



## Insights into Human-Computer Interaction in Emotion Analysis for Music Education Performance Based on AI-powered CAD

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**Abstract.** This study explores the intersection of human-computer interaction (HCI) and emotion analysis within the context of music education performance, leveraging AI-powered computer-aided design (CAD) tools. As music education increasingly incorporates technology, understanding how emotional responses can be analyzed and enhanced through HCI becomes crucial. This paper describes the emotional expression and artistic treatment in music education performance, aiming at realizing the full display of music works, endowing the music with new vitality, and promoting the further improvement of the music education performance level in China. In order to design a data warehouse architecture suitable for big data analysis. In music education performances, expressing emotion and re-creating art can be an icing on the cake. In addition, the re-creation of emotion and art in music education performance can bring a better aesthetic experience to the audience.

**Keywords:** Human-Computer Interaction; Musical performance; emotion analysis, Digital Art-Based Music Education; AI-powered CAD

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### 1 INTRODUCTION

The main function of music lies in the expression of emotions and the sublimation of performers' emotions. Among them, music education performance is a subjective aesthetic re-creation activity. Under the condition of respecting works, music art is re-created to express the emotions in music works. The popularization of the Internet and computers has brought China into the information age. In recent years, technological words such as cloud technology, big data, algorithms, etc., have often become hot words in society, which has aroused people's widespread concern, and the degree of informatization in Chinese society has deepened. Music education performance, as a creative

aesthetic activity, has strict requirements for performers' artistic skills. The level of performers' artistic skills, the depth of excavation of works, and the amount of emotional input determine whether the audience can feel the beauty of music art. As a creative aesthetic activity, music education performance has strict requirements for performers' artistic skills. The level of performers' artistic skills, the depth of excavation of works, and the amount of emotional input determine whether the audience can feel the beauty of music art [18]. Singing emotions are different for people, and people's feelings about songs are different, and the emotions aroused by different songs and sounds are also different. In recent years, data warehouses have become a hot field of data management research. The main reason is that the current demand for data warehouse systems has undergone fundamental changes in the data source, data service, and hardware environment. With the rapid development of science and technology in China, it has entered the development stage of the big data and cloud era. With the gradual penetration of big data in our lives and work, big data has attracted more and more people's attention. The rise of cloud computing, the Internet of Things, and other technologies indicates that we have gradually entered the era of big data. With the development of information technology, people have gradually stepped into the ternary world of human-machine-thing integration in the era of big data [5]. In recent years, big data has attracted the attention of academia and industry. Google and government departments such as the United States and other organizations such as McKinsey & Company and Gartner Company have paid great attention to it. Art is an important way for the general public to express human emotions. Only flexible artistic treatment can fully embody the emotions in music education performances, and it can also realize the resonance between performers and audiences [15].

Big data is generally used to describe a large amount of unstructured data created by a company, which usually takes a lot of time and money when it is downloaded to a relational database for analysis and application. Major media around the world also publicize and report on big data. All these show that big data has deeply influenced people's daily life. But behind this fiery scene, ordinary people don't know enough about big data, and the development of big data still faces some challenges, and the technology needs to be further improved. From a technical point of view, we can find that the relationship between big data and cloud computing is like the front and back of a coin. Big data can't work with a single computer, and it must be done in a distributed architecture. The highest state of music education performance lies in the perfect presentation of the performers' thoughts and emotions to the audience on the stage through the performers' perception of music, the combination of this perception with the performers' own artistic accomplishment and social experience, and the treatment of art.

In this paper, a variety of research methods are used to demonstrate it. In the research of big data, a number of formulas and data graphs are established for analysis. In the study of music education performance, a corresponding model diagram is established to analyze and explain it.

The main contributions of this paper are: (a) the method of argumentation is used to explain and analyze its research, (b) several formulas are established to interpret them, and (c) music education performance by using big data.

The rest of this paper is arranged as follows. The second part briefly discusses and studies the related work. In the third part, the related research on music education performance is carried out, and the corresponding model diagram is established to analyze it. The fourth part studies big data through the establishment of formulas and other methods to analyse it. The fifth part summarizes the full text.

## 2 RELATED WORK

The task of art is to show human emotions, and human emotions also need to be shown by art, which is closely related to the most sincere emotions and creative imagination of human beings. This relationship between art and human emotion is more evident in music education performance. Music education performance is a multi-level and complex art. The main structure of different data

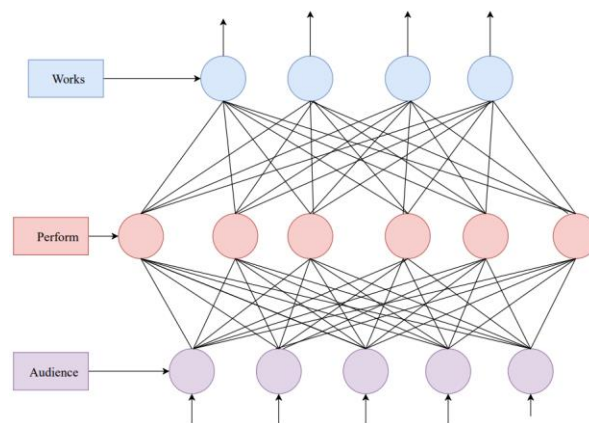
warehouse implementation schemes and the improvement of their defects in recent years. According to the different research standpoint. Many composers integrate creative ideas into the performance of their works, re-create music, and endow it with the soul. Only by re-creating and endowing music with more abundant emotions can musical works be more aesthetic. The original framework can not fully meet the needs of future social development, and it faces many challenges. In order to better understand the network big data and promote its better development in the future, this paper makes research and thinking. In the musical performance, performers will combine their inner feelings with their artistic treatment of musical works through their own understanding of musical works, and finally complete the display of musical works' images and the revelation of their connotations so that the audience can appreciate the beauty. In music education performance, sound is a material medium that contains rich emotions. The voice, the performer's body language, and facial expressions form an artistic form. The audience accepts this artistic form by the senses and then slowly tastes the emotions that the music wants to express. In the research, the programming model for large data set processing proposed by Chen C and Zhang C Y was mainly used for Internet data processing at first, such as document grabbing, inverted index building, etc [4]. Liu Y, Liu Y, and Zhao Y put forward a large data warehouse based on H Hadoop, whose goal is to simplify data aggregation, ad hoc query, and analysis of large data sets on Hadoop so as to reduce the burden of programmers [12]. LOS proposed an optimizer that can generate parallel execution plans with fault tolerance. This optimizer can output a parallel execution plan with fault tolerance by relying on the input parallel execution plans, the fault tolerance strategies of each operator, and the expected value of query failure [13]. Xiao Feng ci Xiang proposed MRShare architecture to convert batch queries and combine a group of tasks that can share scanning, M ap output results, etc., into one to improve performance. The National University of Singapore has made an in-depth analysis of the factors that affect the performance of Hadoop and put forward five effective optimization techniques, which have improved the performance of Hadoop nearly three times, approaching that of a relational database [19]. Li G, The M ap-Reduce-Merge framework proposed by Cheng X can process data from two heterogeneous data sources at the same time. For multi-table join, the current mainstream research focuses on only one task to complete the join operation [11]. Madden and Sam proposed an optimization model for any join condition. All the above join methods are used to perform the join first, then perform an aggregation operation on the connected data [14]. Chen Y, Alspaugh S, Katz R proposed a one-to-many replication method. After the M ap stage, tuples will be replicated to multiple nodes to ensure the locality of the connection operation [6]. However, when the number of nodes and the amount of data increase, It will bring a huge increase in the amount of I/ O and network transmission. The cost of a star connection can be reduced by pre-ordering and dividing data according to connection attributes, but considerable pre-processing cost and space costs have to be paid. Jagadish H V, Gehrke J, and Labrinidis A put forward many advanced technologies, which mainly adopt the shared-nothing structure, divide the relationship table horizontally among nodes, and use the optimizer to schedule and manage the execution process. Its goal is high performance and

### 3 EMOTIONAL ANALYSIS OF MUSIC EDUCATION PERFORMANCE

#### 3.1 Research on Emotional Expression in Music Education Performance

The so-called emotion refers to the general public's psychological feelings while experiencing the objective world. The emotional expression in music education performance is that musicians show their understanding and emotion of music through artistic performance. The essence of music education performance is to show the musical works and the artistic feelings of the performers. In music education performance, all creative thinking can't be separated from proper emotional expression. In order to achieve the goal of arousing the audience's emotional resonance and reaching the highest level of music education performance, we must conduct in-depth research on music works and accurately grasp the author's creative intention. For music performers, imagination and

association are very important. For excellent songs, songs are not just the combination of some notes but tunes with certain literariness and beautiful lyrics. These constitute an excellent song, especially for folk songs, which are an artistic form. When they are created, they are good at grasping a certain characteristic of folk customs so as to arouse people's association, stir people's emotional strings, achieve unexpected artistic effects, and shape the musical image of your people. In specific performance activities, if music performers want to fully express the emotions contained in the works, they must conduct in-depth research on the music works, understand the works from an objective point of view, and firmly grasp the emotional tone of the music. Only in this way can they lay the foundation for music education performances [7]. For performers and audiences, the exchange and communication of songs is a kind of cultural carrier. Through the function of this cultural carrier, a unique connection relationship can be formed between performers and audiences, and emotion is a kind of connection bond, which closely links audiences and performers. Only the correct emotional expression of the original musical works can stimulate the performers' imagination and complete the artistic treatment of the musical works. The model diagram is established for further research, as shown in Figure 1.

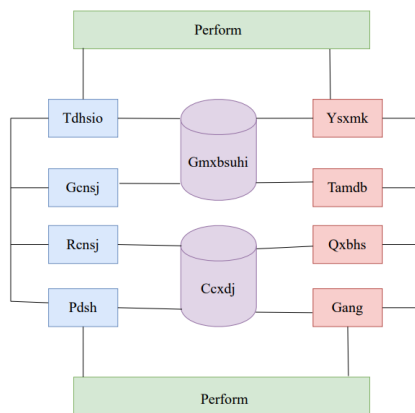


**Figure 1:** The model diagram of the connection among audience performances.

Art re-creation in music education performance is a process of re-creation and sublimation of the original music education performance. Music performers also need to integrate their understanding of music works and their true feelings into their performance activities. This kind of emotion towards music is not generated at a certain moment but gradually established in the daily activities of constantly studying music. It is not only a general perception of music but also an emotion generated by a certain work. In the stage of music education performance, performers should also give full play to their subjective initiative, sublimate the emotion and connotation of music works through their own understanding of music works, and better present the ideological content of music works through subjective creation and imaginative publishing. This is the skill that performers should have, and show the same works in different musical expressions to make the music education performance novel. The secondary processing of performers can ensure that the works have the creators' own aesthetic ideas. The essence of music education performance is to show the musical works and the artistic feelings of the performers. For music performers, imagination and association are very important. In music education performances, the performers' full use of their musical imagination is helpful to reveal the connotation of music works accurately, and to have a profound grasp of the emotions and artistic conception to be expressed by music works. To some extent, this artistic treatment of music works is also a kind of creation that enables music works to show their beauty emotionally.

### 3.2 Handling and Expression of Emotional Expression in Music Education Performance

Performance is not only an art but also a science. Emotion is the source of music creation and the soul of music works, and the ultimate goal of music education performance is to convey the emotion of music works. In music education performance, the performance effect will be greatly reduced if there is no skillful support. Singing skills can make the audience feel a more intense and rich artistic atmosphere and can bring the audience a better artistic appreciation process [20-17]. Nowadays, many performers have been engaged in art training since childhood, and they don't have much contact with the outside world. Therefore, these performers have some serious problems due to a lack of life experience. That is to say, when these performers perform a particular song or other art forms, they may not have experienced this kind of life, so they can only copy and sing the existing music forms when performing music. Although the ultimate goal of music education performance is emotional expression, we should also fully realize that different performers interpret different connotations of music works. Artistic treatment is the sublimation of emotional expression. The emotional expression of music is mainly realized through various forms of artistic treatment. If there is no artistic treatment, the emotional expression of music will become a mere formality. Expression is the basis of artistic treatment [10-3]. In essence, music education performance is the expression of artistic emotion of a work. The highest state of music education performance is that performers can use a variety of artistic treatments to show the profound connotation of music works in performance activities. In music education performance, performers must first deeply understand music works if they want to convey their feelings accurately. Music education performance refers to the performer's expression of music to the audience in the form of a personal performance. It is an artistic form formed by the combination of the emotional expression and personal imagination of music performers. A successful musical performance not only requires the performer to have a correct understanding of the musical works and true emotional expression but also requires the performer to have strong artistic processing ability. Learning is the most basic requirement for music performers. An excellent music performer not only needs good natural conditions but also needs rich spiritual connotations. In the research, it is expressed and analyzed by establishing its model diagram, as shown in Figure 2.



**Figure 2:** Model diagram of performance factors and conditions.

Team cooperation can improve performers' artistic processing ability in music education performance. When one partner's expression or action changes with the fluctuation of his feelings, the other partner's feelings are often affected. Music creation needs high, comprehensive quality music. Establishing the consciousness of active creation at ordinary times can improve the artistic processing ability in music education performance. An excellent music performer not only needs

good natural conditions but also needs rich spiritual connotations. Music creation needs high, comprehensive quality music. Establishing the consciousness of active creation at ordinary times can improve the artistic processing ability in music education performance. Therefore, music performers should actively cultivate creative consciousness and stimulate creative enthusiasm, so as to improve their artistic processing ability. Performers must show their work with their true feelings. The "true emotion" here is not the ordinary emotion that the performer can express at will, but the emotion that the performer needs to express in the musical works after fully mobilizing his own emotions associated with the works after having an accurate understanding of the musical works [9-1]. In the artistic processing activities, performers must thoroughly study the music score text, find out the difference between the emotion they want to express and their own musical sense, and try their best to capture their own sound appearance in the performance activities and adjust their performance state in time. Through its research, the corresponding tables are established to analyze it, such as Table 1 and Table 2.

<i>Factor</i>	<i>proportion</i>	<i>Data</i>
<i>Mood</i>	<i>78%</i>	<i>75%</i>
<i>Self</i>	<i>23%</i>	<i>31%</i>
<i>External cause</i>	<i>52%</i>	<i>53%</i>
<i>Another person</i>	<i>23%</i>	<i>53%</i>

**Table 1:** Music emotion comprehensive evaluation.

<i>Factor</i>	<i>proportion</i>	<i>Data</i>
<i>Health</i>	<i>32%</i>	<i>67%</i>
<i>weather</i>	<i>64%</i>	<i>24%</i>
<i>Strange</i>	<i>42%</i>	<i>74%</i>
<i>Another person</i>	<i>53%</i>	<i>34%</i>

**Table 2:** Music emotion comprehensive evaluation.

Emotional expression induces artistic treatment, and artistic treatment returns to emotional expression, thus forming a feedback loop. In music education performance, performers must complete the artistic treatment of music works based on their own experiences. Emotion is a series of thoughts, feelings, and psychological reactions produced by individuals in the objective world. Emotion is the source of music creation and the soul of music works, and the ultimate goal of music education performance is to convey the emotion of music works. In the performance, in order to perfectly present the three aspects, endow the performance with greater charm, and produce better results, it is necessary to create a beautiful sound image. Therefore, performers must have a comprehensive and profound understanding of the original musical works and show the musical image to be displayed in the original musical works in their own form through their own imagination so as to create a sound image with rich connotations and infect the audience with sound. For any art form, there is a set of methods to integrate performers and art forms, but no matter how varied the ways of integration are, the most important thing is expected, that is, through the performers' understanding of art, applying their thinking to their roles or transforming themselves into protagonists, thinking about what the protagonists think and reading what they think.

## 4 BIG DATA RESEARCH

### 4.1 Research on Big Data Algorithm

Big data is divided into two parts: one is "network," and the other is "data." The network exists as a platform, and the footprints left by users on the platform are "data." Because there are many

users, a large amount of data is generated on this new platform, which is called network big data. The emergence and development of new things have their own laws, and it is people's unshirkable responsibility to study new things. The data migration cost is too high. Introducing a storage management layer between the data source layer and the analysis layer can improve the data quality and optimize the query, but it also costs a lot of data migration cost and connection costs during execution. The traditional data warehouse assumes that the theme is less changeable, and the way to deal with the change is to modify every part of the whole process from the data source to the front end and then reload or even recalculate the data. It takes a long period to adapt to changes. This mode is more suitable for occasions with high requirements on data quality and query performance but not too concerned about the cost of preprocessing. The most important and important task of a big data processing system is to analyze the appropriate mode according to a large amount of data, then put forward the relevant, clear meaning, and formulate scientific and reasonable coping strategies so as to further achieve specific business objectives. Now, the widely accepted definition of big data is to realize the data management mode of high-speed data processing on the basis of huge amounts, complex types, and high-value data information. Big data can't reflect the information value it contains without the support of various data application technologies. Cloud computing technology is one of the most important and widely used technologies. Cloud computing is a service form in which users purchase network resources and services and save hardware and server facilities. The increase in information and the complexity of data types and structures have brought great difficulties to the data integration management of big data. On the one hand, a large amount of data has its own sources, and it has different characteristics of: structured, semi-structured, and unstructured. Its storage methods are also different, so it needs complex transformation to be integrated and managed. In the research, the corresponding algorithm formulas are established to explain and analyze it, such as formulas (1) and (2), and (3) plus (4) and (5).

$$\sinh^{tdiv^{4+1-11}} + E * \frac{t-1}{r} \quad (1)$$

$$\bar{l} - 1 \cdot n_{11}'' - |12 \cdot H_- + 1| T | t \quad (2)$$

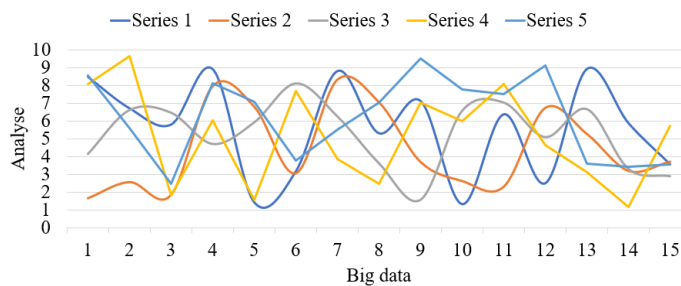
$$F_x + I_0^{3i} \nu \max^y - 2k, 2 \quad (3)$$

$$\lambda y + \max rotH - \Gamma_L l + 4 \quad (4)$$

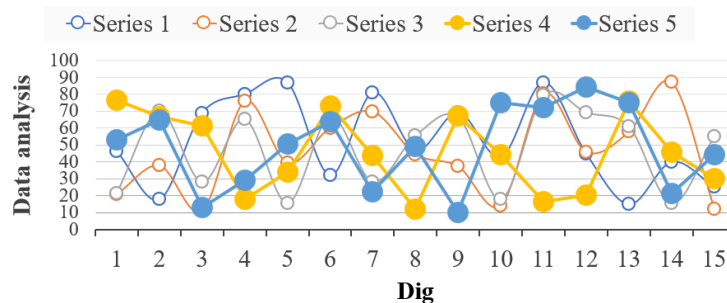
$$txt \uparrow t^{\frac{1}{0}}, 1 + 1 \rightarrow LxM \quad (5)$$

With the rapid development of big data, at present, big data has been integrated into all aspects of our lives and work, but at the same time, people will also face various problems in the process of calculation, such as the emergence of large-scale samples, which directly leads our people to face various complex data objects. Therefore, the important problem that we should solve at present is to quantify the complex nature of big data and conduct in-depth analysis and research on the problems contained in the data. When all the above problems are solved quickly, to a certain extent, more people can understand what the model of big data is and what the characteristics and advantages of big data are so as to further acquire relevant knowledge and information. With the rapid increase of data volume, the scale of the parallel database has to be increased, which leads to a sharp increase in its cost. For the sake of cost, more and more enterprises have turned their applications from high-end servers to large-scale cluster platforms composed of low-end and middle-end hardware. Big data technology is a method to use and extract effective information from massive

data with the rapid expansion of data volume. A data warehouse is the foundation of big data analysis, and data mining is the method to establish a data warehouse and also the method to use and analyze data. The research results are shown in Figure 3 and Figure 4 by establishing data graphs.



**Figure 3:** Data mining analysis diagram.



**Figure 4:** Data map of data mining principle.

Data mining is not only the method of building a data warehouse but also the method of using and analyzing data. Data mining can automatically find useful information in large data repositories. Data mining is used to explore large databases and discover previously unknown useful patterns. The Internet of Things is another key technology in the era of big data, and it is the product of remote sensing technology, remote control technology, and intelligent technology. The so-called Internet of Things means connecting to the Internet through various items or exchanging information between items. This data processing platform is also faced with many difficulties, such as too large data, complex structure, long cycles, and great difficulty in the calculation process. These problems will not only bring more severe and complex challenges to the overall structure and calculation methods of the processing system but also bring bigger problems to the running speed and other aspects of the data processing system. Each of these problems is a very serious and important problem that must be solved urgently. It is the most basic criterion for the system to be optimized continuously, and it is also an essential foundation for the system to be processed effectively. Therefore, if we want to improve the computing ability of data effectively, we must strengthen the solution of these key problems. For the processing of massive data, the manual method can no longer meet the demand, and it must be processed by tools. Type-I operation data generally only stores data within 90 days, mainly storing detailed data, which generally reflects the current state of the real world. The operation database has a small amount of data but high frequency and allows users to add, delete, modify, and query, which can reduce data redundancy and avoid abnormal updates. The



analytical database has a large number of queries, but its frequency is low, and it can only be queried. It does not pay attention to reducing data redundancy. In the research of principle, the corresponding algorithm formulas are established to explain and analyze this, such as formulas (6) and (7) and (8) plus (9) and (10).

$$\frac{\bar{f}}{2t} R' = \frac{11}{0} c | -1 - 11 | \cdot 1, +1 \quad (6)$$

$$1r\sqrt{tt^x} 1_1^{-1} i' i'^+ - ru \quad (7)$$

$$w + y^{2+x} \gamma_{yJ}^{\frac{Hr_{11}}{-1}} \quad (8)$$

$$411^{+1} \neg [z_1 \lambda_1]_1^\lambda \triangleleft R \quad (9)$$

$$q_{x_i - k + 1/x} \gamma^C k \quad (10)$$

The magnitude of network data is huge, so the first important problem we face is storage and processing, which is also one of the basic problems in dealing with network big data. With the popularity of the Internet, mobile phones, computers, and other devices have entered the homes of ordinary people, and both the collective and the individual have to contact the Internet every day, so a large amount of data will be generated all the time. The application of network big data, in essence, is to study and discuss the historical data, discover the laws contained therein, and guide future production practice. Based on this, all walks of life give full play to their own advantages, start with their own data, and formulate their own goals and strategies. The development of big data networks has just started because their development speed is amazing, which leads people's research to lag behind the needs of development. On the surface, the challenge of network big data is how to make the data meet the needs of users, but on the deep level, this challenge is the complexity and uncertainty of data. The uncertainty of network data is reflected in the data itself, the object of data production, and the data model. The research is illustrated by the best-effort data analysis diagram, as shown in Figures 5 and 6.

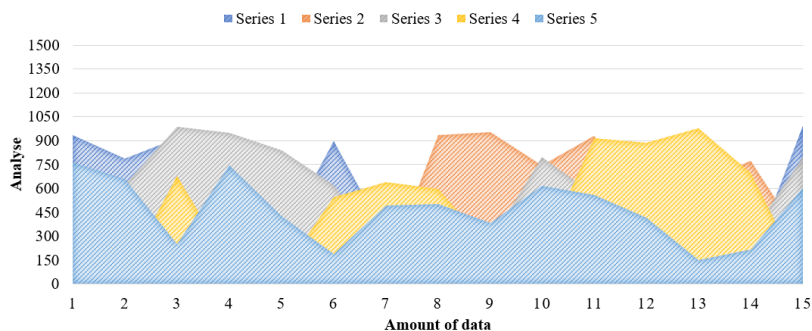


Figure 5: Data map of network data analysis (1).

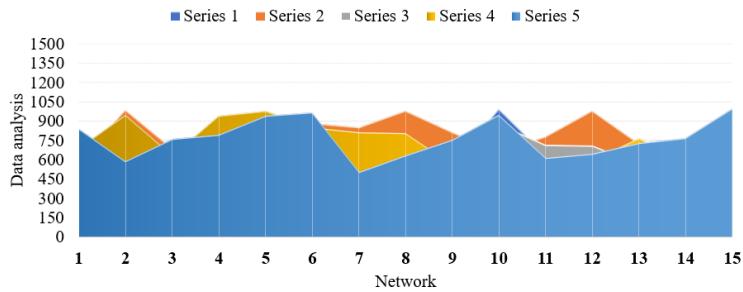


Figure 6: Network data analysis data diagram (2).

One of the most important aspects of analyzing big data is effectively expressing and learning it. No matter what kind of data, there are many ways of expression. However, the most important way is also the simplest model, which is still at a low level, so it can't give us a good learning effect. In view of this, deep learning has emerged.

#### 4.2 Big Data Problems and Analysis

As we all know, the main characteristics of big data are that the types and patterns of data are diversified and rich, the relationships between them are also very complex, and the quality of data is uneven. All these factors will lead to big problems in the process of data calculation or expression, and the complexity and difficulty of calculation under the traditional data pattern will constantly increase while the semantic analysis will become more complicated. The previous data analysis system can realize the effective analysis of structured data. However, big data includes a lot of semi-structured and unstructured data, which makes the previous data analysis system no longer suitable for data management in the new era. Automation technology gives us the opportunity to collect in every step of the customer-facing process. Behavior of data set on the web page. Early technicalization uses analysis methods to segment the market. The original segmentation method uses demographic technology and hard data of consumers, such as geographical location, age, gender, and ethnic characteristics, to establish market segmentation. However, marketers soon realized that behavioral characteristics are also important parameters for customer segmentation. Because people leave their information at different nodes of the Internet, the information of a single node is not easy to expose users' privacy. According to its research, the corresponding data map is established, as shown in Figure 7.

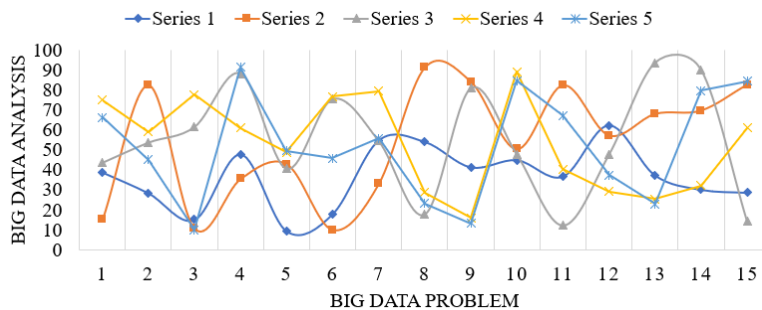


Figure 7: Data map of proportional analysis of big data problems.

In the process of solving big data, we should make an effective evaluation of its computability in advance and further confirm the calculation method to support the application of value-driven data in specific fields. On the basis of the complexity of big data itself, this paper makes in-depth research and analysis on the data-centric computing mode, finds out a scientific and reasonable improvement way, and establishes a more standardized and scientific data mode so as to carry out further research work on the related theories of big data, and finally establishes a firm theoretical foundation of data computing that does not depend on the total amount of data.

## 5 SUMMARY

In the music education performance, the emotional expression of the performers will have a direct impact on the stage's expression and also have an effect on the emotional experience of the audience. Nowadays, the importance of information is becoming more and more important. With the development of science and technology, the way information is generated, transmitted, and applied has changed dramatically. In order to present music works to the audience perfectly, performers must give full play to their artistic talents and, at the same time, flexibly respond to various changes on the stage, mobilize the audience's appreciation mood, and guide the audience's aesthetic direction. The acquisition of art requires innate conditions but also acquired efforts. Only by doing everything possible to improve their cultural accomplishment and artistic quality, stimulate their creative enthusiasm, and consolidate their artistic skills can performers effectively meet the audience's aesthetic needs. In the face of big data, there is a long way to go. Big data analysis forces us to reflect on the traditional data warehouse architecture and humbly study new platforms such as MapReduce, so as to think at a higher level and find a data warehouse architecture that meets the needs of the times. Nowadays, China is in an important period of rapid development. With the rapid circulation of information about the development of science and technology, communication between people and so on is becoming more and more intensive, and our lives are becoming more and more convenient. Big data is an important product of the high-tech era.

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