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Research and Practice Conception of AI-Driven Precise Diagnosis of Historical Styles in Piano Teaching in Colleges and Universities

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Abstract: ***In piano teaching in colleges and universities, the accurate grasp of historical styles is a core link to improve students' performance literacy and inherit music culture. Relying on teachers' professional experience, the traditional teaching model plays an irreplaceable role in style inheritance and skill guidance, and there is room for improvement in the accuracy of diagnosis, feedback efficiency, and coverage of personalized guidance. The rapid development of artificial intelligence technology provides a new path for improving the quality and efficiency of piano teaching in colleges and universities. Its advantages in audio recognition, data modeling, and intelligent analysis can complement traditional teaching, realizing the accurate capture, quantitative analysis, and scientific diagnosis of historical styles in piano performance. Based on the actual needs of piano teaching in colleges and universities and the characteristics of artificial intelligence technology, this paper clarifies the core objectives and principles of the research and development of "precise diagnosis of historical styles", systematically constructs a research and development framework covering key links such as data resource construction, algorithm model research and development, diagnosis module design, and teaching adaptation optimization, and puts forward specific practical paths and guarantee measures. It focuses on emphasizing the two-way efforts of technological empowerment and the improvement of teaching subject capabilities, cultivating college piano teachers and students who can use artificial intelligence, promoting the upgrading of piano teaching towards precision, personalization, and intelligence, helping students accurately grasp the essence of styles of piano works in different historical periods, and improving their musical performance and aesthetic abilities.***

Keywords: Artificial Intelligence, Piano Teaching in Colleges and Universities, Historical Styles, Precise Diagnosis, Research and Practice, Intelligent Music Education.

1. R&D Principles, Framework Construction and Subject Orientation of AI-Driven Precise Diagnosis of Historical Styles in Piano Teaching in Colleges and Universities

In piano teaching in colleges and universities, the accurate interpretation of historical styles is the core demand to improve students' performance art literacy and inherit Western classical music culture. Relying on teachers' rich professional experience, the traditional teaching model plays an irreplaceable core role in style explanation, skill demonstration, and emotional guidance. At the same time, limited by teaching scenarios and individual energy, there is room for improvement in the accuracy of historical style diagnosis, feedback efficiency, and coverage of personalized guidance. The breakthrough of artificial intelligence technology in fields such as audio recognition, data modeling, and intelligent analysis is not a substitute for traditional teaching, but rather serves as an important auxiliary tool to complement traditional teaching, realizing the quantitative capture, precise comparison, and scientific diagnosis of historical styles in piano performance, and promoting the transformation of piano teaching from "experience-driven" to "data empowerment + experience-led". Based on this, this paper focuses on the research and practice of AI-driven "precise diagnosis of historical styles" in college piano teaching, combines the actual needs of college piano teaching with the characteristics of artificial intelligence technology, constructs a systematic R&D framework, clarifies key R&D links, puts forward feasible practical paths and guarantee measures, highlights the two-way efforts of "technological empowerment" and "subject improvement", focuses on cultivating college piano teachers and students who can use artificial intelligence tools, and provides practical reference for the reform of college piano teaching.

The research and development of AI-driven "precise diagnosis of historical styles" in college piano teaching must be based on the core needs of college piano teaching, focus on the core pain points of historical style diagnosis, and follow the four principles of practicality, accuracy, adaptability, and innovation. The principle of practicality requires that the R&D results be closely integrated with the actual piano teaching in colleges and universities, which can be directly applied to classroom teaching, after-class practice and other scenarios, solve practical problems in teachers' teaching and students' learning, and avoid disconnection between technology and teaching; the core of the principle of accuracy is to realize the precise positioning and quantitative analysis of style deviations, break the subjectivity of traditional experience-based diagnosis, establish a unified style diagnosis standard, and ensure that the diagnosis results are scientific and reliable; the principle of adaptability emphasizes that the R&D system must adapt to the learning needs of students at different levels, take into account the differences between piano majors and non-majors, and at the same time adapt to the existing teaching equipment and teaching models in colleges and universities to reduce the application threshold; the principle of innovation requires integrating the latest artificial intelligence technology with piano teaching concepts, breaking the limitations of traditional diagnosis models, and realizing the innovation of diagnosis methods, feedback mechanisms, and guidance models to improve teaching effects.

The construction of the R&D framework is the core of the implementation of "precise diagnosis of historical styles".

Combining technical characteristics and teaching needs, a four-level R&D framework of "data resource layer - algorithm model layer - diagnosis module layer - teaching adaptation layer" can be constructed. Each level supports and cooperates with each other to ensure the scientificity and practicality of the system. The data resource layer is the foundation of R&D, whose core is to build a sample database of piano works covering different historical periods and styles and a standardized style feature parameter system to provide data support for algorithm modeling and precise diagnosis; the algorithm model layer is the core support, responsible for realizing the feature extraction, style recognition and deviation diagnosis of performance audio; the diagnosis module layer is the core of user interaction, realizing functions such as audio collection, diagnosis display, and guidance generation; the teaching adaptation layer is the key to implementation, promoting the in-depth integration of the system with college piano teaching scenarios and building a closed-loop teaching model.

2. Key R&D Links, Implementation Paths and Subject Ability Training of AI-Driven Precise Diagnosis of Historical Styles in Piano Teaching in Colleges and Universities

Data resource construction is the basic premise of precise diagnosis R&D, whose core lies in building a comprehensive and standardized sample database and a standardized style feature parameter system. The construction of the sample database must take into account representativeness and comprehensiveness, select classic piano works from different historical periods such as Baroque, Classical, Romantic, Impressionist, and Modernist, covering representative works by different composers such as Bach, Mozart, Beethoven, Chopin, and Debussy. No less than 50 classic works are selected for each period, and each work includes standard performance audio and score data by professional performers. At the same time, collect performance audio of college students at different levels to build a student performance sample database for model training and diagnosis verification.

The construction of the style feature parameter system is the key to realizing precise diagnosis, which needs to convert the abstract characteristics of piano styles in different historical periods into measurable and comparable specific parameters. Combining the actual characteristics of piano performance, the parameter system can be constructed from two dimensions: performance skills and work ontology. The performance skill dimension includes parameters such as keystroke strength, keystroke speed, pedal application duration, ornamentation performance rhythm, and speed fluctuation range. For example, the keystroke strength fluctuation range in the Baroque period is controlled at 5-10dB, while that in the Romantic period can reach 10-20dB; the work ontology dimension includes parameters such as melody rhythm complexity, harmony change frequency, interval span, and texture density. For example, the melody rhythm complexity in the Classical period is low, the harmony change frequency is 1-2 times per measure, and the harmony change frequency in the Impressionist period can reach 3-4 times per measure. Through repeated analysis and verification of standard samples, the standard range of different parameters in each historical period is determined, forming a standardized style feature parameter system.

Algorithm model R&D and diagnosis module design are the core support for the accuracy of the system. The algorithm model layer needs to combine technologies such as machine learning and deep learning to build three core models: the audio feature extraction model uses technologies such as Mel Frequency Cepstral Coefficients (MFCC) and Short-Time Fourier Transform (STFT) to preprocess performance audio and extract core feature parameters; the historical style recognition model adopts a hybrid model combining Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN), and after training with standard samples, the style recognition accuracy must reach more than 90%; the style deviation diagnosis model clarifies the type, degree and cause of deviation by comparing students' performance parameters with standard parameters, providing support for personalized guidance. The diagnosis module layer designs a simple and easy-to-use operation interface, including four core modules: audio collection, style recognition, deviation diagnosis, and guidance suggestions, realizing real-time collection, precise diagnosis, intuitive display and targeted guidance.

Teaching adaptation optimization is the key path to promote the implementation of R&D results, which needs to deeply integrate the precise diagnosis system with college piano teaching scenarios. On the one hand, it adapts to teachers' teaching scenarios, provides functions such as statistics of students' performance data and analysis of class style mastery, helps teachers formulate personalized teaching plans and improve teaching efficiency; on the other hand, it adapts to students' learning scenarios, provides functions such as after-class independent practice, real-time diagnosis feedback, and personalized improvement guidance, and cultivates students' independent learning ability. At the same time, the system must adapt to the existing teaching equipment in colleges and universities, support multi-terminal access, and can be connected with online teaching platforms to build a closed-loop teaching model of "classroom teaching + after-class practice + precise diagnosis + personalized guidance".

3. Implementation Guarantee Measures and Subject Literacy Improvement of AI-Driven Precise Diagnosis of Historical Styles in Piano Teaching in Colleges and Universities

Technical guarantee is the basic support for system R&D and application, which needs to focus on three aspects: team building, technology iteration, and data security. Establish a professional R&D team covering fields such as artificial intelligence technology, music education, and piano performance, responsible for the R&D, debugging, update and maintenance of the system, and timely solve technical problems; establish a technology iteration mechanism, track the latest development trends of artificial intelligence technology and music education, regularly upgrade and optimize the system, and improve the diagnosis accuracy and functional practicality; strengthen data security guarantee, establish a safety management mechanism for sample data

and students' performance data, standardize the process of data collection, storage and use, and protect students' personal information and performance data security.

Talent guarantee is the core support for promoting the implementation of the system and realizing "technological empowerment + subject improvement". It focuses on improving teachers' ability to apply artificial intelligence and cultivating interdisciplinary talents, creating teaching and learning subjects who can use AI. Strengthen the training of college piano teachers' ability to apply artificial intelligence, help teachers master the system operation methods through special lectures, practical training, exchanges and discussions, improve their ability to use artificial intelligence technology to assist style teaching, and realize the dual empowerment of "experience + technology"; colleges and universities offer interdisciplinary courses on artificial intelligence and music education, cultivate compound talents who not only master piano performance and teaching knowledge but also have a foundation in artificial intelligence technology, to meet the dual needs of system R&D and teaching application; strengthen cooperation with artificial intelligence enterprises and professional music colleges, introduce advanced technologies and talent resources, improve R&D level and teaching adaptability, and provide more learning and exchange opportunities for teachers and students to help them improve their AI application literacy.

Teaching guarantee is the key to ensuring the effective application of the system, which needs to promote the in-depth integration of the system with the college piano teaching system. Colleges and universities attach importance to the reform of piano teaching, incorporate the precise diagnosis system into the piano teaching system, clarify the application scenarios and teaching requirements, and promote the innovation of teaching models; establish a scientific teaching evaluation mechanism, incorporate students' ability to grasp styles and independent learning ability into the evaluation system, and form a comprehensive evaluation result combined with system diagnosis data and teachers' comments; carry out teaching practice pilots, select some piano classes for pilot application, summarize experience, optimize system design and teaching adaptation plans, and gradually promote the application in the whole school.

4. Conclusion

The research and practice of AI-driven "precise diagnosis of historical styles" in college piano teaching is an important exploration for the intelligent and precise upgrading of college piano teaching, which bears profound practical significance and theoretical value for promoting the high-quality development of college music education. It does not deny the irreplaceable value of traditional teaching—on the contrary, it takes the advantages of traditional teaching based on teachers' professional experience as the foundation, and uses artificial intelligence technology to make up for the deficiencies in traditional historical style diagnosis, forming a complementary and mutually reinforcing teaching pattern of "experience guidance + technical empowerment". This pattern not only solves the bottlenecks in the improvement of historical style diagnosis in traditional teaching, such as unclear standards, lagging feedback, and insufficient personalized guidance, but also provides new technical support and practical tools for teachers' teaching and students' learning, effectively promoting the transformation of college piano teaching from "experience-driven" to "data-driven + experience-led".

In terms of practical value, the research and development of the precise diagnosis system can help college piano teachers accurately grasp the weak points of students' historical style mastery, formulate more targeted teaching plans, reduce the burden of manual diagnosis, and improve the efficiency and quality of style teaching. For students, the real-time diagnosis feedback and personalized guidance provided by the system can help them clearly recognize the deviations between their own performance and the standard historical style, actively adjust their performance skills and interpretation methods, and gradually improve their ability to grasp historical styles and their musical aesthetic literacy. In the long run, this research can also promote the innovation of college piano teaching models, enrich the connotation of intelligent music education, and provide a useful reference for the intelligent transformation of other music professional courses in colleges and universities.

It should be noted that this research still has certain limitations. For example, the sample database of the precise diagnosis system mainly covers classic piano works of mainstream historical periods, and the coverage of works of minority styles and modern experimental styles needs to be further expanded; the algorithm model still has room for improvement in the recognition accuracy of some subtle style features, especially the accurate capture of emotional expression differences in piano performance, which requires in-depth research and optimization combined with more professional music theory and performance practice. In addition, the popularization and application of the system also need to consider the differences in the level of artificial intelligence application among college piano teachers and the differences in teaching conditions among different colleges and universities, and formulate more flexible and diverse promotion strategies.

Looking forward to the future, with the continuous development of artificial intelligence technology such as deep learning and natural language processing, the AI-driven "precise diagnosis of historical styles" system will be further optimized and improved. On the one hand, it is necessary to strengthen the in-depth integration of artificial intelligence technology and piano teaching practice, continuously expand the sample database, optimize the algorithm model, and improve the accuracy and comprehensiveness of style diagnosis, so as to better adapt to the actual needs of college piano teaching. On the other hand, it is necessary to pay more attention to the training of the main body's ability, further improve the artificial intelligence application literacy of college piano teachers and students, guide teachers to use intelligent tools to better play their leading role in teaching, and guide students to use intelligent tools to carry out independent learning and exploration, so as to realize the two-way win-win of technological empowerment and subject literacy improvement. At the same time, it is necessary to strengthen interdisciplinary cooperation and exchanges among computer science, music education, piano

performance and other fields, jointly promote the innovation and development of intelligent piano teaching, and make positive contributions to the inheritance and development of piano art and the improvement of the quality of college music education.

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