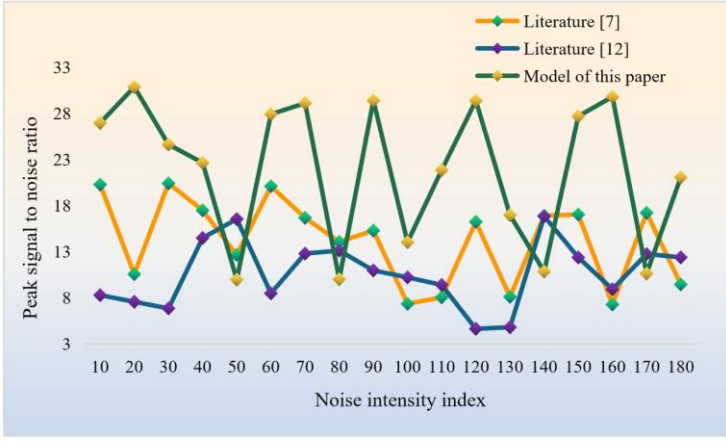

Figure 5: Peak signal-to-noise ratio before and after image denoising.

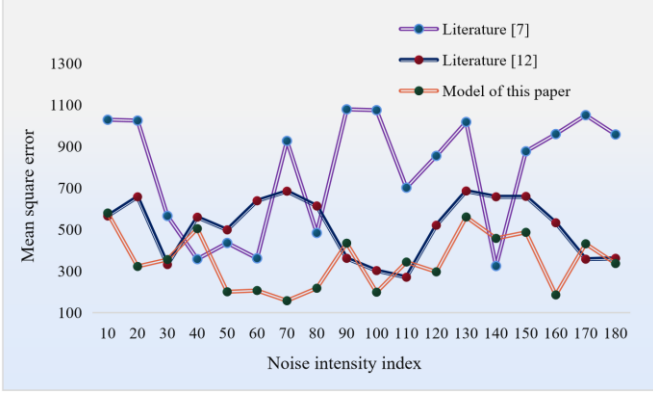

Figure 6: Mean square error before and after image denoising.

Original image	*Noise image*	*The model of reference*	*The model in reference*	*Model of this paper*
Man	0.580	0.694	0.756	0.780
Couple	0.593	0.697	0.748	0.783
Hill	0.58	0.695	0.759	0.801

Table 3: Structural similarity index of each algorithm.

By using image quality operator to directly evaluate the restoration results, this experiment adopts the method in literature, the method in literature and the method in this paper to select the best restoration image, and the change of image quality evaluation is shown in the figure. Combining the restoration image quality change with the restoration image results, it can be clearly seen that the methods in literature and literature can't effectively represent the change trend of restoration image quality. However, this method is just the opposite, which can effectively evaluate the image quality. As shown in Figure 7.

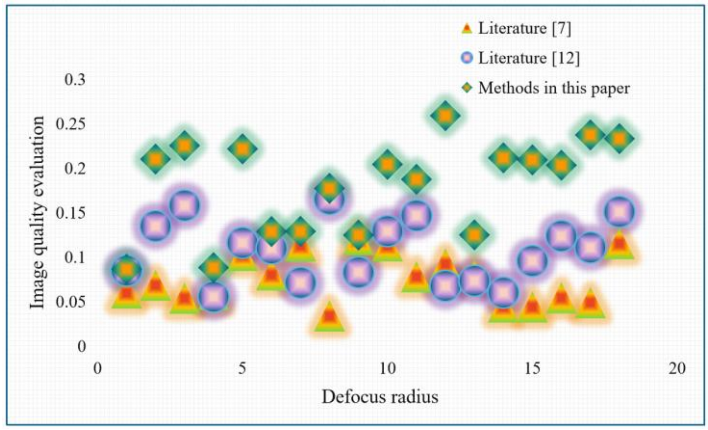

Figure 7: Changes of image quality evaluation.

In order to study the comparison of the accuracy of image restoration in folk music scores by the three methods, this experiment is conducted by using the methods in document, document and this method. The results of the comparison of the accuracy of the three methods are shown in Figure 8.

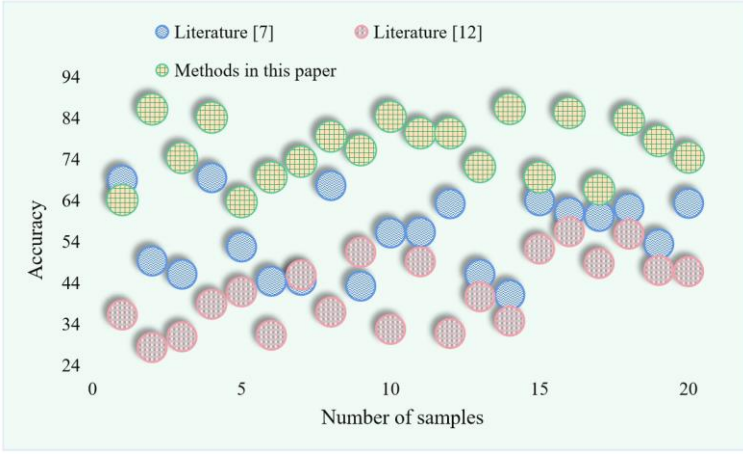

Figure 8: Change of image restoration accuracy of folk music score.

It can be seen from the data in Figure 8 It can be shown that the method adopted in this paper is the most feasible.

5 CONCLUSIONS

The music computer aided system mainly connects the external equipment and the computer. By collecting the trainer's physiological state and music expression state. Analyze the audio and video information of the trainer, and provide scientific parameters through the analysis of the system software. And generate images and data, which can be used by teachers to give more targeted guidance to students. In this paper, image restoration technology is used to study the score of folk music. The research shows that the method used in this paper has the highest accuracy, with an average accuracy of 76.59%, followed by the method in literature, with an average accuracy of 55.65%. However, the method in document is relatively low among the three methods, and the average accuracy is only 41.85%, which shows that the method adopted in this paper is the most feasible. The folk music score records and transmits music in the form of "words", which is a transformation process from intangible to tangible. Only by scientifically and systematically preserving the archives of Chinese folk music scores and providing and utilizing them through image restoration technology can we achieve inheritance in development and promote the prosperity and development of Chinese folk music scores in inheritance.

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