Music Chord Recognition Based on Robust PCP Feature and SVM

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Abstract

Music is the most direct and effective means to express emotion, and the effective identification of music works can help us better understand the works and realize the correct interpretation of music. This paper takes robust PCP feature and SVM as the research object. Firstly, the related concepts of terms and a large number of robust CFO description chord spectrum methods used in audio analysis are introduced. Secondly, it expounds the correlation between SVM and speech tonality, designs the system of music chord recognition, tests the performance of the system, and focuses on the test in the direction of recognition rate. Finally, the test results show that the system greatly improves the recognition of music chords with the support of robustness feature optimization and SVM pattern.

Keywords: *Robustness, PCP Feature, SVM, Music Chord*

1 INTRODUCTION

In many music information retrieval applications, it is necessary to analyze the harmonic structure of music. In western music, harmonic structure is usually described by information about chord structure and chord progression [1-2]. The human brain can not only reorganize more objective things, but also deal with and understand more complex subjective things, such as music. Even so, extracting important information from music is still a hot research field for computer lovers. The development of music is inseparable from chords. In life, people usually think that music is "sound". However, with the continuous improvement of social and economic level and material conditions, as well as the gradual increase of spiritual and cultural demand, a large number of modern music creation have been produced. [3-4].

Music chord recognition based on robust PCP feature and SVM has been explored and studied by many scholars. In the middle of the 20th century, the search of vocal music content mainly focused on the basic theoretical scheme to improve the signal. Note recognition was the focus of research at that time. Some scholars used chromaticity features and HMMs with EM algorithm to realize the recognition of chord recognition system. The innovation of this method is to combine music knowledge into the model by defining a state transition matrix based on the pitch distance in the pentatonic ring [5-6]. At the same time, it also avoids the random initialization of the mean vector and the covariance matrix of the observed symbol distribution. In addition, when training the model parameters, they assume that the chord distribution does not consider the type of music, that is, they do not model separately for the type of music, and then selectively update the weight of the parameters. However, in this way, the distribution of parameters cannot be corrected [7-8]. Hidden Markov model and artificial neural network are two technologies with important theoretical and application value [9-10]. The gradual maturity of these technologies has laid a solid theoretical foundation for music chord recognition based on robust PCP feature and SVM.

This paper first introduces the research background, then briefly describes the concept of music, and classifies and distinguishes it. Then the characteristics of SVM are described in detail. Finally, the trained robust PCP feature is used to test whether the composition of music chords and the change of strength, and specific methods are given to improve its recognition rate and accuracy. At the same time, it is also verified by experiments that the conditioning numbers we have learned can be detected under different intensities and different scenarios, and these algorithms can be applied to real life for processing and application.

2 DISCUSSION ON MUSIC CHORD BASED ON ROBUST PCP FEATURE AND SVM

2.1 *Characteristics and Definitions of Musical Chords*

Since ancient times, music art has always been an important part of human spiritual life. With the development of society and times, people have a new understanding of music. With the continuous improvement of the level of science and technology, the acceleration of the process of economic globalization and the enhancement of the trend of cultural diversity, all

these factors provide more possibilities and creative ideas for music creation. In addition, due to the scientific and technological progress and innovation, more talents emerge to the public, which makes composers need to consider a variety of complex emotional factors and personal feelings under the cultural background [11-12]. With the development of acoustic research, people began to study the methods of producing and transmitting sound, such as the research of various speakers, including pipes, musical instruments and strings. In the mid-19th century, people began to study the properties of the most advanced sounds, such as harmony. This marks a new stage in sound research. The study of the basic principles of acoustics and music has laid the foundation for today's use of computers to process audio and music signals.

With the development of music, people have a new definition of chord, from the initial single tone, double sign to polyphony. The chord mentioned in this paper is a simple and abstract relationship between the player and the player. It contains two types: one is finger. The second refers to sound (hereinafter referred to as sight play), which includes three types: the cross fabric of bass area, treble area and high octave chord.

2.2   *Introduction to Proper Terms of Music Specialty*

Pitch: some music sounds high and some sounds low. This is called pitch. Pitch is expressed in vibrations per second. The higher the frequency, the higher the tone, the lower the tone, the lower the frequency, the lower the tone. This sound that vibrates 440 times per second is called "a", which is the current international standard sound.

Interval: Specifies the distance between two notes. The unit used to calculate the interval is called "degree", and the number of syllables between two notes is called several degrees.

Octave: if the frequencies of a group of sounds are arranged strictly according to x1, X2, x4,..., that is, according to the rule of 2n, they sound like "the same pitch sequence". Because the human ear is sensitive to the frequency index, the above-mentioned "x2 represents isometric" relationship is the most basic relationship in music. In music, X2 is an octave.

Consistency: it is composed of three or more scales according to three degree interval relationship or non three degree interval relationship.

Harmony: harmony is a chord progression in which each chord is connected according to certain rules. Harmony is based on the mode that makes the melody more richly express the music content.

Semitone and whole tone: divide an octave into twelve equal parts, one semitone for each, and two semitones correspond to a whole tone. Half tones correspond to small seconds and whole tones correspond to large seconds.

2.3   *Principle of Music Recognition*

In modern society, with the continuous development of science and technology and economic level, people's demand for material life is also higher and higher. This phenomenon makes people have higher requirements and pay more attention to music art to a new point, that is, rhythm and beat, so that it can meet the needs of popularization and personalization. Music feature detection for audio files, analyze and identify many characteristic elements describing music: pitch, duration, intensity, beat, color, melody, melody, rhythm, music style characteristics, etc. Music is one of the most important parts of human spiritual world. Frequency file refers to the direct recording of the data obtained by binary sampling of the waveform of simulated real sound, that is, the reflection of real sound. In this way, the storage space of the sound file generated by storing the sound information is relatively large. Module files (mod, S3M, XM, MTM, far, Kar, it, etc.) have the same attributes as MIDI files and sound files, which means that module files contain not only instructions on how to play musical instruments, but also sample data of beep. However, the difference is that module files have many different formats, depending on how they are encoded. In order to extract the characteristic parameters of melody, different coding formats must be processed accordingly.

2.4   *Role of Identifying Chord Features*

Due to the growing demand for content-based search with intermediate functions, the search engine based on text keywords can no longer meet the needs of users. If computers can more accurately identify and transcribe chords in music, tags can be used to match the chord process of text blur, downloading and playing songs.

Understanding chords can make people analyze the structure of music more meaningful and appropriate. Chords often have a certain length, so music can be segmented and spliced according to the results of chord recognition. On the one hand, it can deepen the understanding and analysis of complex music structure, on the other hand, it can create more complex music emotional expression forms and enrich music expression forms.

2.5   *SVM multi-classification algorithm*

SVM is a binary model, which is a linear classifier with the largest interval defined in feature space. The goal is to find the maximum interval. The kernel method of support vector machine is the main embodiment of its superiority. It maps linear and indivisible data into high-dimensional feature space through nuclear technology, so

as to classify them in high-dimensional space. The following is a brief introduction to its principle.

For a dichotomic problem, the training data set on the feature space is written in the form: where, $x \in x = R''$, yi $\in Y=[-1,+1]$, $=1,2,..,N$, that is, the total number of samples is N. The characteristic parameters of each sample data are column vectors, and the vector is n-dimensional. The goal of learning is to find a separate hyperplane in the feature space, which separates instances of different types on both sides. The formula of the hyperplane is formula (1):

$$R \times x + a = 0 \qquad (1)$$

In general, if the data set can be classified, the number of corresponding hyperplanes is countless. The purpose of support vector machine is to find the hyperplane with the largest interval from the nearest instance, which can be expressed as a function. Formula (2) represents the distance between the ith sample and the separation hyperplane:

$$y = \min\left(y_i\right) \qquad (2)$$

When the above formulas are equal, the corresponding sample vector is represented by X, and X is the support vector. In general, the linear separability of data is not strict, so the above formula has no solution.
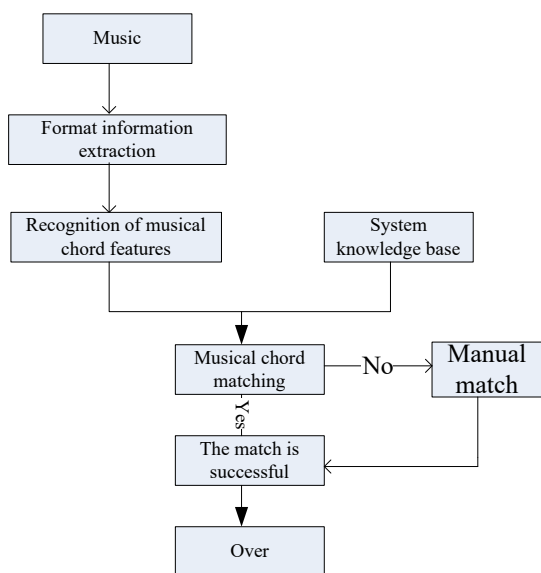
3 EXPERIMENT

3.1 *System Design*

Figure1.Music and Spin recognition system processes

Figure 1 is the flow chart of music and rotation recognition system designed according to the robust PCP feature and the application of SVM. As can be seen from the figure, when the music sounds, the system will record the music audio, then extract the music format information, and identify the music features after the extraction. At the same time, the system will match and compare the extracted music format information from the system music database. If the matching is successful, the matching result will be directly displayed and the system operation will be ended. However, if the automatic matching fails, the matching can be performed manually, and then the matching will be performed again until the matching is successful and the operation will be ended.

3.2 *Music and Spin Recognition Needs*

Chords can be divided into sound level and silent level. The classification standard of sound level is to distinguish according to the pitch. Therefore, the recognition of music features can also be divided into the following levels: on the one hand, extract the basic features of chords, on the other hand, analyze the complex features on this basis, and finally analyze the music. Based on the basic and complex characteristics, style and emotional connotation of music, note is the smallest basic unit of music. Each piece of music is a sequence of many different notes on a time axis. The basic properties of music are related to the information of notes, which can be obtained directly from music.

With the development of music, the sequence of notes plays a more and more important role in people's life. As the most active, intuitive and representative of rhythm and melody, beat stress. THM and melody represent the change law of tonal order on the time axis, and the description of music rhythm and melody is clearer. The structure, subdivision and emotional connotation of music are the general characteristics of music. They represent the most complete description of music.

Among all recognition categories, basic function recognition is the simplest and can be extracted directly from music format files. Complex characters must be analyzed through the recognized basic features to analyze the order of notes. They are recognizable but relatively complex. In this paper, the basic features, complex features and overall features of music structure are preliminarily identified by combining the robustness features and SVM model. This paper will directly extract the basic attributes of music from the music format, then analyze the extracted note sequence to obtain the attributes of melody and rhythm, and then compare and analyze the music structure according to the attributes of beat and phrase.

4 DISCUSSION

Table 1 is the data table of different types of music and spin recognition in this test.

Table1. Identification data

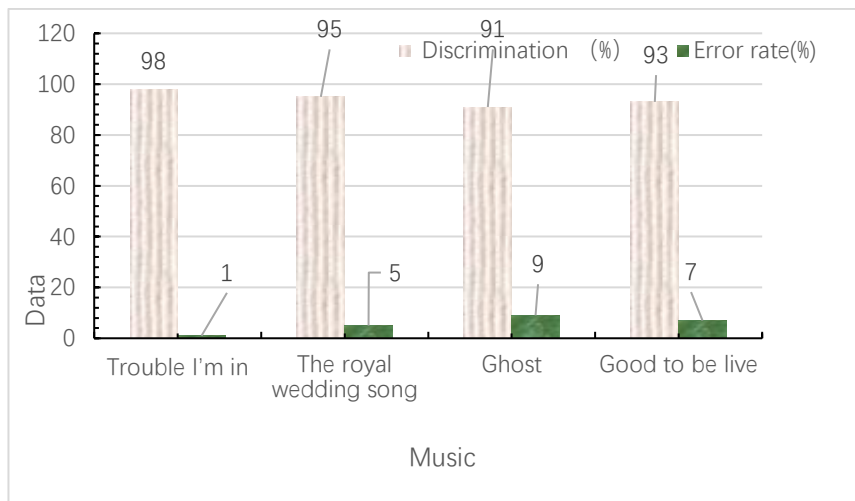| Test music	Characteristic	Recognition mode	Discrimination (%)
Trouble I'm in	PCP	SVM	98
The royal wedding song	PCP	SVM	95
Ghost	PCP	SVM	91
Good to be live	PCP	SVM	93

Figure2.Comparison diagram of the music and spin recognition ratio

Combined with Table 1 and Figure 2, it can be seen that the accuracy of all songs after system recognition is more than 91%. The distance measurement of traditional support vector machine kernel function generally supports euclidean distance. Although this technology is simple and easy to implement, sometimes it can not achieve the expected effect for the data from a specific data set.

5 CONCLUSION

In the field of music, it is very important to identify and classify complete music works. For a song that has been identified accurately and quickly, effective training methods can help us express the emotions expressed by the lyrics quickly and correctly. Therefore, it is of great significance to use the robust PCP feature to study whether the chord is composed and distinguish the change of strength, and use it as a classifier to learn and understand the composer's emotional characteristics. At the same time, it can also provide reference value for the relevant theories in the field of music, and help to improve the in-depth understanding and understanding of the integrity and accuracy of music works.

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