Research on Piano Performance Based on Big Data

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Abstract. With the continuous development of the Internet era, the sharing of audio and video resources for piano music is more and more obvious; you can easily find the required video and audio. The enthusiasm of the people to learn the piano more and more high, piano teaching market is becoming more and stronger. However, in the field of piano teaching, there are still some pain points: the current teacher resources cannot fully meet the needs of students for piano practice. Therefore, at present, many companies and institutions are beginning to apply computer technology to piano practice. For actual piano teaching scenario, this paper designed and implemented a proprietary hardware, closely integrated with offline teaching scene, simple and easy to use, interactive is strong piano practice system. Based on the change of sound, visual data is obtained, and piano performance is studied by combining professional knowledge, harmony, musical expression terms and other conditions.

Keywords: Big data, Piano performance, Video resources, Aided design

1. Introduction
With the development of the Internet, online education is becoming more and more developed. At present, the online education is basically for the traditional course to carry on the video study, the Internet enabling education has become the development trend of the industry. In the field of quality-oriented education, especially in the field of music education, many companies and institutions have begun to develop intelligent online music education products to improve the teaching efficiency of teachers and the learning effect of students.

Musical education is crucial to the cultural inheritance of human beings, and piano education is the most important part of music education[1-2]. Receiving good piano education can improve personal accomplishment and cultural quality, edify moral cultivation; it can also develop intelligence and develop coordination. In the field of piano education, children's piano education has a huge market. According to data provided by the Chinese musicians association, the number of children learning piano in China has reached 35 million, and the number continues to grow rapidly.
2. Systematic demand analysis of piano performance

Before the development of large software, it is very necessary to conduct a complete system demand analysis and overall design, which is helpful to optimize the design of software, clarify the development thinking and logic of software, and improve the quality and efficiency of software development. This chapter firstly conducts demand analysis, which is divided into two parts: overall demand analysis and functional demand analysis[3-4]. Then carries on the system design, the system design divides into two parts, the system function design and the database design.

2.1. System demand analysis

For an online education product, the overall needs of the system must be analyzed by students. The piano practice system in this paper is aimed at children under 10 years old, so parents' participation is needed to achieve better teaching effect[5-6]. At the same time, through the research on the offline piano education market, we found that students are enrolled in the piano school, the piano school assigns teachers to train students, the system needs to form a good interaction with the participation of teachers. We also need to organize the teachers through the principal. To sum up, there are five types of users of the piano auxiliary exercise system: system administrator, parents, students, teachers and principals[7]. The system administrator is responsible for uploading and managing music, viewing and analyzing performance data, and analyzing user behavior. Parents are responsible for assigning homework and checking the completion of homework, as well as managing student information. Students are required to view demonstrations and complete assignments. The teacher is responsible for managing the students and assigning homework. The principal is responsible for teacher development. Based on the above analysis, the overall demand diagram of the system can be basically determined:

![Diagram](image)

Figure 1. The close relationship between piano playing process and big data

2.2. System function design

Based on the system demand analysis in the previous section, this paper divides the piano auxiliary exercise system into three ends, namely the client end, the WeChat end and the web end. The client runs on the iPad and can be divided into playing module and playing module according to module
functions. WeChat end is carried by WeChat public number, which can be divided into operation module, user management module and social module according to module functions. According to the module function, the webpage can be divided into the music management module and the data analysis module.

The performance module is mainly responsible for the social functions of students and teachers. In the playing module, the users who are in the same school, under the same teacher and the users who are concerned with the current users will be presented in the form of CARDS. On the cover of the card is the user's head, and at the bottom of the card is the latest track that the user has played. Click on the card to go to the next level of the page. The left side of the next level of the page shows the user's personal information, including the tracks the user played, the popularity rating, and the number of stars they received. On the right side of the next page are playing CARDS, arranged in reverse chronological order. At the top of the page at the next level, you can focus on the user (teacher or student) of the current page. Clicking on the playing card allows the user to see a playback of the current playing. For this performance, users can click like, average or dislike.

3. Design of database of piano performance

There are a lot of physical objects involved in the piano assisted exercise system, including five kinds of users, recording, diary, homework, demonstration, books, music, etc., and there is a strong correlation between objects and objects, so we choose MySQL database with good correlation support to build the database needed by the system. Among the database servers, we chose the MySQL database server of alibaba cloud to support our business. As can be seen from the e-r diagram of the database, various relationship tables associate various entity objects in the database around the entity objects in the database. It can also be seen from the e-r diagram of the database that choosing MySQL database can better meet the requirements of the system for complex relevance.

![E-r diagram of the database](image)

Figure 2. E-r diagram of the database

3.1. Design of open table

This table stores the basic information of the score. Among them, the illustrations, the electronic music spectrum XML file and the files generated by the music spectrum parsing are stored in alibaba cloud OSS.
server, and only the URL is recorded in the music spectrum table. The specific fields of the open table are shown in Table 1.

**Table 1. Design of open table in piano performance**

| Field               | The data type      | Note                                           |
|---------------------|--------------------|-----------------------------------------------|
| Id                  | Int (11)           | The primary key id                           |
| Illustration path   | Varchar (255)      | Illustrations of the URL                     |
| Open path           | Varchar (255)      | Score of the URL                             |
| English name        | Varchar (255)      | The English name of the score                |
| Name                | Varchar (16)       | Name                                          |
| Page number         | Tinyint (4)        | The number of pages in a book                 |
| Open data path      | Varchar (255)      | The URL of the data store from the clef       |
| Book id             | Int (11)           | The book id where the score is located        |
| Created at          | Datetime           | Creation time                                 |
| Is deleted          | Tinyint (4)        | Whether it is deleted or not                  |
| Is one hand         | Tinyint (4)        | One hand or two hands                         |

3.2. Recording table design

The information related to the recording is stored in the recording form. This table stores not only information about the students' practice recordings, but also information about the teacher's demonstration recordings, distinguished by the field type. The specific fields of the recording table are shown in Table 3-5.

**Table 2. Design of recording table in piano performance**

| Field               | The data type      | Note                                           |
|---------------------|--------------------|-----------------------------------------------|
| Id                  | Int (11)           | The primary key id                           |
| Open data path      | Varchar (255)      | The URL of the data store from the clef       |
| Created at          | Datetime           | Creation time                                 |
| Is one hand         | Tinyint (4)        | One hand or two hands                         |
| Size                | Decimal (4,2)      | The size of the recording file                |
| Duration            | Decimal (4,2)      | Length of recording                           |
| Audio path          | Varchar (255)      | Audio file address                           |
| Algorithm path      | Varchar (255)      | Algorithm file address                       |
| Playback path       | Varchar (255)      | Playback file address                        |

After the pitch is obtained, the positioning algorithm module will locate the notes according to the score. In the positioning algorithm, the module has two positioning modes: uncertain positioning and certain positioning. When the tone matches the current position or the next position of the score, the positioning method is determined. When all do not match, the positioning method is uncertain positioning. In the initialization, the module assumes that the user played from the first position of the score. The module will compare the tone with the first position of the score. When there is a mismatch, we will look at the next position of the current position. If they do not match, then we need to calculate the similarity between the detected tone and the reference score to conduct the uncertain positioning. At this time, a temporary position will be given in the system. After the positioning of subsequent tones is determined, we will know the previously uncertain positioning interval. At this time, we conduct dynamic time planning and correct the previous uncertain positioning to get the best positioning.

After obtaining the result of detecting the tone of the whole song, and having the time information
and positioning information of each tone, the evaluation module will make an evaluation on the performance of the user. The evaluation mainly includes the evaluation of pitch correctness and the evaluation of playing rhythm. The evaluation of tonal correctness is to score the result of the comparison between the notes played and the score; the evaluation of playing rhythm is to score the result of comparing the standard playing time given by the score with the actual playing time.

4. Conclusion

This paper mainly uses digital analysis technology in music analysis, and specifically USES it in cool edit software, making it one of the analysis methods of music works. On this basis, new ideas of music research and new opinions of music analysis are put forward, which is a new viewpoint of applying electronic products to music teaching and solves the fundamental problem that some music teaching cannot use physical objects to express music. On this basis, further in-depth research on music skills and emotions is carried out to enable students to complete the third creation which is relatively complete in terms of structure and emotion, so as to promote the interesting and long-term development of music teaching. However, the author's research ability of electronic software is limited, and can only stay on the basic equipment research, the depth of the research needs to be deepened. I hope that I can supplement the deficiencies in the thesis through my future study.

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