

A Method for Evaluating and Improving Vocal Pronunciation Quality of Vocal Music Students Based on Artificial Intelligence Technology

Yuhong Ao

<https://orcid.org/0009-0008-5699-977X>

College of Education and Music, Hainan Vocational University of Science and Technology, China

Wuyun Ao

<https://orcid.org/0009-0007-4183-8546>

College of Education and Music, Hainan Vocational University of Science and Technology, China

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ABSTRACT

The combination of artificial intelligence (AI) and vocal music education is a hot spot in intelligent-driven teaching practice, especially in the open and distance learning environment. In this study, the authors explore the application of AI technology in the evaluation of singing quality. By using AI as the mainstream method to analyze vocal music signals, they establish a set of quantifiable standards for the objective evaluation of vocal music performances. The results show that the scoring system based on AI can effectively evaluate the accuracy of students' singing, and the correlation coefficient between the score of the system and the score given by human experts is 0.645, with a deviation of about 3.000%. In addition, this method can identify the weak links in students' singing and provide targeted feedback, thus improving their vocal skills. This novel evaluation method improves the fairness and accuracy of performance evaluation and contributes to the overall improvement of vocal music teaching quality.

KEYWORDS

Artificial Intelligence Technology, Vocal Music Major, Pronunciation Quality Evaluation, Automatic Scoring System, Phoneme Classification

INTRODUCTION

Vocal music teaching is an emotional art that cultivates students' pronunciation skills and expresses rich song connotations through vocal music training (Zhou, 2023). Voice is just skill and means. Expressing emotion is the purpose of singing. Correctly handling the relationship between vocalization and expressing emotion enables singers to freely express the emotion of the songs, thus achieving the goal of singing with emotion. It is also the goal pursued by singers and vocal music teaching (Dai, 2024; Yuan, 2024).

To achieve this goal effectively, vocal music teaching must be inseparable from the scientific and comprehensive teaching evaluation system as a support. Vocal music teaching evaluation is a complex teaching activity (Xia & Yan, 2021). In traditional teaching, people have some misunderstandings

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about the concept of evaluation. They often equate evaluation with examination or test, separate evaluation from students' learning process, simplify the purpose and function of evaluation, and regard it as selection or performance evaluation (Meylani, 2024). In the process of evaluation, students' due positions are ignored, and students are excluded from the evaluation object. In addition, traditional evaluation of vocal pronunciation quality often relies on the personal experience and subjective judgment of teachers. Although the traditional evaluation method can initially guide students to master basic vocal pronunciation skills, it is limited by the teacher's personal ability and subjectivity. Although the subjectivity of evaluation can be minimized by calibrating the conversation, the current evaluation results still cannot meet the actual needs in objectivity and comprehensiveness (Selevan et al., 2016; Zong, 2025). At present, the vocal music industry's evaluation of singing quality mainly relies on empirical subjective judgment, pitch, and other physical attributes, or it converts comprehensive feelings into specific quantitative scores (Barsties & De Bodt, 2015). The same vocal pronunciation may produce different evaluations, and the evaluators' personal moods and psychological states will also affect their judgment on vocal pronunciation quality, leading to the deviation of evaluation results (Kim, 2023). This subjectivity and instability affect the accuracy and fairness of evaluation and bring unnecessary troubles and misleading information to students.

The emergence of artificial intelligence (AI) provides a direction for solving the above problems. AI is one of the most advanced development directions in the computer field; it involves the computer itself, psychology, neurophysiology, and sociology and has obvious interdisciplinary characteristics (Irshad et al., 2022; Menshikov et al., 2024; Ying et al., 2024). AI technology has made significant progress in areas such as speech recognition and natural language processing, providing new possibilities for the objective evaluation of student vocal pronunciation quality (Zhang & Zhang, 2024). AI technology can establish accurate speech models through the analysis and learning of a large amount of speech data, thereby achieving objective and quantitative evaluation of pronunciation quality (Yin, 2018). The automatic scoring system of AI has obvious advantages. For example, no matter how different the time, place, or raters are, the results will not be biased. In addition, it can efficiently complete the evaluation of a large number of candidates, thus greatly improving the examination efficiency.

Focusing on the vocal music course, we applied performance evaluation in vocal music teaching. By using AI technology, we aimed to develop a more scientific, objective, and efficient evaluation tool for vocal music teaching quality and to promote the development of art education in an intelligent and personalized direction. The goal of this study is to build an automatic vocal pronunciation evaluation system based on deep learning to realize objective quantitative evaluation of vocal pronunciation quality. The research methods included creating a test database, designing an experimental scheme, and processing speech signals. First, students' vocal pronunciation performance data were collected, and acoustic parameters, such as pitch, duration, and timbre, were extracted. We then used a pretraining model to analyze these parameters and match them with standard vocal pronunciation data, thus obtaining accurate evaluation results. In addition, music experts were invited to manually grade each sentence in the database as a reference for the accuracy of machine grading. The introduction of an automatic vocal pronunciation evaluation system reduces the labor cost and makes vocal pronunciation evaluation in large-scale examinations and daily teaching more convenient and efficient. This system provides a fairer competitive environment for students and reliable teaching feedback for teachers; thus, it is helpful to formulate personalized teaching strategies and promote students' all-round development.

This paper consists of six parts. In the first part, we introduce the research background, challenges, research objectives, and solutions. In the second part, we review the related research progress, and then in the "Methodology" section, we expound the construction method of a vocal music pronunciation evaluation system. In the "Results" and "Discussion" sections, we show the experimental data and results analysis and discuss the results and point out the limitations and future research direction. Finally, in the "Conclusion" section, we summarize the main contributions of this paper.

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