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Research on Regional Cultural Characteristics and Artistic Expression Methods in Ethnic Piano Music Creation

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Abstract Chinese national music culture has a long history and contains rich regional characteristics and artistic connotations. Regional cultural characteristics have important value in ethnic piano music creation, but the traditional creation method is less efficient. In this paper, a deep learning-based automatic generation system for ethnic piano music is constructed, which consists of four parts: a score feature extraction layer, a data enhancement module, a Word2Vec-CBOW feature fusion layer and a BiLSTM-CRF fingering generation layer. Specifically, pitch information and velocity information are obtained through score feature extraction, data enhancement is performed by utilizing the symmetry characteristics of the left and right hands, fusion feature vectors are trained using the Word2Vec-CBOW model, and fingering sequence generation is realized by combining the BiLSTM-CRF network. Experimental results show that the system achieves 94.88% accuracy and 92.18% F-value on the MAPS dataset when the task loss weight is 30. The pentatonic scale rate test shows that the pentatonic scale rate of the generated Chinese style piano music in the major key of Celadon reaches 100%, and that of Chrysanthemum Terrace reaches 91.563%. The subjective evaluation experiment in which 40 evaluators evaluated 20 pieces of generated music showed that this paper's method is superior to the traditional method in terms of coherence and emotional expression. The study shows that the system can effectively integrate regional cultural characteristics and provides a new technical path for ethnic piano music creation.

Index Terms Regional Cultural Characteristics, Ethnic Piano Music, BiLSTM-CRF, Word2Vec-CBOW, Pentatonic Scale Ratio, Automatic Generation System

I. Introduction

Ethnic music is an art form with strong ethnicity and regionality, which is an artistic achievement formed by the people through long-term performance, compilation and theoretical reflection [1], [2]. Through the art of folk music, it can help us understand the qualities of national culture, national customs, national emotions and national spirit of different regions in a comprehensive, full and thorough way [3]-[5]. In the development of traditional Chinese music culture, line melody and pentatonic modulation have become the presentation style of the aesthetic consciousness and creative thinking of national music, and a series of famous and excellent works have emerged [6], [7]. Specifically, in the early days of China, there were people who composed around Western compositional techniques and national music elements, forming a series of piano music with national style, national flavor and national characteristics, which provided a reference for the development of the nationalization and localization of piano art [8]-[11].

Piano music has the characteristics of elegance and vulgarity as well as playing melody very beautiful, which can not only enrich the audience's feelings, but also effectively improve the audience's music cultivation and enhance the audience's music aesthetic level [12]-[14]. The spread and evolution of the art of piano performance in the global context not only carries the weight of music history, but also continuously absorbs the essence of national culture around the world [15], [16]. And in the modern perspective, exploring the development and utilization of the cultural characteristics and expressive methods of Chinese national music in piano art possesses distinctive practical significance for the continuous promotion of the nationalization and transformation of piano art.

This paper constructs an automatic generation system for ethnic piano music that can integrate regional cultural characteristics. The study first analyzes the interactive relationship between regional culture and piano music, and explores the artistic value of regional culture in piano music creation. Then a multi-level deep learning network architecture is designed to obtain the basic feature information of music through the score feature extraction layer, expand the scale of training data by using the data enhancement module, adopt the Word2Vec-CBOW model for feature fusion, and finally realize the automatic generation of fingering sequences through the BiLSTM-CRF network.

The study verifies the effectiveness of the system through pentatonic scale rate test and subjective evaluation experiments, and provides technical support for the inheritance and development of ethnic piano music.

II. Interaction and artistic value of regional culture and piano music

II. A. Influence of regional culture on piano performance

The richness and diversity of regional culture gives piano playing a profound connotation and a unique artistic style, which makes piano playing present diversified characteristics. First of all, regional culture provides rich musical materials for piano performance. Folk songs, operas, music and other musical elements from different regions are skillfully used and integrated by pianists to make the performance present a unique musical style. Secondly, regional culture influences the style and emotional expression of piano performance. Differences in cultural backgrounds, historical traditions and aesthetic concepts between regions make pianists present different styles and emotions in their performances. Finally, regional culture plays a positive role in promoting the creation and development of piano works. Through in-depth exploration and research of different regional cultures, pianists create a series of piano music works with distinctive regional characteristics. These works not only enrich the connotation of piano music, but also inject new vitality into the development of piano art.

Chinese civilization has a long history, and this characteristic makes piano music pay more attention to the presentation of the integration of tradition and modernity in the process of interpretation. First of all, the historical inheritance of regional culture gives piano performance a profound cultural heritage. The cultural traditions and historical backgrounds of different regions provide a rich source of material and inspiration for piano music creation. In the process of playing, pianists will deeply excavate the essence of local regional culture and skillfully integrate it into their performance, so as to make the music works more regional characteristics and national flavor. Secondly, the historical inheritance of regional culture influences the skills and styles of piano playing. Piano players from different regions have gradually formed their own unique performance techniques and styles in their long-term artistic practice, which are often closely related to local cultural traditions and aesthetic concepts, and have distinctive regional characteristics. Finally, the historical inheritance of regional culture also profoundly shapes the emotional expression of piano performance. As a carrier of emotion, music is deeply influenced by the emotional elements and expressions in regional culture. In the process of playing, pianists will deeply experience and comprehend the emotional connotation of regional culture and integrate it into their own performance, which makes the music work more infectious and expressive.

II. B. Artistic Value of Regional Culture in Piano Music Composition

II. B. 1) Presentation of musical diversity

The integration of Chinese regional cultural characteristics into piano works has greatly enriched the diversity of global music. Each regional style carries unique aesthetic connotations and emotional expressions, which are interpreted by the piano, a traditional Western instrument, to show the depth and breadth of Chinese music. From the boldness of the Northeast to the softness of the South, from the roughness of the Northwest to the mystery of the Southwest, the musical characteristics of different regions constitute a colorful scroll of Chinese music culture, making Chinese piano works an indispensable part of the world's musical treasury. The embodiment of this artistic value is not only limited to the formal beauty of music, but also touches on the common emotional experience and cultural identity of human beings at a deeper level. Every performance of Chinese piano works on the international stage is a profound dissemination and exchange of local culture. It encourages musicians and audiences from all over the world to explore and understand the background of Chinese culture, and stimulates interest and research in traditional Chinese music.

II. B. 2) Cultural heritage and innovation

The presentation of regional culture in piano works is not only the inheritance of traditional culture, but also a kind of innovation based on it. The composers have dug deep into history to extract the essence of folk music, and then remodeled it with contemporary aesthetics and compositional techniques. They use polyphony, variation and improvisation to weave traditional melodic lines into a complex musical tapestry, so that the ancient movement is intertwined with modern consciousness. Such works are both a tribute to the past and a vision for the future, allowing the world to hear the voice of China and see the unique charm and infinite possibilities of Chinese culture. Each performance is a cultural exchange, stimulating the global audience's interest in traditional Chinese music, promoting understanding and respect among different civilizations, and demonstrating the role of music as a bridge to the common language of mankind. In this process, the piano becomes a link between the past and the future, and its timbre and expressive power puts a new coat on traditional melodies. For example, a composer may use the piano's unique pedal effect to create the mood of Jiangnan, or reproduce the sound of galloping horses' hooves on the Northwest grassland through the rapid running of scales. This kind of cross-cultural musical dialog not only enriches the vocabulary of piano music, but also expands the boundaries of regional cultural expression.

II. B. 3) Cultural exchange and understanding

As an “international language”, the piano is able to cross cultural and linguistic boundaries, allowing people all over the world to understand and appreciate the beauty of Chinese regional culture. The performance of Chinese piano works on the international stage not only demonstrates the unique charm of Chinese music, but also promotes the dialog and exchange between different cultures. It opens a window for foreign audiences to understand Chinese culture, deepens their knowledge of Chinese history, geography, humanities and other aspects, and helps to promote cultural understanding and respect on a global scale. This in-depth cultural exchange, beyond simple audio-visual enjoyment, stimulates people's desire to explore the roots of Chinese culture and promotes the recognition and appreciation of global cultural diversity. Under the keys of the piano, not only notes flow, but also cultural resonance across thousands of mountains and rivers, building a world of mutual understanding, respect and harmonious coexistence.

II. B. 4) Enhancement of the country's cultural soft power

The application of regional cultural characteristics in piano works enhances the international influence of Chinese music, thus strengthening the country's cultural soft power. When more and more Chinese piano works are recognized by the global music industry and incorporated into the international music education system, it not only enhances the status of Chinese music, but also provides a strong support for the dissemination and promotion of Chinese culture in the world. This kind of cultural export helps to shape China's international image of openness, tolerance and pluralism, and further promotes the interaction and integration of Chinese culture with the world's culture.

III. Folk Piano Music Composition System

The structure of the ethnic piano music automatic generation network in this paper is shown in Figure 1. The system consists of four parts: score feature extraction layer, data enhancement module, Word2Vec-CBOW feature fusion layer and BiLSTM-CRF fingering generation layer. The score feature extraction layer preprocesses the data to obtain comprehensive score feature vectors. The data augmentation module implements sequence transformation, which allows the model to be trained on both left-handed and right-handed data [17]. The Word2Vec-CBOW feature fusion layer utilizes the score context information to train the original score feature vectors and obtain the fusion feature vectors. The BiLSTM-CRF fingering generation module is used to capture the mapping relationship between the fused feature vectors and the output fingering sequences and to learn the constraints inside the output sequences [18].

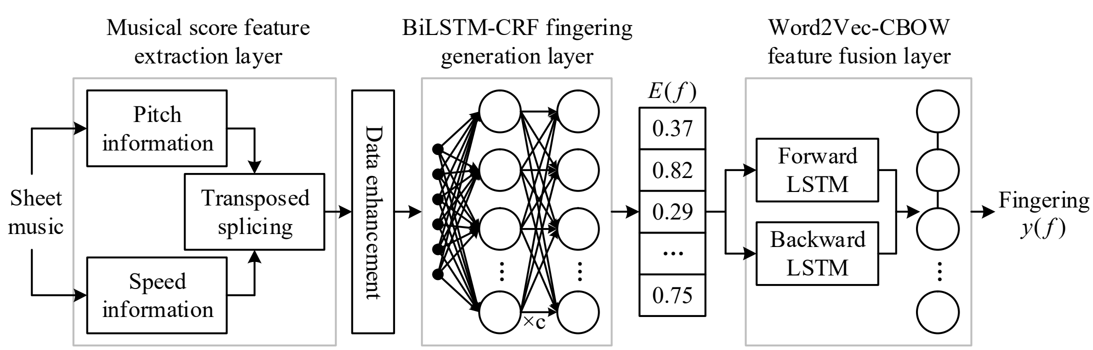


Figure 1: Fingering generation system

III. A. Musical score feature extraction layer

In the actual playing, the velocity also affects the fingering. Based on this, we design music score feature extraction methods that can extract pitch information and velocity information simultaneously.

The score feature extraction layer preprocesses data from the original score based on the pitch sequence P, note start time t_{cm} and end time t_{off}.

The pitch information reflects the position of the fingers during playing. The unique heat vector p of pitch, the pitch differential encoding d, the black key identifier and the chord identifier are extracted as pitch-related features.

The pitch unique heat vector p is the pitch MIDI unique heat encoding. The basic idea of pitch differential encoding d is to represent the relative distance of keys by using the difference of neighboring pitches, which is calculated as follows:

$$d(t)=\begin{cases}100k, & t=1\\ x(t)-x(t-1)+100k, & |x(t)-x(t-1)|<12, t>1\\ 80\,\mathrm{sgn}(x(t)-x(t-1)), & |x(t)-x(t-1)|\geq 12, t>1\end{cases} \quad (1)$$

where, $d(t)$ is the pitch difference encoding of the current time step, x represents the pitch MIDI, t is the time step variable, and k denotes the number of notes contained in the chord; in the case of a monophonic, k is specified as O.

The black key identifier or chord identifier is a boolean value. A setting of 1 indicates that the key corresponding to the current pitch is a black key or that the current note is a chord. Some specific fingerings are not available when the finger is pressed on the black key or playing a chord.

On the other hand, information about the tempo of the music affects the fatigue and comfort of fingering when playing. The consistency and the true time value of notes are defined as velocity-dependent features. Density is defined as the number of notes that will sound within 1s after the current note starts. The true time value is defined as the difference between the note end time t_{off} and the start time t_{on}.

After the score feature extraction layer, the note sequences will be expanded from a sequence of one-dimensional code elements, with a single pitch quantity as the representation, to a sequence of multivariate code elements consisting of multidimensional feature vectors for subsequent Word2Vec-CBOW training.

III. B. Data enhancement

Ascending pitch playing in the left hand is subject to the same ergonomic constraints as descending pitch playing in the right hand. Based on this feature, the pitch difference encoding of the left hand can be transformed into the pitch difference encoding of the right hand.

Considering that the left-hand pitch differential encoding is non-chordal, $d(t)$ is the same for ascending playing in the left hand as for descending playing in the right hand, it is obtained:

$$d_R(t)=-d_L(t), \quad d_L(t)<100 \quad (2)$$

where, $d_R(t)$ is the right hand pitch difference encoding and $d_L(t)$ is the left hand pitch difference encoding.

Consider the case when the current note is a chord, according to Eq. (1) and Eq. (2), it is obtained:

$$d_R(t)=x_L(t-1)-x_L(t)+100k=200k-d_L(t) \quad (3)$$

where, x_L is the original pitch data of the left hand, and k is the hand index used for chord fingering.

Combining Eq. (2) and Eq. (3), a data conversion method based on the symmetry properties of the left and right hands can be obtained:

$$d_R(t)=\begin{cases}-d_L(t), & d_L(t)<100\\ 200k-d_L(t), & \text{other}\end{cases} \quad (4)$$

where $d_R(t)$ is the right-hand pitch difference data of $d_L(t)$ transformed by Eq. (2), and k denotes the number of notes contained in the chord.

After completing the transformation of Eq. (4), the left-hand pitch difference sequence $d_L(t)$ is replaced with the new $d_R(t)$, and the rest of the features remain unchanged. The left-handed data share parameters with the right-handed data during training to realize joint training of left and right hands.

III. C. Feature Fusion Layer

The sliding-window fully connected layer mechanism of Word2Vec-CBOW extracts the context-trained fusion feature vector at the current time step, a feature suitable for modeling multidimensional musical score features.

The structure of the Word2Vec-CBOW model $x(t)$ denotes the original feature vector and $E(t)$ is the trained fusion feature vector.Word2Vec-CBOW is a self-supervised model that uses the original data to train the fusion feature vectors without fingering labels. c is the window length parameter, which represents that the model utilizes the first $c-1$ and second $c-1$ raw score feature vectors around the current time step t to train the fusion feature vector.

The $2(c-1)$ original feature vector vectors around the t moment are linearly transformed before the input layer as a way of extracting the contextual information of the current time step, and this process is represented as follows:

$$Y_{in} = \sum_{i=1-c}^{c-1} W_1 x(t+i), \quad i \neq 0 \tag{5}$$

where Y_{in} is the output vector of the input layer, $W_1 \in R^{v \times n}$ is the training weight matrix of the input layer, v is the dimension of the original feature vectors, and n is the number of neurons of the input layer, and each original music score feature vector within the window length shares the same training weight matrix, W_1.

The output layer uses a fully connected layer to increase the fitting ability of the fused feature vectors with Eq:

$$E(t) = \sigma(W_2 Y_{in}) \tag{6}$$

where $W_2 \in R^{n \times v}$ is the weight matrix of the output layer, σ is the Sigmoid activation function, and $E(t)$ is the trained fusion feature vector of dimension v.

Finally, the training objective of the Word2Vec-CBOW model is $\sum_t \min |x(t) - E(t)|$.

where $x(t)$ is the original feature vector. The training objective is such that the fused feature vectors do not lose the original score features. For training, the model is trained using stochastic gradient descent, the loss function is chosen as the cross-entropy function, and the weight matrices W_1 and W_2 are updated by the backpropagation algorithm.

III. D. Automatic Generation Network for Ethnic Piano Music

The automatic generation network for ethnic piano music is shown in Fig. 2, and the construction of the automatic generation network and fingering generation goes through the following steps:

(1) The timing differential control BiLSTM-CRF under the off-track strategy is used as the learning network to determine the states, actions and gains. The combination $(\Delta k, f_{t-1})$ of the input key difference Δk between two neighboring notes and the previous finger sequence number f_{t-1} generated by the learning network is used as the state state, and the generated current piano music sequence number f_t is used as the action action, and the current generated piano music serial number of the current piano music is generated as action action, and the score R_t corresponding to the evaluation level of the current piano music serial number is used as revenue reward.

(2) First initialize and set a unified initial state value function. The values under different states and actions are initialized by setting the value to 0 uniformly, and setting the number of training cycles, greedy probability ò, learning rate α and discount factor γ.

(3) Input the extracted musical key sequence, consider the previous key and the previous piano music sequence number, and select the action with the largest value function in the current state to generate the output piano music sequence number. The current state information $(\Delta k, f_{t-1})$ is composed of the key difference Δk between two neighboring notes and the previous piano music sequence number f_{t-1}, and the learning network is based on the $\varepsilon-$greedy strategy, and searches to arrive at the action corresponding to the maximum value in the current state A_t i.e., the current piano music sequence number to be selected is generated.

(4) The generated piano music sequence number is evaluated and scored, and the score is fed back to the learning network as a gain to continue training. Each generated piano music sequence number A_t, its merits are evaluated and scored, and the score is used as the gain of the action in that state R_t and fed back to the learning network to continue training for the update of the value.

(5) The learning network updates the value function $Q(S_t, A_t)$ for the action in this state according to the gain fed back from the quantitative evaluation system of piano fingering. The action value function value is updated.

(6) Repeatedly perform the above steps 3~5 until the number of training times reaches the pre-set value and the training ends. After initialization all the values are 0. As the training proceeds, the values corresponding to different combinations of states and actions change. When the number of training times reaches the pre-set value, the total gain is more stable and reaches a higher value also obtains a better table, the training ends.

(7) Finally, the key features of the music are input, and the learning network greedily makes action selection based on the table obtained from training to generate the fingering sequence.

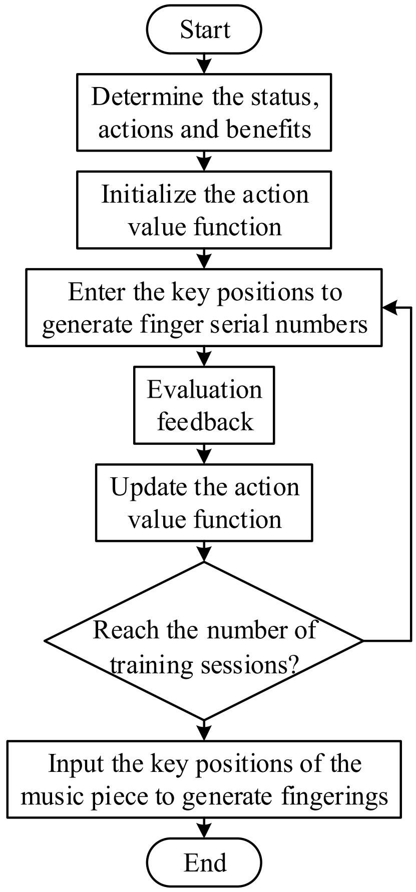


Figure 2: Steps for generating piano fingerings

IV. Experimental results and analysis

IV. A. Parameterization

(1) Network parameterization

Among the conditional generative adversarial networks, the parameters of the generator are chosen to be the same network parameters of the dual-stream architecture model. For the discriminator, the number of output channels corresponding to the three convolutional layers are 32, 64 and 128 respectively, the size of the convolutional kernel is 3x3, the random discard rate is 0.26, the activation function of the convolutional layer is ReLU, the input batch size is 200, the loss function corresponding to the generator and the discriminator are binary cross-entropy loss function, the optimizer is Adam optimizer, the learning rate of the generator and the discriminator are 0.0008 and 0.002 respectively. The learning rate of the generator and the discriminator are 0.0008 and 0.002, respectively.

(2) Impact of loss weights on performance

In order to enable the generator to better learn the dependencies between piano note labels, this section explores the impact of the loss weights of the tasks corresponding to the generator of the ethnic piano music composition system, on the performance of automatic piano music scores. Experimental validation was conducted on the validation set of the MAPS dataset, and the results are shown in Table 1. According to the results in the table, it can be seen that the F-value and recall of the algorithm in the validation set are maximized when the task loss weight is 30, and the F-value gradually decreases when the weight value continues to increase. Therefore, the task loss weight size is set to 30 in the algorithm.

Table 1: Accuracies of the algorithm under the influence of different loss weights

Weight	ACC/%	Recall	F value
1	93.58%	88.49%	90.28%

10	93.22%	88.12%	90.63%
20	94.46%	89.63%	91.40%
30	94.88%	90.23%	92.18%
40	94.02%	89.46%	92.14%
50	93.78%	90.14%	91.45%

IV. B. Analysis of generated results

All the experiments in this paper are completed in the server, the configuration of the ethnic piano music creation system server in this paper is shown in Table 2. The language used is Python, and the development platform used is PyCharm 2021 Professional Edition.

Table 2: experimental environment configuration

Configuring	Model parameter
Central processor (cp2)	Intel Xeon Silver 4210R
Graphical processor (gp)	NVIDIA GeForce RTX 3090
Memory size	32GB
GPD	24GB
Operating system	Ubuntu 18.04 LTS

The first experiment is to obtain the pitch table experiment, the final result is shown here, that is, the midi pitch table before performing the pentatonic scale rate calculation, taking Jay Chou's “Chrysanthemum Terrace” piano performance version as an example. The second experiment is to test different styles of piano midi music for the pentatonic scale rate of the main melody, and the test pieces are all main key piano music. The final experimental results of the ethnic piano music composition system are shown in Table 3. From the results, the pieces of Chinese style music have higher major pentatonic scale law or minor pentatonic scale melody. Among them, Celadon Porcelain, Chrysanthemum Terrace, Tang Li Frying Snow, Flowering Moon and Chinese Folk Songs are actually music composed in major pentatonic scale, while Cup of Happiness and Thousand Gold Buried Bones are music composed in minor pentatonic scale.

Table 3: The theme of music is the pentatonic scale

Music name	Music style	Major pentatonic scale	Small tone scale
Blue and white porcelain China travel line	China line	100%	55.467%
Chrysanthemum platform	China line	91.563%	52.946%
Chinese Chinese pear Fried snow China air line	China line	93.579%	50.796%
Traditional Chinese wind	Traditional Chinese wind	100%	48.803%
Cup of huanhuan China travel line	China line	62.895%	89.124%
Chinese folk song traditional Chinese wind	Traditional Chinese wind	100%	47.619%
China travel line	China line	68.163%	85.346%
Chinese pop	Chinese pop	78.264%	43.701%
Those years of Chinese popularity	Chinese pop	75.305%	55.124%
Carrying you modern music	Modern music	50.745%	68.067%
Always with me	Modern music	74.536%	51.472%
Variations of the stars	European classical	71.438%	48.662%

In order to avoid chance, this experiment was also carried out with different styles of open-source piano midi datasets for pentatonic scale rate, 80 pieces of music were extracted from each dataset, and the final results were in four parts, which were the mean and maximum of the major pentatonic rate and the mean and maximum of the minor pentatonic rate of their main melodies, and the results are shown in Table 4. Where the maximum values of the major and minor pentatonic rate of the main melody in the extracted pieces are shown in parentheses.

Table 4: Average pentatonic scale and maximum

Data set name	Data set style	Large tone scale (maximum)	Small tone scale (maximum)
Nottingham	Eurofolk	70.014%(75.428%)	42.078%(60.138%)
MAESTRO	European classical	66.397%(73.262%)	54.528%(70.169%)

Classical Archives	European classical	63.604%(70.142%)	51.094%(72.22%)
e-Piano Competition	European classical	64.387%(71.024%)	53.704%(74.63%)
POP909	Popular, folk songs	71.358%(78.563%)	50.568%(70.152%)
AILabs1k7	Popular, modern	70.142%(74.25%)	51679%(73.163%)

The main melody pentatonic scale rate of 50 pieces randomly selected from more than 800 pieces of Chinese-style piano midi music produced by the Ethnic Piano Music Creation System is shown in Fig. 3. Some of the pieces in the figure do not have a high rate of the main melody in either the major pentatonic scale rate or the minor pentatonic scale rate, which is caused by the fact that the piece is not composed using the pentatonic scale based on the Gong mode, but rather the pentatonic tonal modes in the other modes.

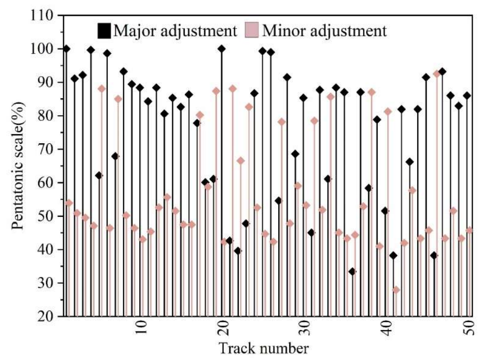


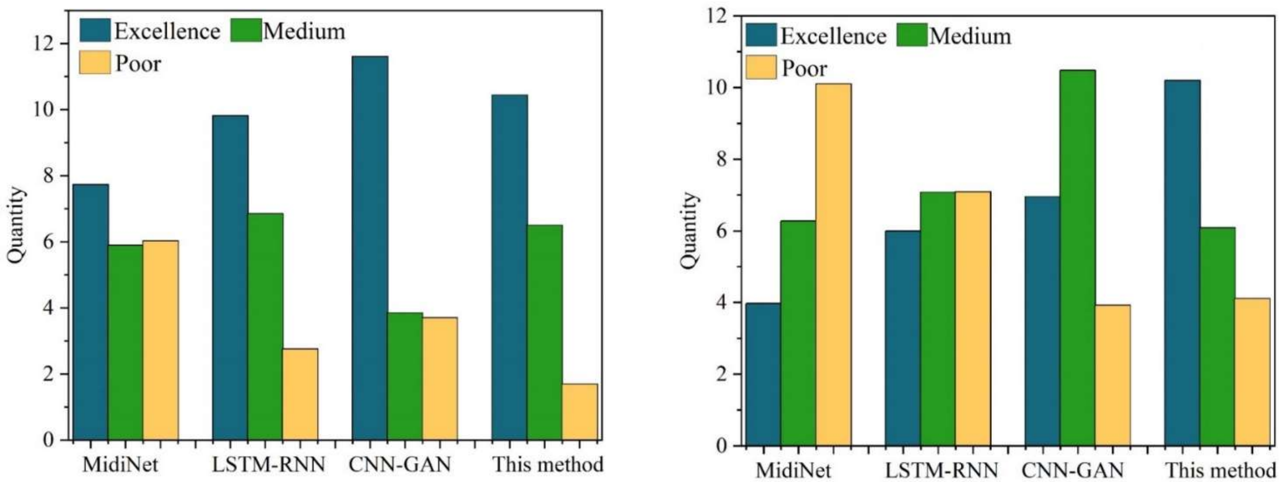
Figure 3: The main melody is the pentatonic scale

From the perspective of chromatographic energy in music research, the sum of the chromatographic energy distributions of the five notes of the pentatonic scale in the key of C in the experimental results of the five-tone Gong-tone style Chinese folk music is above 80%, while the value of this value is much lower than 80% for the Central European classical music, the Arabian traditional music, and the Japanese folk music. This is basically consistent with the results of the experimental study of Chinese wind music in pentatonic mode in this section.

IV. C. Subjective evaluation and analysis of the model

In the field of computer-generated music, objective metrics only reflect the similarity between the generated music and the target music, but do not adequately evaluate the musicality and aesthetics of the generated music, so subjective evaluation of the model using human listening evaluation is needed. This paper adopts the user survey, which is mainly used in music research, as the subjective evaluation method of the model. In order to make the evaluation of the experimental results more fair, therefore a diverse group of evaluators, clarifying and standardizing the evaluation indexes, and combining objective indexes are used as several means to improve the fairness of the evaluation results. Specifically, 40 people selected from the population with different experiences were used as the evaluators of music, of which 20 were male and 20 were female. The evaluation indicators for the music songs were categorized into 2 aspects: emotional expression and coherence. Each aspect was categorized into 3 grades, which were excellent, moderate, and poor. First, 20 musical pieces (5 pieces for each model) were generated using 4 different algorithms, namely, melodic theme-conditional CNN-BiLSTM model, MidiNet model, LSTM-RNN model, and the method in this paper. These musical compositions were randomly numbered to form 20 serial numbers for testing and evaluation. Second, for each model-generated piece, 20 evaluators randomly selected one piece of music for evaluation and marked it on an evaluation sheet that included the song number, evaluator number, emotional expression and coherence of the evaluation. The results are shown in Figure 4.

Analyzing the subjective evaluations of the evaluators, the music generated by the ethnic piano music composition system in this paper is more natural and smooth between the notes in terms of coherence and sounds close to a complete piece. In terms of emotional expression, the emotions, atmosphere and mood contained in the music are more accurately expressed. From the above analysis, it can be seen that the Melodic Theme Conditional Ethnic Piano Music Composition System has obvious advantages over the other three models in terms of coherence and emotional expression.



(a) The continuity of music (b) The emotional expression of music

Figure 4: Model subjective evaluation and analysis

V. Conclusion

This study realizes the effective integration of regional cultural characteristics and modern technology by constructing an automatic generation system for ethnic piano music based on deep learning. The system performs well in the MAPS dataset validation, achieving the best performance when the task loss weight is set to 30, with the accuracy and recall reaching 94.88% and 90.23%, respectively. The pentatonic scale rate test verifies that the system effectively maintains the characteristics of traditional Chinese music, and the generated music excels in terms of major pentatonic scale rate, with a number of compositions reaching a high percentage of over 90%. The subjective evaluation experiments further confirmed the practical value of the system, with 40 evaluators from different backgrounds giving positive comments on the coherence and emotional expression of the generated music, showing significant advantages over traditional methods.

The innovation of the system is to take regional cultural characteristics as important input elements, and realize effective learning and reproduction of traditional music elements through multi-level feature extraction and fusion techniques.The introduction of Word2Vec-CBOW feature fusion layer enables the system to better understand the contextual relationship of the music, while the BiLSTM-CRF network ensures the reasonableness and fluency of the generated sequences. The experimental results show that the method not only achieves good results in terms of technical indexes, but more importantly, it shows great potential in terms of cultural inheritance and artistic expression, which opens up a new path for the digital inheritance and innovative development of folk music, and is of great significance in promoting the integration of traditional culture and modern technology.

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