

# Music Teaching Reform in Colleges and Universities under the Background of the Development of Contemporary Music Discipline

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**Objectives:** With the continuous progress of information technology, multimedia teaching forms with a large number of emerging educational technology development carry more audio-visual information, with rich pictures, demonstration images, audio-visual integration characteristics, which has been widely used in the process of music teaching in Colleges and universities. **Methods:** And it has gradually become the main teaching mode of music teaching in schools, and have been increasingly popular. Therefore, the development of modern music discipline and the reform of music teaching in schools are analyzed to find a suitable way for music teaching in schools, so as to gradually improve the development speed of music education in China. **Results:** The study based on digital audio related technology contained in CAT-based Solfeggio and ear training system provides an example to demonstrate the message mechanism. Audio feature extraction and matching technology are also discussed. Several types of audio feature extraction methods and their features are analyzed. **Conclusion:** The design of the whole framework and the realization of the core algorithm of Solfeggio and ear training learning assistant system are completed. Tests show that the algorithm can be well applied in the system, while making the system more flexible and scalable, and can be further extended.

**Keywords:** music discipline; college music teaching; CAT technology

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With the continuous progress of computer technology and the acceleration of economic globalization, multimedia technology has gradually integrated into different aspects of people's lives and become the most critical technology in the world. Especially, the contemporary educational technology has been widely used in the field of teaching. The artistry of the classroom can be reflected by vivid pictures, rich pictures and beautiful music, which improve the quality of teaching<sup>1</sup>. In the current education industry, multimedia technology, with its own advantages, has become an indispensable assistant tool in the contemporary teaching process<sup>2</sup>. Flipping classroom

is the current representative form of educational technology, but can flipping classroom achieve teaching objectives and achieve good teaching results in classroom activities? With the continuous progress of Internet and digital technology, in the process of music education in China, digital music teaching mode is used based on traditional music teaching methods, and it is gradually becoming a development direction<sup>3</sup>.

This kind of auxiliary teaching method can simulate a series of sounds such as string, Orchestra and percussion through digital technology. It can also fully reflect the rhythm of rock, jazz, tango and other rhythms, so that music teaching reform is facing development opportunities. Similarly, it also puts forward a

new demand for curriculum teaching<sup>4</sup>. However, in the process of higher music teaching, solfeggio is the most critical component. First, it can improve the students' hearing ability; secondly, the ability to sing immediately after reading music, which should also fully combine speed, rhythm, melody and other aspects, so the teaching of solfeggio is simple and complex. Therefore, the digitalization of this kind of classroom teaching has become the main problem in the teaching and research of art major in Colleges and universities<sup>5</sup>.

The innovation of the study is to design a programming example to demonstrate the message mechanism, starting with a given collaborative system task, combine the characteristics of multimedia teaching of music courses in Colleges and universities. Based on CAT technology, the tasks and resources needed are analyzed effectively. Through a series of transformation methods, special standards are observed at the same time, simulation and system function verification are carried out, and collaborative simulation and system testing are carried out. The optimization of this system promotes the improvement of multimedia teaching effect of music courses.

Using classroom CAT technology to analyze the effect of multimedia teaching mode of music course in Colleges and universities, the study is divided into five parts. The first part introduces the background, methods, innovations and research methods. The second part is about the application of multimedia teaching mode in college music teaching, which lays a theoretical foundation. The third part puts forward the technical method of college music CAT, and carries out the performance optimization analysis of multimedia system; the fourth part introduces the algorithm into a system to test the operation efficiency of the multimedia teaching system of music course combining software and hardware; The fifth part is a summary of the results of this study, which also points out the shortcomings of this study.

Flipping classroom is a kind of teaching method, and Salman Khan was widely valued at first. Subsequently, under the guidance of the scholar

Mantz S, Khan College gradually became an important position for educators to use the flipped classroom teaching mode<sup>6</sup>. At present, the concept of flipped classroom has been applied by schools in various countries around the world. This concept originated in junior high school and was later used in Colleges and universities. Demorest S proposed that because the teaching effect of "flip classroom" in the West is obviously closely related to network technology, the domestic education field began to pay attention to a few years ago, and some key schools launched pilot work, and achieved good results<sup>7</sup>. Stensth believed that as an emerging teaching method of information technology, more in-depth discussions and analysis have been carried out. Music is developing rapidly and culture is changing in the direction of diversification. Diversity in the digital music environment is increasingly reflected. Students' opinions and perceptions of music are not limited to the concepts of educators<sup>8</sup>. Raglio A suggested that piano timbre plays a key role in the teaching process and plays a role of sound, which was relatively simplified. Students can no longer meet their requirements in the process of training auditory technology, which in turn has caused many problems. For example, students in the passive learning process, the low level of cognition is not conducive to the smooth progress of teaching activities, their practice level cannot be better improved, and their practical ability cannot be effectively linked with teaching effectiveness and test results<sup>9</sup>. Caraman C believed that multimedia devices can produce synthetic teaching content, with correct pitch rhythm, and can play according to the teacher's design and students' learning situation sentence by sentence, while the timbre, speed and tone can change with the content<sup>10</sup>. Xie MA proposed that this kind of automatic broadcast function can relieve the pressure of teachers' constant accompaniment of model singing, save time and energy, and also enable students to form a good auditory basis, in order to better participate in various performance activities<sup>11</sup>.

Generally speaking, compared with the previous teaching mode, teachers only need to use multimedia equipment scientifically, which will

certainly improve the teaching effect in the course of Solfeggio and ear training. Therefore, a series of discussions and analysis are launched on the development of modern music discipline and the reform of school music teaching combined with the previous research results.

## METHODS

### Music Feature Matching Algorithms

Sound has the physical characteristics of acoustic characteristics, which refers to timbre, pitch, length and intensity, referred to as the four elements of sound<sup>12</sup>. The pitch is an important characteristic parameter of the evaluation function in this paper. Sound pitch features are transformed from gene contour features. There are three main methods for pitch extraction: instant domain method, frequency domain method and time domain and frequency domain synthesis method. There are several main methods of time domain method, namely short-time autocorrelation function method, zero-crossing rate method, parallel processing technology (PPROC, AMDF) and so on<sup>13</sup>. Frequency domain method can also be divided into several main methods, namely simple inverse filter tracking method, frequency extreme point detection method, FIR filter, wavelet function method and so on. Firstly, the linear smoothing algorithm uses sliding window for linear filtering.

$$y(n) = \sum_{m=L}^L x(n-m) * w(m) \tag{1}$$

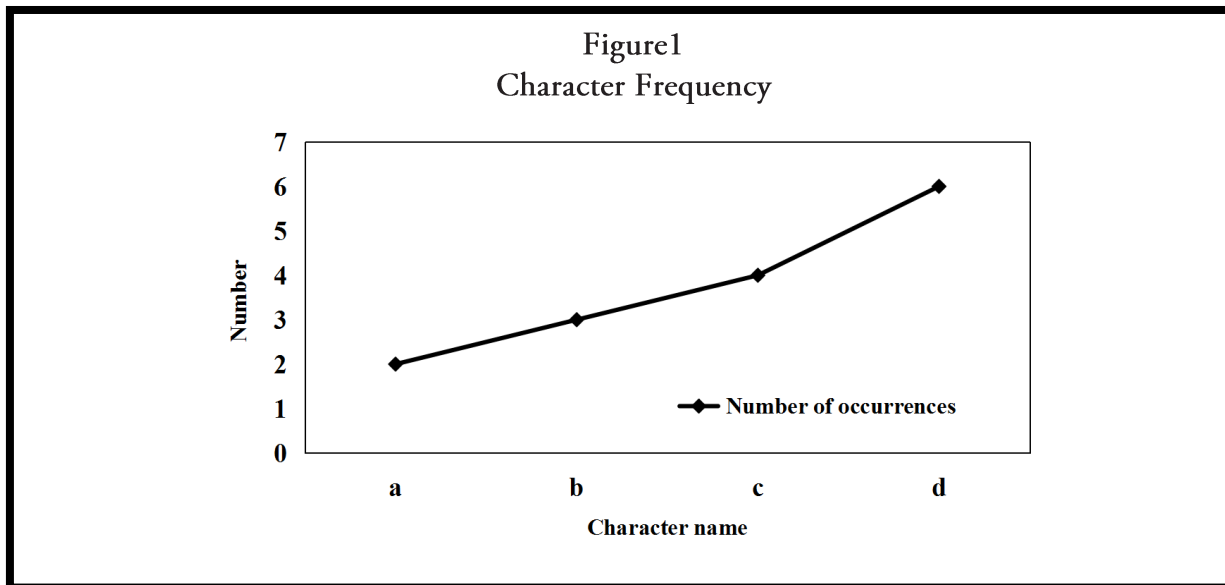
In the upper formula,  $\{w(m), m = -L, -L+1, \dots, 0, 1, 2, \dots, L\}$  is the smooth window of  $(2L + 1)$  point, which accords

$$\sum_{m=L}^L w(m) = 1$$

with: . Linear smoothing can not only minimize the "outliers" in the signal, but also make corresponding changes to the values of the sample points in the simplification. In such cases, the effect of smoothing will be more remarkable if the length of window is increased,

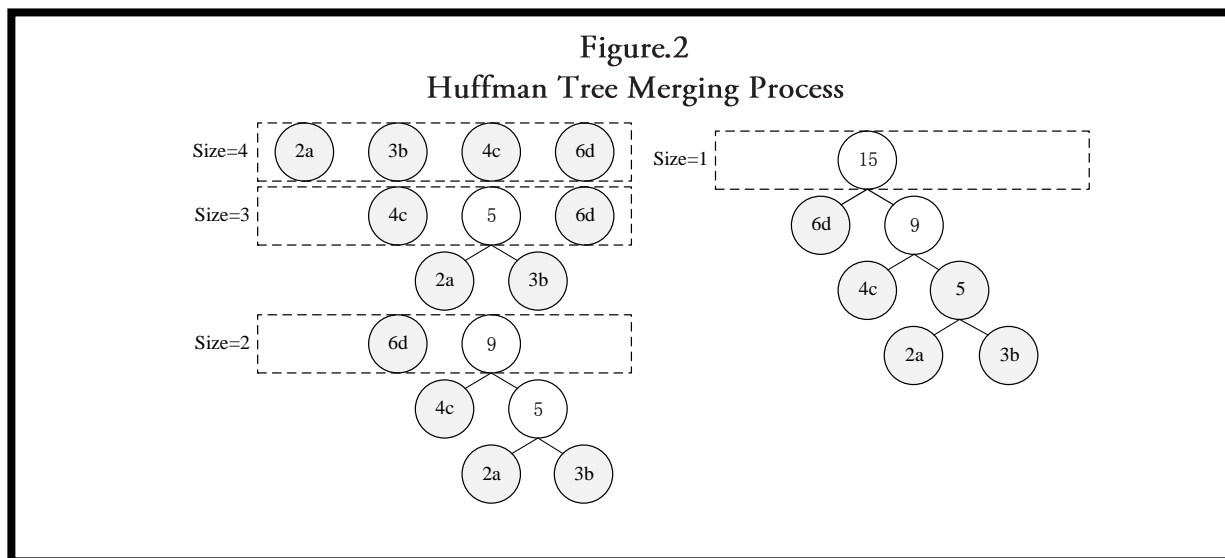
but this will make the step between two adjacent smoothing segments more obvious and the signal will be more blurred<sup>15</sup>. Therefore, in order to make the smoothing effect more remarkable, most of the two medians are connected, and the integration of the two medians is smoother. This is the use of two different ways: median smoothing and linear smoothing, which can improve the smoothing effect. With this kind of processing, the smoothed pitch trajectory will be more similar, so it should be treated by secondary smoothing. After the first balance, the pitch trajectory will be further smoothed. And after extracting the features of solfeggio fragments, a comparison between these features and the characteristics of music score should be made, and then infer the accuracy of these features. Because the voice has the flexibility in terms of time, the singing method can be different from that of a piece of vocal music practice. It can use both fast rhythm and medium-slow rhythm.

For different types of Huffman encoding formats, it can also be compressed and coded to reduce the space resources occupied by data. The Huffman decoding process consists of the following steps: First, to calculate the frequency of each different character in the data, it is necessary to scan the data as a whole. After scanning the input data, a statistical table is generated, which records the frequency of each different character. This statistical table is called a frequency table. The frequency table is also the main component of the file header. It is necessary to create a different character array record and count its frequency, so that it can be reduced in equal proportion. Huffman tree is a binary tree. The way to construct Huffman tree is to use greedy strategy. Building Huffman tree is the most important part of Huffman coding. The construction of Huffman tree requires the following steps. Numbers are used to represent the frequency of character generation. Each character is a single node number. For example, if the string "aabbccccddddd" is coded, the character frequency is shown in Figure 1 below.



The process of greedy strategy is to count the two characters with the least number of occurrences. The frequencies of the two trees must be added together, and then merged to assign the merged results to the new root node. There were initially four characters, so there were

four single-node trees. This process is repeated, because the lowest frequency trees are merged, so there will eventually be only one tree. Then the Huffman tree construction process is completed. The merging process is shown in Figure 2.



When the data is finally encoded, each leaf node of the binary tree represents a character. The encoding process is a path from the root node to the leaf node. For coding, the following rules should be followed: from the root node, if the leaf node enters the right direction, it needs

to be coded as 1, and if the left subtree, it needs to be coded as 0. All bytes have only two different states, 0 and 1. From the Huffman tree in the figure above, it can be seen that the Huffman coding table generated is shown in Table 1.

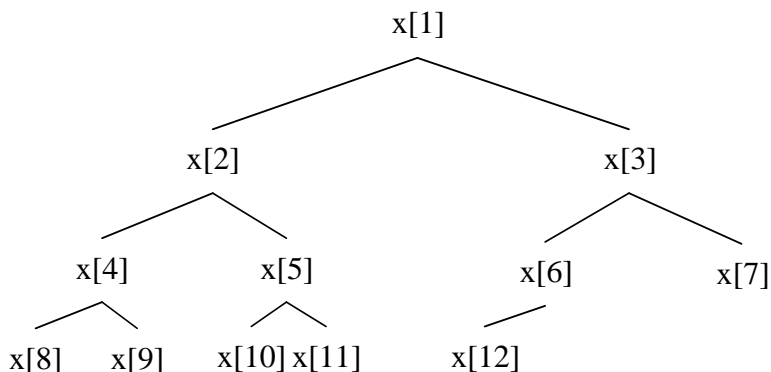
**Table.1**  
**Huffman Coding Table**

character	frequency	Code	Code length
a	2	110	3
b	3	111	3
c	4	10	2
d	6	0	1

Huffman code path is the last leaf node, so there is no code overlap. Any leaf node is not the ancestor or descendant of another leaf node, which means that the encoding result of any character has uniqueness. In decoding, this feature ensures that ambiguity is avoided. The length of the encoding is determined by the frequency of different characters appearing in the

data. The heap in the data structure is used to realize the priority queue. Minimum heap is a data structure. In storage mode, one-dimensional linear table storage elements are used. These elements logically form a binary tree. A logical binary tree of the smallest heap is shown in Figure 3.

**Figure.3**  
**Minimum Heap Logical Binary Tree**



The task of the minimum heap is to extract the smallest elements and insert operations, so in order to maintain the characteristics of the heap, each insert and extract has to adjust the nodes. For priority queues, two basic operations are needed: inserting new elements, extracting the smallest elements, constructing Huffman tree and obtaining Huffman code table. In order to decompress, a file header is needed to ensure the correctness of the Huffman tree constructed by

decoding. Huffman decoding first needs to know the address information of the location stored in the code table. The two main components of the memory address of base address and offset address are: the code table information generated during coding is stored in memory, the starting address of code table information is stored in base address, the information of code table number is stored in base address signal register, and the information of code stream signal is output at the same time.

### Audio Digitization Method

In nature, the voice is more complex and the waveform is more changeable. If we want to complete the storage by computer, the waveform should be converted to digital mode. The current mode of use is pulse code modulation coding, which is called PCM (Pulse Code Modulation) coding. In the phase of converting changing analog signals into digital coding, the three steps PCM should use are sampling, quantization and coding. Depending on the analog-to-digital converter (ADC), an amplitude value is continuously collected on the waveform of analog audio at intervals of one time, which is called sampling. The data obtained from each sampling is relative to the acoustic signal at that time point, that is, the sampling sample. Connecting these samples together, the elaboration on a sound wave is enabled. Although the sampled signal is discrete in time, its range of values is a continuous interval in magnitude (it can be any value in a real number field). In order to store the magnitude representing the sound size into the computer, the sampling value should be expressed by a limited binary digit string, that is, quantized into a set of finite magnitude values. Firstly, the whole amplitude is divided into a set of finite small amplitudes, and the sample values existing in a certain step are divided into one type and assigned. After audio analog signal is sampled and quantized, in order to store digital audio into computer, it must be coded, that is, the whole analog-to-digital conversion process is realized by representing the quantized values of all samples by binary digits.

For MIDI message mechanism, MIDI devices generally consist of four parts: MIDI port, MIDI keyboard, sequencer and synthesizer. The MIDI keyboard itself is silent and is only used to generate MIDI messages. A sequencer is a computer software or electronic device for recording, playing and editing MIDI files. Most sequencers can input and output MIDI files. A synthesizer refers to a MIDI sound synthesizer, which is an electronic musical instrument. The real synthesizer looks like a small box with many buttons in front of it, but sometimes we

completely replace the synthesizer with a computer, using its sound card, wave meter, operating system and MIDI software to realize the function of a professional electronic synthesizer. How does a computer process MIDI messages? When a MIDI keyboard is connected to a computer's sound card and a key on the keyboard is pressed (assuming it is a baritone C), the keyboard sends three bytes of information to the MIDI Out port. In hexadecimal notation, these three bytes are (two bytes count as one byte):  $9n+3C+40$ .

"Flipping Classroom" lets students control their learning. In the traditional classroom, in order to balance the quality of teaching and to make most of the students accept the teaching content, music teachers often choose the course with moderate difficulty, but for the top students in the class, the teaching content seems endless. For the students with weak foundation, it is difficult to accept for a while. Teachers are difficult to adjust the audience and grasp the difficulty of teaching. But after using the flip classroom model, it brings a brand new music learning experience for students. Watch the teaching videos provided by teachers for students at home or based on the online video platform. Using this video, students can adjust their learning arrangements according to their own state in a relaxed and pleasant environment. This enables students to better absorb knowledge according to their own rhythm, without considering the learning status of other students. Students with good foundation can learn more than one section of music lessons through micro-lessons and curtain lessons at the same time. For students with weak foundation, only one or two sections are needed to complete the task of classroom teaching. For unknown areas, one can adjust the course progress by video stopping, pausing, fast regression, fast forward, playback, pullback and other methods, and watch the video rhythm fast or slow all by ourselves. Chat software can also be used to help teachers and partners to solve the difficulties encountered in the learning process, in a sense, improve the efficiency of teaching, reduce teaching time, excellent results gradually emerged. "Flipping Classroom" increases classroom interaction. The advantage of using flipped classroom form is that it increases the time for teachers and students to coexist. By

watching videos of knowledge points after class, students can better communicate with teachers in class "one-to-one", and students can carry out learning activities through their own cooperative groups. Teachers can also gather students with relatively concentrated questions to explain, integrate them into the discussion process, answer students' questions, and give effective guidance to all students' learning.

In these ways, chords can be played on the keyboard. Note On messages are generated by keyboard input, and the computer can play notes when it receives these messages. When the keys are loosened, the keyboard can send the Note Off message to the computer through information. Generally speaking, MIDI keyboards connected

to computers are called "MIDI controllers", which are responsible for generating MIDI messages and transmitting them to computers. Some MIDI controllers do not look like keyboards, such as MIDI guitar controllers that look like clarinets or saxophones, MIDI wind controllers, MIDI drum controllers and MIDI string controllers. While controlling these controllers, each controller generates three Note On messages and three Note Off messages. In addition to Note On and Note Off messages, there are many kinds of MIDI messages. The corresponding relationship between some important MIDI messages and functions are shown Table 2:

**Table2**  
**Important MIDI Message and Function Comparison Table**

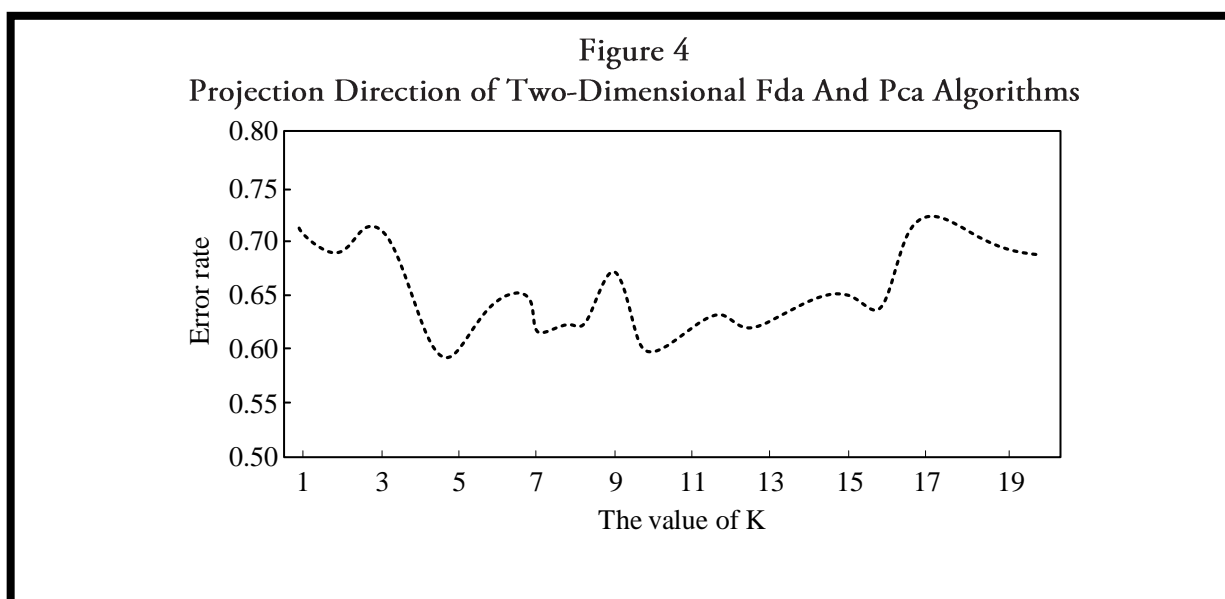
MIDI news	format	function
Note Off	8n kk vv	kk=Key number ( 0-127 ) vv=speed ( 0-127 )
NoteOn	9n kk vv	kk=Key number ( 0-127 ) vv=speed ( 1-127 , 0=note off )
Polyphonic After Touch	An kk tt	kk=Key number ( 0-127 ) tt=After the press ( 0-127 )
Control Change	Bnccxx	cc=Controller ( 0-121 ) xx=value ( 0-127 )

Channel Mode Local Control	Bn 7A xx	
All Notes Off	Bn 7B 00	
Omni Mode Off	Bn 7C 00	
Omni Mode On	Bn 7D 00	
Mono Mode On	En 7E cc	cc=Channel number
Poly Mode On	Bn 7F 00	
Program Change	Cn pp	pp=program ( 0-127 )
Channel After Touch	Dn tt	tt=After the press ( 0-127 )
Pitch Wheel Change	En ll hh	ll=Low 7 bit ( 0-127 )

**RESULTS**

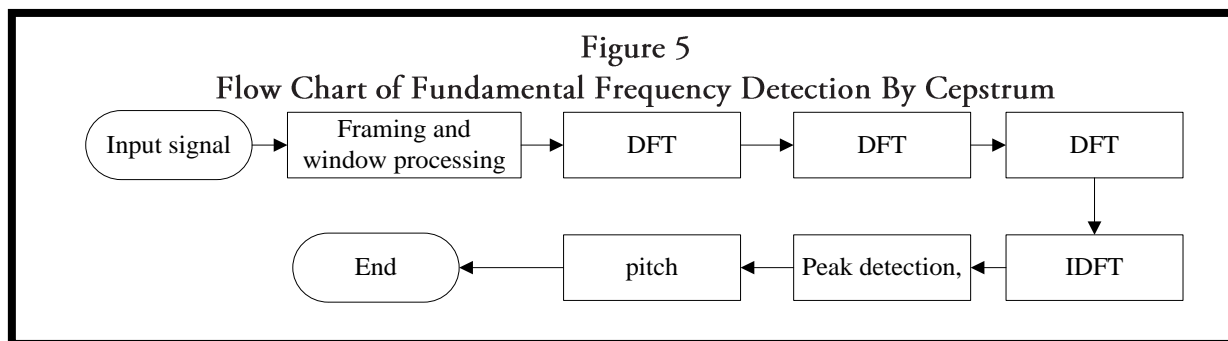
To introduce the algorithm into a system for testing, the first step is to call the computer audio input device to record the sound information of singing. Secondly, the audio signal is preprocessed and processed, and the voice of the singer is compared with the data in the standard database, so that the corresponding results can be better feedback to the users and the problems can be found. In Windows environment, if a piece of memory space is to be obtained, the required function is Global Alloc Ptr. However, due to the virtual storage management mechanism of

Windows operating system itself, this kind of memory space may be transferred to the hard disk. In such cases, reading and writing of the hard disk may waste a lot of time. Therefore, discontinuity problems will arise at any time in the recording and sampling of sound. In order to solve this kind of problem, Wave in Prepare Header function should be used, which can make the replacement problem from buffer to hard disk not occur before reaching the waveform input device. At the same time, the function Wave in Unprepare Header should be used to unprotect the buffer, and the function to release the buffer must adopt the Global Free Ptr function.



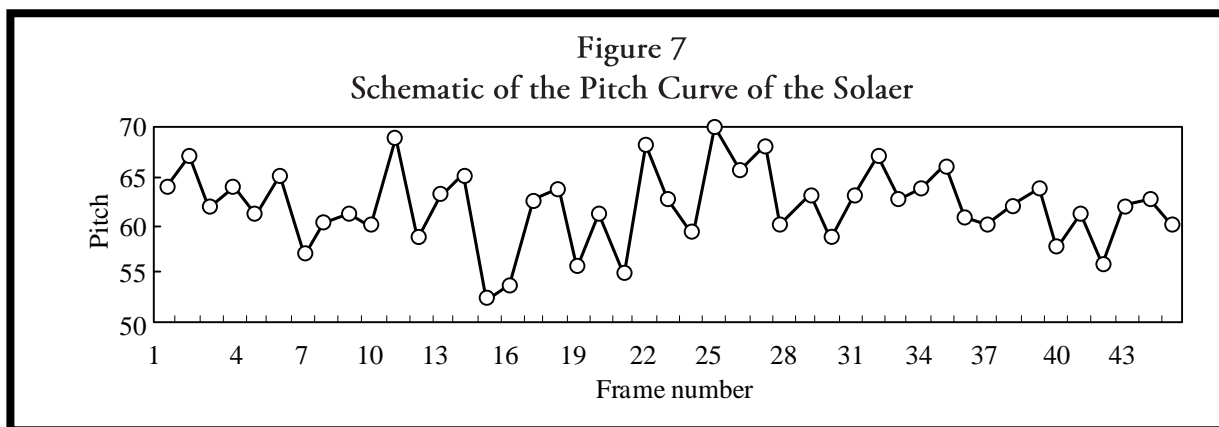
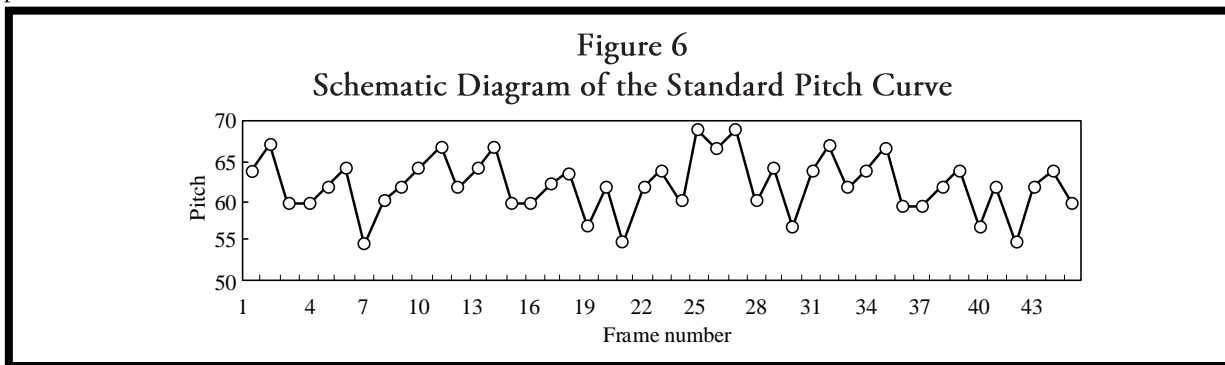
Because the sound signals belong to a kind of signal that changes with time, the waveform changes quickly with time. However, if the time unit of the signal is reduced or the signal is amplified in the process of sound observation, the change of the waveform will be slowed down continuously, which is the short-term stability of the audio. On the basis of these features, the pretreated signal can be processed for a short time, that is, subframe processing, so that pitch can be obtained from it. Pitch feature extraction is a feature quantity for quantitative analysis of sound intensity. It is constrained by the frequency of the sound signal. Spectrum can make a general prediction of pitch. On the basis of the short-term energy method mentioned above, the short-term frame can be obtained from the signal, and the fundamental frequency can also be defined on the premise of spectrum analysis. In high school, audio is the most

important component. For the pitch of the singer and the original, the pitch can be effectively recognized by using the contrast of fundamental frequency. For fundamental frequency detection, it includes correlation processing, Waveform Estimation and transformation. In the vocal music evaluation system mentioned here, the cepstrum method is the way to obtain the fundamental frequency parameters, which is derived from the transformation method. Figure 5 is the main process of detecting fundamental frequency by cepstrum method. In this kind of transformation, the selection of window function is very critical, and Hamming window is the basic choice;  $\ln |S(w)|$  represents logarithmic amplitude spectrum; and  $|S(w)|$  represents the amplitude spectrum of sound signal. The cepstrum of the signal is accomplished by Fourier transform, and the period of the pitch can also be obtained from the cepstrum waveform.



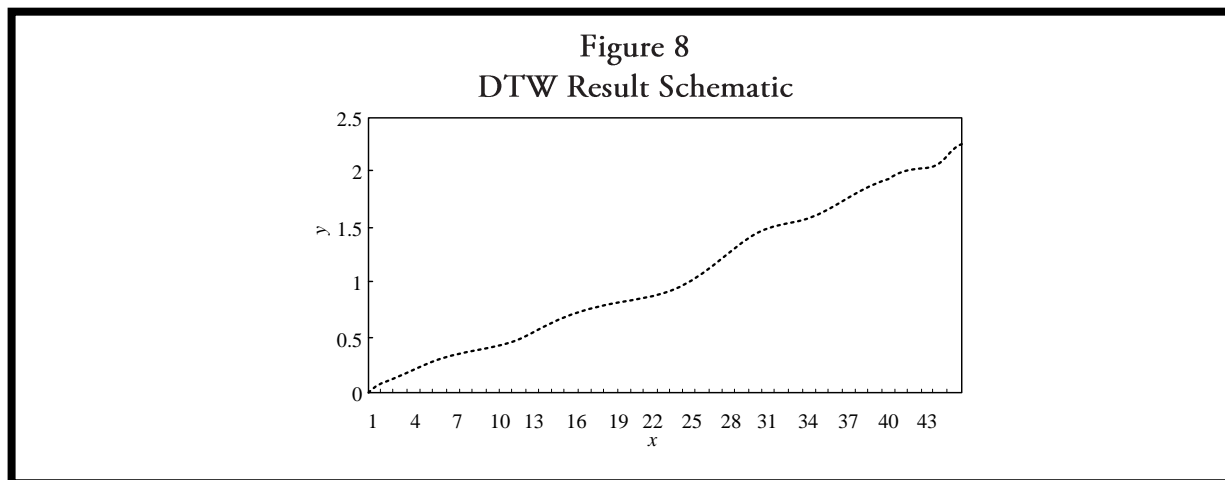
Because pitch signals in MIDI files are stored in semitone format, the obtained pitch sequence can be converted into semitone format. In the algorithm used this time, the dynamic time warping method is used, that is, DTW algorithm to estimate the distance of feature parameters. In the process of speech signal processing, this method is widely used, which is to complete the similarity comparison. Firstly, people select a

Solfeggio track from the standard library. According to the feature extraction method mentioned above, the pitch feature extraction of the user's selected Solfeggio track is carried out, as shown in Figure 6 below. After the completion of the solfeggio, the pitch features of the solfeggio situation are acquired, as shown in Figure 7.



In the process of defining the similarity, DTW is used to get the average distance between the two features. Figure 8 provides the DTW results of the standard and feature songs. In this example, the minimum average distance of DTW

is 2.2, which is larger than the system setting threshold of 3.5 (according to experience settings), which indicates that this solfeggio is successful and can remind users to choose the next solfeggio topic.



## DISCUSSION

At present, for music teaching in Colleges and universities, the traditional teaching methods are gradually

difficult to meet the requirements, so this teaching mode should gradually change, and slowly adapt to the needs of teachers and students. Therefore, the development of Contemporary

Music discipline and the reform of music teaching in Colleges and universities are studied. Firstly, the current situation of traditional Solfeggio Teaching and the development of digital Solfeggio teaching software at home and abroad are studied and analyzed, and the related concepts of solfeggio music theory are introduced. The digital audio related technology, MIDI technology, audio feature extraction and matching technology involved in CAT-based solfeggio algorithm are deeply analyzed, and several audio feature extraction methods and their characteristics are studied. Based on this, the overall structure design and important module implementation of Solfeggio and ear training learning assistant algorithm are realized. At the same time, the prototype algorithm and the effect of using the algorithm are demonstrated. The algorithm of Solfeggio teaching software studied integrates a series of technologies, such as computer multimedia digitization technology, interactive technology, database and so on, to form "differential interaction of media information flow". On the whole, multimedia teaching method can improve the efficiency of extracurricular learning, and then achieve teaching objectives, so that students can enter a new realm of contemporary music learning.

### Human Subjects Approval Statement

This paper did not include human subjects.

### Conflict of Interest Disclosure Statement

None declared.

### Reference

1. Cameron L. How learning designs, teaching methods and activities differ by discipline in Australian universities. *Journal of Learning Design*, 2017, 72(3):27-43.
2. Caraman C. Musical Excellence: The Spiritual Panacea of the Future. *Social Science Electronic Publishing*, 2017, 47(1):143-150.
3. Demorest S M, Kelley, Jamey, Pfordresher, Peter Q. Singing Ability, Musical Self-Concept, and Future Music Participation. *Journal of Research in Music Education*, 2017, 64(4):405-420.
4. Feng C, Canfei H E, Deng H, et al. Development and innovations in the human geography discipline at Peking University. *Acta Geographica Sinica*, 2017, 27(11):99-106.
5. Gray S D P. The discipline of general practice: recognition and teaching. *Br J Gen Pract*, 2018, 68(670):212-213.
6. Impett J. Artistic Research in Music: Discipline and Resistance: Artists and Researchers at the Orpheus Institute. [3]2017, 66(28):1036-1042.
7. Littlejohn, Deborah. Disciplining the graphic design discipline: The role of external engagement, mediating meaning, and transparency as catalysts for change. *Art*, 2017, 16(161):33-51.
8. Mantz S. Sourcebook for Research in Music by Allen Scott, Phillip D. Crabtree, Donald H. Foster. *Microcomputer Applications*, 2017, 7(5):43-49.
9. Raglio A. [Music therapy and Rehabilitation medicine: state of the art and future perspectives. Editorial].. *Giornale Italiano Di Medicina Del Lavoro Ed Ergonomia*, 2017, 39(4):271-272.
10. Stenseth, Karette. Music therapy and interactive musical media in the future: Reflections on the subject-object interaction. *Nordic Journal of Music Therapy*, 2018, 27(4):1-17.
11. Troncoso D G, Pérez C V, Vaccarezza G G, et al. [The influence of pedagogic and discipline training on the teaching quality of university professors].. *Revista Medica De Chile*, 2017, 145(5):610.
12. XIE Bangxiu. On the Beauty in the Teaching-Learning Process of "Do-Re-Mi" in The Sound of Music. *Education Teaching Forum*, 2018(8):439-446.
13. Xie M A, Yang Y F, Tao Y, et al. Effects of musical cultural experience on music emotion processing. *Chinese Science Bulletin*, 2017, 62(20):2287-2300.
14. Yarui WU. Bilingual Teaching Practice and Research of Introduction to Ecology in Physical Geography and Resource & Environment Discipline. *Asian Agricultural Research*, 2017, 56(9):75-76.
15. Yu X. Research on Enhancing the Actual Effects of Multimedia Teaching in Colleges and Universities. *Asian Social Science*, 2017, 72(3):27-43.