A Method for Improving the Pronunciation Quality of Vocal Music Students Based on Big Data Technology

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ABSTRACT

With the development of internet technology, big data has been used to evaluate the singing and pronunciation quality of vocal students. However, current methods have several problems such as poor information fusion efficiency, low algorithm robustness, and low recognition accuracy under low signal-to-noise ratio. To address these issues, this article proposes a new method for evaluating sound quality based on one-dimensional convolutional neural networks. It uses sound preprocessing, BP neural networks, wavelet neural networks, and one-dimensional CNNs to improve pronunciation quality. The proposed 1D CNN network is more suitable for one-dimensional sound signals and can effectively solve problems such as feature information fusion, pitch period detection, and network construction. It can evaluate singing art sound quality with minimum errors, good robustness, and strong portability. This method can be used for the evaluation and diagnosis of voice diseases, helping to improve students' professional abilities.

KEYWORDS

Acoustic Parameters, Artistic Voice, Big Data, Convolutional Neural Network, Quality Evaluation, Quality Improvement

INTRODUCTION

Music is a field that has an extensive influence on human beings and the natural world. People's love for a good voice in the popular sense is inestimable. Today, with the development of science and technology, big data technology has been integrated into people's lives, and it has a wide audience in the field of singing. For example, China's most influential application products such as "Sing Ba" and "National K Song" have as many as 700 million users. Among these products, the popularity of the singing scoring system of the Chinese Academy of Sciences demonstrates people's appreciation for singing and the need for the cultivation and practice of high quality vocal music.

The artistic expression of the voice in opera, stage, film, television, and radio is referred to as artistic voice in the industry (Huang, 2022). There are diversities of styles and evaluation standards, but good voices with many popular styles must have something in common, and this commonality

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can be extracted as a popular evaluation standard for good voices. The traditional singing evaluation includes standard pitch lines. As long as the pitch of the user's singing is aligned with the pitch line, he can achieve high scores. At the same time, there is an evaluation system that seems to be a parallel world, that is, the evaluation of vocal music teachers or music critics. The evaluation criteria of singing include many aspects, such as air sinking, head cavity resonance, and accurate rhythm. The traditional singing voice evaluation standards are mostly judged by people, which are highly subjective and lack scientific explanation and objective evaluation standards. In addition, due to people's neglect of talent training in the field of singing, the influence of cognitive limitations and uselessness, the research and development of singing science is seriously restricted, resulting in a current lack of professional talent in the field of singing (Hao, 2021). According to the Chinese Music Industry Players Survey Report released in 2017, the talent shortage is one of the three biggest problems facing Chinese music start-up companies, but the cultural industry including the music field, is also affected by the current global economic downturn. As an industry that maintains a high rate of growth, music is the most important part of the cultural industry. Therefore, the cultivation of singing artists is imperative (Yang & Yue, 2020). The process of cultivating singing artists includes many aspects such as the selection of voice talents, voice guidance, singing training, and voice maintenance (Zhao & Jin, 2022). In view of the subjective limitations of the traditional singing voice evaluation process, it is hoped to scientifically define singing voice quality evaluation criteria by means of scientific research and establish a complete set of singing voice objective evaluation systems. The evaluation system further promotes the development of subjects such as vocal music education and voice medicine, as well as the cultivation of talents and the maintenance of voice (Syafitri et al., 2018).

The physical attributes of the singing voice include sound quality, tone intensity, pitch, timbre, tone length, and breathing stability (Atmowardoyo et al., 2020), subjectivity, empiricism, and abstraction (Hsieh et al., 2020). For example, in singing competitions, there are two common evaluation methods of singing level. One is quantitative expression by one or more professionals (O'Brien et al., 2018). This evaluation method is relatively fair, but it is closely related to the singer's singing state and the evaluator's preference, and there are large subjective factors, and the evaluation results have large errors. The second is an evaluation team composed of a large number of audiences, and errors are eliminated to a certain extent according to the comprehensive evaluation of the evaluation team, but the accuracy of the evaluation results is also greatly affected due to the inconsistency or large gap in the professional quality of the audience (Oh & Song, 2021). Therefore, the subjective evaluation method is not only inefficient, but its accuracy is also questioned. In recent years, due to the proposal of convolutional neural networks and the continuous emergence of related achievements in deep learning technology, artificial intelligence technology has continued to develop and mature; it has been successfully applied to the fields of image, speech, and art, and has made breakthroughs in accuracy. Face++'s face recognition technology and iFLYTEK's speech recognition technology are among the top in the world. The application of artificial intelligence in the field of art also includes rendering of art paintings and style transfer technology. It is challenging to apply artificial intelligence technology to the field of voice, such as in the evaluation of voice quality, the fusion of multi-style voice characteristics, and the identification of voice diseases; however, it is very meaningful for the cultivation of singing talent (Kessler, 2018).

Ultimately, because the quality and state of the singing voice are of great significance to the scientific selection, teaching, training and diagnosis of voice diseases, it is necessary to study an effective method to scientifically evaluate them. In this paper, and in consultation with a large number of documents, the voice evaluation parameters are scientifically explained and defined, and a complete set of singing voice evaluation parameters is proposed. For noise-polluted sound signals, a pitch period extraction based on wavelet transformation and fourth-order statistics is proposed. In addition, the algorithm of singing voice evaluation was studied in detail by using a convolutional neural network, a one-dimensional convolutional neural network evaluation algorithm suitable for

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