Mutual interaction and integration of music culture of She and Han nationalities into the present

Interação mútua e integração da cultura musical das nacionalidades She e Han no presente

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Abstract: The purpose of this paper was to level determine of mutual interaction and integration of the musical culture of She and Han nationalities into modernity through the study and coding of folk songs from four China geographical regions (Fujian, Zhejiang, Jiangxi, and Anhui provinces) using a new musical feature density map for machine music classification. The conducted simulations revealed that FIR-ELM is the best choice of the three classifiers (ELM, R-ELM, and FIR-ELM) analyzed as it is able to provide the highest classification accuracy. The simulations performed found that the low-frequency FIR-ELM is capable of 80.65% classification accuracy, as the FIR-ELM is an improved version of the ELM and thus performs better during the classification of folk songs. The findings of this study can be used as a basis for further research on the interaction and integration of the musical culture of these nationalities.

Keywords: music, She nationalities, extreme learning machine.

Resumo: O objetivo deste artigo foi determinar o nível de intera-ção mútua e integração da cultura musical das nacionalidades She e Han na modernidade através do estudo e codificação de canções folclóricas de quatro regiões geográficas da China usando um novo

mapa de densidade de recursos musicais para classificação de música de máquina. As simulações realizadas revelaram que o FIR-ELM é a melhor escolha dos três classificadores analisados, pois é capaz de fornecer a maior precisão de classificação. Os achados deste estudo podem servir de base para novas pesquisas sobre a interação e integração da cultura musical dessas nacionalidades.

Palavras-chave: música, nacionalidades She, máquina de aprendizado extremo.

Introduction

The 1970s became the period when the political philosophy of multiculturalism was first proposed and recognized, thereby giving a strong impetus for the traditional cultures to be further developed and preserved. However, with the growing economic globalization and social modernization, minority cultures increasingly face the dilemma of inheritance and development. China is remarkably illustratory in these terms – this is evident in all its cultural dimensions, viewing the process in terms of the distinctiveness and commitment of the people to national traditions, including musical art. Being a state of many nations, each of which has its customs and traditions, China can be proud of many new musical styles dramatically differing from anything Western ears used to hear. Its traditional musical art is known for the myriad of instruments and distinctive performance techniques able to trace the "soul" of a particular nationality (CHEN, 2020; LIU, 2020; ZHANG, 2016).

With the fast development of multimedia technology, the amount of music data stored and shared on the internet steadily increases. As a result, the demand for music multimedia technology grows, which is tightly linked with severe challenges and changes. The automatic music classification technology has become especially useful in this respect. It plays a fundamental role in pieces' indexing and searching, enabling convenient management of music of varying genres. One of the key branches of automatic music classification is regional music classification, directed chiefly at folk songs (JIN, 2011; LOH, EMMANUEL, 2006).

Currently, there are relatively few studies on automatic regional music classification. Contemporary approaches are similar to those used to classify musical genres. However, they are increasingly faced with the problem of insufficient consideration of the temporal characteristics of music. Instead, the melodic temporal structure is a central feature of folk songs, and temporal characteristics are critical for distinguishing folk songs of different regional styles.

Literature Review

Chinese musical art is multiply recognized to have a unified, pluralistic, and integrative internal structure (STAVITSKAYA, 2015; LIKHACHEV, 1985). While living in differing natural conditions and being engaged in productive and mental labor, representatives of different nationalities have created unique musical works that are still popular among the local population (HUANG *et al*., 2014). The *Song of Chile* and the *Song of Mulan* are still on the lips of the general public (DOU, LIU, 2010). What is more, the achievements of ethnic minorities in China are vividly represented in the culture of this country: the *History of Song*, the *History of Liao*, and the *History of Jin* (three of *Twenty-Four Histories of China*) written under the guidance of the Mongol historian Toqto'a and Uighur historians Yue Zhu and Quan Puan-Sali are highly valued among historians.

The natural process of mutual influence of Chinese minorities' cultures is a rather long phase of the absorption of borrowed patterns and elements as well as the emergence of regional forms and styles of one national culture (DOU, LIU, 2010). In the predominance of cases, Chinese folk songs were created by locals and passed from one generation to another orally. Different dialects, customs, and living conditions have deeply affected the formation of the melody style of Chinese folk songs (DU, 1993). As a result, folk tunes from one region acquired a distinct and stable performance manner, dissimilar to those from other territories (MIAO, QIAO, 1985). Based on these characteristics, Chinese ethnomusicologists conducted a study proposing the division of Chinese folk songs according to geographic factors giving it the name "*Music Geography*" (MIAO, QIAO, 1985; HUANG *et al.,* 2014). As a subfield of cultural geography, music geography first emerged in the 1970s. Until then, the investigation of spatial representations in Western music was predominantly descriptive, focusing on collecting and classifying musical folklore (CONNELL, GIBSON, 2003). Regional characteristics of folk songs were also the point of interest of investigators from other countries. For

example, researchers from Greece discovered radical differences between Greek folk songs from the mainland, Islands, and Asia Minor (DU, 1993; FOTIADOU *et al*., 2016), while scholars from Japan noted that folk songs from Kanto and Kansai areas are characterized by distinct melodic patterns (HAN, 1989).

Research on Chinese folk songs' regional classification is deemed widely beneficial for understanding the music structure of such compositions, providing ways to automatically and quantitatively analyze them, and promoting further development of intelligent music education. However, regional music classification is drastically dissimilar to the mature music genre classification since folk songs typically have no strict creation rules. On the contrary, the principal feature of folk songs is the melodic temporal structure, and temporal characteristic is vital for distinguishing folk songs from other styles. Unfortunately, the existing approaches to regional music classification usually fail to consider the temporal characteristics of music adequately.

Kulabukhov (2007) noted that the reign of the *Han* and *Zhou* dynasties was an explicitly favorable era for the development of musical art in China. During that period, Confucianism had a strong influence on the music promoting ceremonial and religious themes, while folklore collecting was the task of specially appointed officials. During the *Tang* and *Song* dynasties, the science of music continued to develop. Composers wrote hymns and works for general and narrow audiences. In the predominance of cases, the core emphasis was set on the beauty of nature (BASSIOU *et al.*, 2015; FOTIADOU *et al*., 2016).

A synthesis of recent literature by Yang and Welch (2022) points to the dynamism of shaping the paradigm of contemporary Chinese education. In particular, they identify among the main factors influencing the mechanism of Chinese music formation: state financial support, regional political priorities, curriculum implementation, and pedagogical innovations in music education. In addition, Chen and Tsai (2019) emphasize that one of the most common problems of Chinese music history is the lack of a learning system and organized resources.

With the acceleration of the modern process and development of music, the situation with the resources of Chinese traditional musical culture is rather disappointing. Tang and Fei (2022) point out that, as history progresses, many remarkable traditional musical works are beginning to gradually disappear. At this moment, therefore, it is urgent enough to use modern high-tech instruments to preserve traditional musical forms of Chinese music with some value for digital storage and management.

In socio-cultural terms, music is a remarkable aesthetic art of expressing a specific thought or feeling (CONKLIN, 2013). Since the beginning of the 20th century, Chinese musicians have faced the dual challenge of how to overcome the limitations of traditional culture and create a modern society by inheriting cultural foundations that support collective identity and people's connection with the past (KAWASE, TOKOSUMI, 2010). Today, identity and musical art represent a solid link connecting overseas Chinese diasporas. Chinese immigrants are becoming increasingly prone to uniting their personalities to such factors as common descent (OWEN, 2000). However, no less often, they redefine collective identities that bring together groups of Chinese immigrants of different national origins and ideological beliefs. In this respect, Chinese music and songs are also frequently used to create collective identity in Chinese communities (JIN, 2011).

Problem Statement

The natural process of mutual influence of the cultures of the peoples of China is a rather lengthy process embedding borrowed patterns and elements into another culture and stimulating the emergence of regional forms and styles of one national culture. The analysis of scientific publications on the matter showed that the interaction and integration of the musical culture of *She* and *Han* nationalities is a relevant topic these days. Therefore, a study in the field should be conducted in order to clarify the level of interaction between these two nationalities.

The primary **motivation** for writing this paper was the interest in (1) the musical culture of different ethnic groups of China,

manifestation of their identity through music, as well as their interaction, integration, and development.

The **ultimate aim** of this work was to determine the level of mutual interaction and integration of the musical culture of *She* and *Han* nationalities into modernity through the study and coding of folk songs from four geographical regions of China using a new musical feature density map (MFDMap) for machine music classification.

The **research objectives** were as follows:

- study folk songs of China using machine music classifiers;

- analyze Chinese folk songs by regions using three classifier types: ELM (Extreme Learning Machine), R-ELM (Regularized Extreme Learning Machine), and FIR-ELM (Finite Impulse Response Extreme Learning Machine);

- determine which classifier is more effective for identifying *Han* and *She* nationality music.

Materials and Methods

The object of this study is represented by folk songs. Being a unique element of cultural heritage, folk songs acquire different regional peculiarities during their evolution due to the influence of geographic factors and languages. In view of this, the current study divides the folk songs into four classes according to the geographical regions being home for *Han* and *She* nationalities: *in Fujian Province, Zhejiang Province, Jiangxi Province and Anhui Province.* When selecting the regions for the study, several factors were taken into account:

1. The comparison between she folk songs and Han folk songs can be set as the she inhabited areas in Fujian Province, Zhejiang Province, Jiangxi Province and Anhui Province. Comparing the folk songs of She nationality and Han nationality in this area will be more comparable.

2.   Folk songs from neighboring regions usually have similar characteristics due to much the same customs, social structures, practices, and other cultural activities of people in these areas. These similarities generally arise from communication and social exchange between people. However, mountains and rivers often act as natural barriers interrupting contact and therefore, naturally promoting different cultures to develop. As far as the four music territories selected are relatively distant from each other in geographic terms, their categorization as separate classes is reasonable.

3.   The central trouble in deciding on candidates for the study was to avoid regions with a large number of ethnic minorities' representatives. For instance, *Ningxia* has a large population of *Hui* people besides *Han* people, while *Qinghai* is characterized by many ethnic Tibetans as inhabitants. Accordingly, if these regions are analyzed, the overall classification might be complicated and degraded.

4.   Folk songs' popularity was another matter of concern in the process of sampling. The four classes selected encompass folk songs that are more familiar and well known to both professionals and non-professionals in China and beyond.

In total, the corpus comprised 12 folk songs for the analysis. The melody of each of them was encoded into its own MFDMap. As folk music can be regarded as one genre type, its regional classification can also be seen as a classification within one genre. The creation of folk songs is subject to no strict rules as far as they are usually composed by means of improvisation and under the influence of the identity of the locals living on one or another territory. In this research, musical features were extracted from *kern* files since the database used is coded in *kern* format. Machine classification of Chinese folk songs was done through simulations using the MFDMap under three classifiers: ELM (neural networks of direct communication (release date 2006, G. Huang); ELM does not require gradient-based back propagation, it uses generalized Moore-Penrose feedback to make its connections), R-ELM (mechanism of action is based on structural risk minimization and

least squares method), and FIR-ELM (functions based on a finite impulse response to an extreme learning machine). They helped identify differences and similarities in musical works.

Results

In order to classify the folk songs of *Han* and *She* nationalities, a simulation was conducted for three classifiers: ELM, R-ELM, and FIR-ELM. Comparison of the classification accuracy for each classifier is presented in Table 1. As ELM and R-ELM have random characteristics, the simulations for these classifiers were repeated 50 times to get objective classification accuracy results (this is also shown in Table 1). In simulations conducted for the FIR-ELM classifier, the low-pass FIR filter performed best than all the other ones. Therefore, the FIR-ELM classification shown in Table 1 corresponds to an FIR-ELM low-pass filter with a cutoff frequency of 0.3.

Table 1 - Classification accuracy of the ELM, R-ELM, and low-pass FIR-ELM

Number of hidden neurons	ELM		R-ELM		FIR-ELM
	Accuracy, %	Deviation, %	Accuracy, %	Deviation, %	Accuracy, %
50	51.94	7.96	55.35	6.16	29.03
100	50.77	7.22	60.97	5.80	48.39
200	44.00	7.37	63.29	5.71	61.29
500	45.03	9.15	68.45	5.91	67.74
1000	58.06	7.90	69.03	5.13	74.19
1200	60.84	5.97	70.39	5.28	80.65
1500	62.13	6.35	68.71	5.30	80.65
2000	64.97	6.29	69.74	5.29	64.74

The very nature of music implies the availability of a great deal of subjectivity that makes classifying musical pieces a difficult task. Despite the fact that the studied folk songs samples were selected from geographically distant territories, recognizing differences between them might be quite challenging. Regrettably, precisely this was the problem with the distinction between the *Han* and *She* folk songs – difference between them was insignificant.

As evidenced by the data collected, the low-pass FIR-ELM is the best classifier among the three considered, partially because it is an improved version of ELM. The second in performance is the R-ELM; only then comes ELM. The FIR-ELM shows its best performance at 1200 hidden neurons, achieving an accuracy of 80.65%, while R-ELM and ELM accomplish 70.39% and 60.84% accuracy. When the number of hidden neurons is less than 500, the performance of ELM fluctuates a little. Nevertheless, as soon as more hidden neurons are added, it shows a steady performance improvement and reaches 64.97% accuracy with 2000 hidden neurons. The performance of R-ELM is relatively steady; a slight drop is only seen from 1500 hidden neurons. The low-pass FIR-ELM is the most reliable classifier – its accuracy enhances together with the number of hidden neurons, reaches the maximum at 1200 hidden neurons, and maintains this performance until 1500 hidden neurons.

As was already noted, musical features in this article were encoded in *kern* and MFDMap formats. All *kern* files are standard ASCII files. Often the same file is used to encode an individual piece or movement. Figure 1 shows an example of a *Han* folk song encoded using *kern* format, and Figure 2 illustrates an example of a *She* folk song encoded with the MFDMap method.

Figure 1 - *Han* folk song used in the study

The MFDMap method is used to classify folk songs consisting of a single melody line. The same concept may well be employed for polyphonic music, because it takes into account the peculiarity of the intonational and rhythmic development of folk polyphonic music. However, in this case, the structure of the MFDMap needs careful consideration to take into account changes in the number of parts in a musical piece. This is acceptable for Chinese folk songs based on geography but may not be so for other music classification tasks.

Figure 2 - *She* folk song encoded using interval representation (in MFDMap format)

The four regions selected for this research were made sure to have the most extensive samples of songs for analysis. In the great scheme of things, folk songs of *Fujian Province, Zhejiang Province, Jiangxi Province and Anhui Province* are very similar in nature. Nevertheless, despite all the commonalities, each area has some distinctions within itself. To put it another way, in broad terms, they are remarkably alike, but when the area covered by a region is extensive, its folk songs show dissimilarity in many fine details (Table 2).

Table 2 - Comparative characteristics of the music culture of
She and *Han* nationalities

Comparison areas	*She* nationality	*Han* nationality
Singing techniques	Integration of folk singing techniques into pop music	Opera singing introduction into pop music
Songs' content	Content is presented in the form typical for pop music	Interpretation of ancient poetry and mythology
Musical performance	Musical stage drama	Foreign opera and modern Chinese stage drama

The data above suggest that the integration of traditional *She* and *Han* cultures into the current times should focus on three aspects. The first is to form an individual culture system for each nationality and extract its essence and key elements to form the core of its cultural image (in this research, this was done with the help of music classifiers). The second is to take innovation as a driving force, the essence and elements of traditional culture as a basis and integrate the characteristics of the current time into it to form a new cultural image corresponding to modern aesthetics and value system. If the available gap between the traditional culture and the modern aesthetics and values is not addressed (while not being separated from the national culture system), the culture can be lost. The last point to consider in this respect is strengthening cooperation, allocating resources wisely, and promoting cultural exchange.

Discussion

The People's Republic of China is currently on the path of industrialization, urbanization, and globalization. As a result, its national culture is under the real threat of collision and accelerated extinction. The decision to link the past with the following may bring a fair chance for advancement and opening up for the future. This option represents the key to integrating traditional culture into modernity to make the inheritance of national culture better meet the challenges and prospects brought by social development and changes (MALHEIRO *et al.*, 2004).

Numerous pieces of evidence suggest that the musical culture of *Han* nationality was created by the fusion of the musical culture of *Huaxia* in the pre-*Qin* era and ancient Oriental ethnicities (KAWASE, TOKOSUMI, 2010). Also, since taking roots and flourishing is possible for the traditional culture only when it enters into daily life, ancient memory can be integrated back into the national blood only by combining traditions with daily needs (BASSIOU *et al.*, 2015). At the same time, the inheritance and development of national culture must be balanced with economic development. It is necessary to ensure culture's continuity to ensure sustainable economic growth through appropriate and effective commercial activities. In view of this, seeking industrial cooperation or growing a production chain with reference to traditional culture development is the best way for the conventional customs to enter people's lives (KULABUKHOV, 2007).

Another scholarly approach to the discussion of the importance of *She* and *Han* nationalities' musical art in the life of modern society can be found in the work of Huang *et al*. (2014). In general, it significantly differs from that of the present research. Huang *et al.* (2014) focus on the communicative functions of music. They argue that a better understanding of the communicative process of Chinese music culture is possible after considering its artistic information, i.e., the object of musical art. The effective transmission of artistic information is inseparable from communication as it is an essential attribute of culture and an active mechanism of cultural innovation. The survival, development, and inheritance of traditional culture are also closely tied with communication. Hence, they assert that communication is the best embodiment of culture (HILLEWAERE *et al*., 2009; SCHAFFRATH, 1995).

Equally important for the development of traditional culture is cultural exchange. Only by learning from each other can cultures move forward faster (MIAO, QIAO, 1985). The continuous integration and cooperation between ethnic minorities

encourages their development and enriches their cultures (KAWASE, TOKOSUMI, 2010).

Given the extent to which Chinese music is filled with cultural and historical meanings, it should come as no surprise that immigrants use songs as a tool for building collective identity (GUO, LIU, 2016). However, only the art that is closely connected to the public and matches the prevalent aesthetic views is better disseminated. What is more, the communication process should also make full use of various types of media and show their respective advantages in order to effectively promote the national culture of China (I LIMEI, 2019).

The practice shows that music classifier testing is often conducted by collecting folk songs' audio recordings. For example, Bassiou *et al.* (2015) employed canonical correlation analysis (CCA) and deep canonical correlation analysis (DCCA) to calculate the correlation between song lyrics, audio data, and regional tags to classify folk songs. The best result (72.9%) was obtained in the regional classification of folk songs based on CCA. Khoo *et al.* (2012) and others extracted musical features from both temporal and frequency domains of audio files using the R-ELM classifier. Though, their results showed a classification accuracy of 49% only (LOH, EMMANUEL, 2006). Liu *et al.* (2007), in turn, achieved an accuracy of 75.2% by means of the post-processing method and support vector machine (SVM) classifier. Later, they proposed an active feature selection algorithm, which not only reduced the dimension of musical sound features but also improved SVM's performance. Similar to the previous works, Song *et al.* (2011) proposed heuristic forward and heuristic backward feature selection algorithms and also used the SVM for by-region classification of Chinese folk songs (its performance was 78.9%).

The interaction and fusion of *She* and *Han* nationalities have stimulated the formation of Chinese national consciousness as we see it today. Nevertheless, unfortunately, preservation and further development of cultures of these two nationalities require relevant changes in the approach chosen for it. Against this backdrop, it

is critically important to integrate more diverse and modern elements into *She* and *Han* cultures and encourage their musical art innovation and integration into contemporary realities (DU, 1993).

Conclusions

The study of the musical culture of the *She* and *Han* nationalities, their interaction, integration into the present, and role in preserving and transmitting the cultural heritage to the younger generation is an important direction in the development of national identity in the contemporary musical world of China. This paper presents the way to use the MFDMap, a symbolic music encoding method, and demonstrates the possibility of its application in machine classification of Chinese *Han* and *She* folk songs through simulations using ELM, R-ELM, and FIR-ELM classifiers.

The obtained simulation results showed that the low-pass FIR-ELM is the best classifier among the three employed since it is far more robust, especially in solving complex tasks such as music classification. Within the limits of the research, MFDMap used only symbolic representations of the musical features. The carried-out simulations established that the low-pass FIR-ELM is able to provide classification accuracy of 80.65% as FIR-ELM is an improved version of ELM and thus performs better when classifying folk songs. Besides, as was shown by the present research, such an algorithm may well be used for multi-class classification.

The collected findings suggest that the modern culture of China is pluralistic in nature and cannot be separated from the traditions and customs of ethnic groups living on its territory. It represents a multi-element complex that is getting more and more versatile because of inheriting the customs of different peoples, including representatives of *She* and *Han* nationalities. The comparative characteristic of *She* and *Han* songs provided within the present study evidenced that contemporary culture acquires its unique charm only when multiple cultures collide and influence

each other. Despite the ongoing modernization and accelerated cultural development, Chinese musical culture has promoted the preservation of traditions of the past, strengthened social cohesion, and helped preserve cultural identity. It showed that cross-cultural cooperation is the most common way of cultural exchange and one of the methods of integrating traditional and mass culture.

Future research in the field will focus on other well-developed temporal structures to improve the tools for the by-region classification of Chinese folk songs. Also, it is planned to design some new approaches to intellectual analysis of songs from various regions in order to identify commonalities and differences in the music of similar nationalities better.

The practical significance of this work resides in the proposed method of coding songs, which can be taken advantage of in future ethnomusicological studies on Chinese folk songs to find commonalities and differences in the music of different nationalities.

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