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Research Article

Research on the Fusion Model of Professional Vocal Music Performance Voice Care and Artificial Intelligence Technology in Intelligent Medical Treatment

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Intelligent medical treatment is an important research field in today's world. Artificial intelligence technology is the key factor to construct intelligent medical treatment. In the development of artificial intelligence technology, it is necessary to establish a scientific, systematic, and comprehensive system analysis model, inevitably with certain professional characteristics. At present, in the research of vocal health care in professional vocal music performance, the application of intelligent medical care and vocal health care in professional vocal music performance is studied. According to the DEMATEL-ISM research method, this paper constructs 4 internal and external factors and 16 influencing factors to build a comprehensive and systematic weight analysis model, which provides a theoretical and practical basis for the scientific construction of AI technology algorithms. The aim is to improve the value and research significance of intelligent medical artificial intelligence technology in professional vocal music performance sound care.

1. Introduction

For professional vocal singers, "human voice" is their most important natural "musical instrument," and how to protect and care for this "musical instrument" is of great value and significance to singers. According to Chen [1], "scientific sound health care is of great significance to comprehensively improve the technical level and singing quality of singers." How to get a beautiful singing voice depends on the following factors: healthy voice, scientific voice, and good sense of music. Good voice plays a very important role in it, and the larynx vocal cords are an important vocal organ of human beings to produce scientific vibration, promoting the production of sound (voice), and then, by the natural formation of various cavities in the body, resonance is produced to achieve the transmission of sound and ultimately achieve a beautiful voice. Professional vocal music performers master a method of controlling their body vocal function or their required timbre through their own scientific training. However, for a long time, voice health care relies more on their own knowledge, cognition, and traditional medical tests to carry out regular maintenance, which cannot well produce early warning and prompting effect for solving many chronic diseases such as voice pathological congestion, acute laryngitis, vocal nodules, and vocal polyps. More importantly, when the disease is often found, it is based on the very serious condition; singers in the traditional disease prevention and voice health management have a certain lag.

2. Research Status of Voice Health Care in Professional Vocal Music Performance

Chinese bel canto singers pointed out that the problems of white voice, tremolo, throat, nasal, and straight voice are the key to the voice problems of bel canto singers; Gunjawate et al. [2], through statistical research, analyze the influence of the popular folk arts in Karnataka, India, including singing and dancing, on the health of the voice. It is preliminarily concluded that both innate and acquired voice problems will affect the voice health of singers emotionally; Devadas et al. [3]

explored the relationship between voice problems and different health problems such as dental problems, frequent colds, hearing difficulties, occupational nature, and regular medication in the study of Western opera singing methods; in Baird et al. [4], acoustic and laryngoscopic evaluation of voice health care in a cappella choirs in colleges and universities shows that there is little difference between professional and nonprofessional singers in voice health care, but there are differences in access to health-related information, resulting in certain differences; Arunachalam et al. [5] evaluated the voice problems caused by the training of a classical music style. Through research, they found that voice change, high pitch difficulty, voice fatigue, pharyngitis, muscle tension, dysphonia, chronic pharyngitis, and so on are the key to voice problems; Tepe et al. [6] investigated the voice problems of chorus singers by questionnaire and found that the key factors causing chorus voice problems are morning hoarseness, chronic fatigue, insomnia, emotional tension, adolescent girls' physiological period, and so on; Flavia et al. [7] established a 20-item singer's singing ability assessment scale, which includes the singer's background, education, work experience, professional direction, etc. Quantitative analysis of physical health, singing level, and other aspects is performed; García and López [8] demonstrate that flamenco singers' vocal habits, behavioral differences, drinking, smoking, practice, speaking, and other habits are exposed to many voice health risk factors, which make them more prone to vocal fatigue. Mucosal dehydration, voice damage, and muscle stiffness are more common in classical singers; according to Irene and Wilson [9], the "daily life" of professional singers has an important impact on the health of singers' voices.

From the above analysis and research, we can see that the research on voice health care of professional vocal performers at home and abroad is very rich, but today, with the rapid development of artificial intelligence technology, the intelligent medical treatment system formed by combining artificial intelligence technology has not been studied for voice health care of professional vocal performers. There are significant differences between the research scope and artificial intelligence methods in the specific process of large data analysis and research, which are important for daily voice health care and professional vocal performers. We should study and analyze them separately in order to establish a reasonable artificial intelligence model. The authors will use the Decision-Making Trial and Evaluation Laboratory (DTEL), which is considered to be an effective method for identifying causal chains in complex systems. DEMATEL and Interpretive Structure Model (ISM) establish evaluation weights in a combination of qualitative and quantitative ways. At the same time, a multilevel structure model of professional vocal performers is obtained through data analysis. After independent analysis of the influencing factors, multiple factors are comprehensively integrated, and the relevance between factors and elements is considered, so as to establish a systematic sound health management model. In the intelligent medical treatment, the professional vocal performers can perceive the comprehensive interactive effect of artificial intelligence technology and realize the comprehensive management of voice health. This study is of great practical value and significance.

3. Extraction of Factors Affecting Vocal Health Care of Professional Vocal Actors

In order to comprehensively analyze the various reasons that affect the voice health of professional vocal music actors, 57 vocal music teachers, students, and actors were sampled to collect the voice health problems caused by their different perspectives, and a comprehensive system of influencing factors was constructed from both internal and external dimensions, combined with literature research and in-depth interviews with research subjects. The overall analysis system is constructed comprehensively, and the four elements of life, body, training, and society are selected in the final competition. There are 16 influencing factors, such as dietary habits, physical fitness, scientific degree of vocal production, degree of speaking, work and rest habits, health degree of vocal organs, frequency of practice, daily workload, exercise habits, mental health degree, frequency of daily performance, intensity of social pressure, habit of using voice, degree of mental identification, level of vocal singing, and degree of social demand, which are shown in Figure 1.

4. Construction of the Influence System of Vocal Health Care in Professional Vocal Performance and Analysis of the Factors

After sorting out the four elements and sixteen influencing factors, the overall evaluation system is constructed, which is divided into three levels: target level, criterion level, and element level, as shown in Table 1.

4.1. Life Element. Dietary habits (A1): reasonable dietary habits play an important role in the protection of voice in professional vocal music performance. Li [10] mentioned the important value and significance of dietary habits for professional vocal music performance in his research, so dietary habits are one of the important reference indicators.

Work and rest habits (A2): reasonable work and rest habits will affect the fatigue and health of voice in professional vocal music performance. In the study of Xu [11], the key value of work and rest habits for voice health care is very important. It is also very important to take it as an important reference index in the internal influencing factors.

Exercise habits (A3): maintaining good exercise habits plays an important role in reasonable voice health care. Therefore, Yang [12] has a certain demonstration on the role of exercise habits in the prevention and treatment of voice diseases. On the whole, good exercise habits have a certain monitoring index value for promoting scientific voice health care.

Voice habit (A4): voice habit is mainly reflected in the daily use of voice, which is a very dynamic personal habit. This key role value is mentioned in many professional vocal performers' voice health care. Therefore, it is necessary to adjust the corresponding voice habit, which is an indispensable key indicator factor in the big data of intelligent medical treatment.
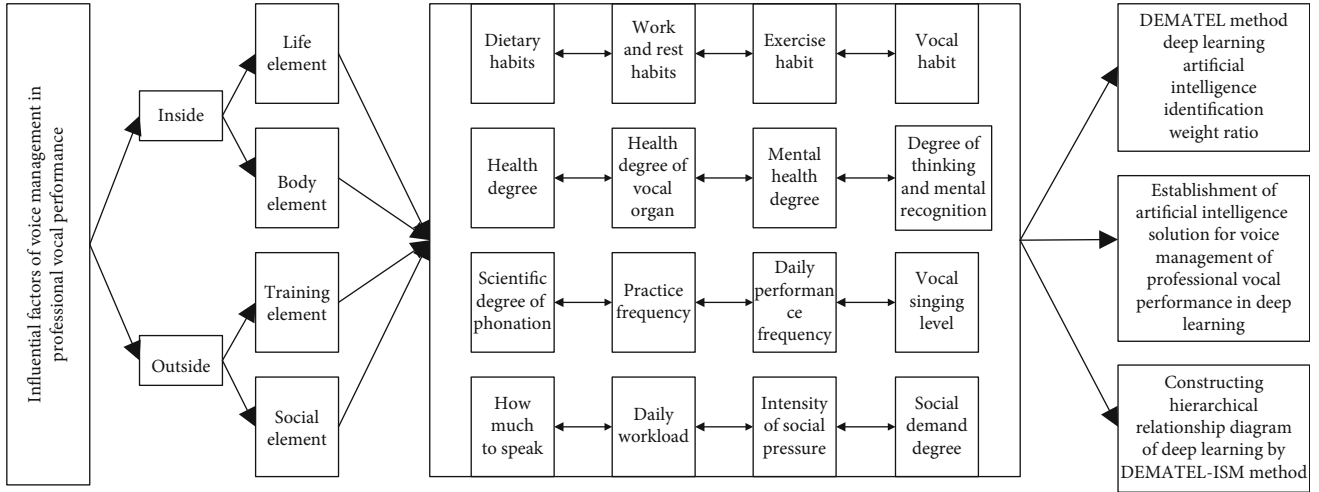
FIGURE 1: Chart of influential factors of voice health in professional vocal music performance.

TABLE 1: Impact index system of voice health care in professional vocal performance.

Target layer	Criterion layer	Feature layer	
The influence index system of vocal health care in professional vocal performance	Life element U1	Dietary habits	A1
		Work and rest habits	A2
		Exercise habit	A3
		Vocal habit	A4
	Body element U2	Physical fitness and health level	A5
		Health degree of vocal organ	A6
		Mental health degree	A7
		Degree of thinking and mental recognition	A8
	Training element U3	Scientific degree of phonation	A9
		Practice frequency	A10
		Daily performance frequency	A11
		Vocal singing level	A12
	Social element U4	How much to speak?	A13
		Daily workload	A14
		Intensity of social pressure	A15
		Social demand degree	A16

4.2. Body Element. Physical fitness and health level (A5): the dynamic supervision of the health status of physical fitness has a very important essential value for the analysis of the state of voice health care.

Health degree of vocal organs (A6): for the voice health care of professional vocal performers, the overall pile body of the vocal organs of singing has important value significance. It is the key influencing factor of the overall body elements, so it is an important key monitoring factor index.

Mental health degree (A7): the degree of mental health for professional vocal music performers' voice health care also has important value and role, and it has an important impact on the vocal music performers to deal with the state of singing voice and voice fusion problems; Feng [13] showed in his research that the degree of mental health for

stimulating voice health care has a certain correlation and is a very important observation index.

Thinking and mental identification degree (A8): Professional vocal music performers need to have certain thinking and mental identification ability. They should have full imagination ability for image description. The degree determines the understanding intention of voice health care. They can judge through daily reflection ability during observation, which has important observation index value.

4.3. Training Elements. Scientific degree of vocalization (A9): an important external indicator in professional vocal performers is the degree of mastery of the scientific nature of vocalization, which is well reflected in the vibration frequency of vocalization and the overall effect of singing. A

TABLE 2: Comprehensive impact matrix of voice health care in professional vocal performance.

Factor	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
A1	0.07	0.09	0.12	0.12	0.15	0.15	0.09	0.10	0.11	0.10	0.08	0.08	0.07	0.11	0.12	0.06
A2	0.18	0.13	0.19	0.19	0.22	0.24	0.19	0.19	0.19	0.17	0.17	0.17	0.14	0.19	0.20	0.17
A3	0.18	0.17	0.11	0.16	0.20	0.20	0.17	0.16	0.19	0.16	0.16	0.14	0.12	0.16	0.18	0.10
A4	0.13	0.14	0.12	0.16	0.17	0.23	0.14	0.15	0.22	0.22	0.22	0.21	0.19	0.15	0.15	0.15
A5	0.25	0.25	0.23	0.26	0.21	0.31	0.25	0.26	0.29	0.28	0.28	0.25	0.24	0.27	0.27	0.20
A6	0.18	0.18	0.14	0.25	0.21	0.19	0.20	0.21	0.25	0.24	0.24	0.23	0.21	0.19	0.18	0.17
A7	0.16	0.18	0.17	0.14	0.19	0.18	0.11	0.15	0.15	0.14	0.14	0.13	0.12	0.15	0.19	0.11
A8	0.18	0.19	0.16	0.22	0.17	0.20	0.19	0.14	0.23	0.19	0.19	0.20	0.19	0.21	0.22	0.16
A9	0.17	0.17	0.17	0.26	0.21	0.27	0.19	0.23	0.19	0.25	0.25	0.24	0.17	0.24	0.24	0.21
A10	0.20	0.20	0.17	0.26	0.21	0.27	0.19	0.23	0.26	0.18	0.25	0.24	0.22	0.23	0.19	0.16
A11	0.23	0.25	0.20	0.29	0.26	0.31	0.24	0.26	0.29	0.28	0.21	0.27	0.24	0.27	0.27	0.23
A12	0.19	0.19	0.15	0.27	0.23	0.28	0.19	0.24	0.26	0.25	0.25	0.18	0.19	0.21	0.25	0.21
A13	0.13	0.13	0.12	0.22	0.17	0.23	0.15	0.15	0.22	0.21	0.21	0.20	0.12	0.15	0.15	0.11
A14	0.23	0.23	0.19	0.26	0.25	0.28	0.23	0.22	0.23	0.23	0.23	0.19	0.17	0.17	0.25	0.21
A15	0.20	0.22	0.19	0.25	0.24	0.27	0.22	0.21	0.22	0.21	0.23	0.20	0.17	0.22	0.17	0.20
A16	0.16	0.16	0.14	0.25	0.20	0.23	0.18	0.17	0.25	0.24	0.24	0.23	0.21	0.23	0.23	0.13

TABLE 3: Influence degree, influenced degree, cause degree, and centrality of each factor.

Factor		Degree of influence	Influenced degree	Centrality	Degree of cause	Factor attribute
Dietary habits	A1	1.63	2.86	4.48	-1.23	Consequence factor
Work and rest habits	A2	2.92	2.88	5.79	0.04	Causal factor
Exercise habit	A3	2.56	2.56	5.12	0.00	Causal factor
Vocal habit	A4	2.75	3.56	6.31	-0.81	Consequence factor
Physical fitness and health level	A5	4.07	3.28	7.35	0.79	Causal factor
Health degree of vocal organ	A6	3.28	3.83	7.11	-0.55	Consequence factor
Mental health degree	A7	2.40	2.95	5.34	-0.55	Consequence factor
Degree of thinking and mental recognition	A8	3.04	3.07	6.11	-0.03	Consequence factor
Scientific degree of phonation	A9	3.49	3.54	7.03	-0.05	Consequence factor
Practice frequency	A10	3.46	3.35	6.81	0.11	Causal factor
Daily performance frequency	A11	4.11	3.36	7.47	0.75	Causal factor
Vocal singing level	A12	3.53	3.14	6.68	0.39	Causal factor
How much to speak?	A13	2.66	2.78	5.44	-0.11	Consequence factor
Daily workload	A14	3.56	3.17	6.72	0.39	Causal factor
Intensity of social pressure	A15	3.44	3.27	6.71	0.17	Causal factor
Social demand degree	A16	3.27	2.57	5.84	0.70	Causal factor

comprehensive analysis of the voice will help to fully control the scientific nature of the overall vocalization.

Exercise frequency (A10): voice management has a certain value of monitoring the frequency of voice use. When the frequency of voice management is increasing, it will put forward better requirements for voice management.

But the endurance of each person is not the same. Therefore, comprehensive big data analysis and evaluation are needed to obtain a better reasonable range.

Daily performance frequency (A11): for professional vocal performers, the pressure faced by the performance and the impact on the voice are very obvious, and the

problems brought by different frequencies are very different. Professional performers often bear strong pressure when dealing with the impact of large frequency of performance. But there will also be a certain limit, so for this artificial intelligence, tracking and analysis through large data can obtain considerable value and significance.

Vocal singing level (A12): for professional vocal performers, the singing level will determine the level of voice use frequency, and this is a positive correlation; when the singing level is higher, it has an important impact on voice health value and significance, and when the singing level is lower, the pressure on voice health is often less. Therefore, it is one of the important observation indicators.

4.4. Social Element. The degree of speaking (A13): the dynamic supervision of speaking at ordinary times has important observation value and significance for voice health care of professional vocal music performance. Speaking is a very noisy thing for singers, so the degree of speaking is an important observation index.

Daily workload (A14): the amount of daily workload and transactional work has an important impact on the voice health of professional vocal performers. Therefore, the evolution and change of daily workload are two of the factors that have a direct impact on voice health.

Intensity of social pressure (A15): the intensity of social pressure has important influence on the psychology of professional vocal performers and will also affect the health care of the voice. The social pressure often has an important critical value, and the results are not consistent at different stages, so close attention is needed.

Social demand degree (A16): the demand for professional vocal performers is large or small, which is an important manifestation of establishing the social value of professional vocal performers, and will also affect the formation of the overall voice health awareness, so it is one of the important external factors.

5. Influence Model and Analysis of Vocal Health Care in Professional Vocal Performance

5.1. Introduction to Methods and Models. Through the use of DEMATEL method to determine the impact of various factors directly affecting the relationship between vocal performers, calculate the impact of various factors and the extent of the impact of the relationship, to obtain the center, the reasons, and ultimately the cause and effect factors. Based on the comprehensive influence matrix calculated by DEMATEL, the ISM interpretation structure model is used to establish a multilevel hierarchical interpretation structure model. The integration of these two methods can reduce the influence of artificial factors in a traditional reachable matrix, construct statistical factors synthetically, and empower and scientifically analyze the related research.

5.2. Model Calculation Process. The DEMATEL research method was used to set up a comprehensive survey and interview, and a five-level evaluation system was established,

Table 4: Weight ratio of comprehensive influence criterion layer of voice health care in professional vocal music performance.

Factor	Life element U1	Body element U2	Training element U3	Social element U4
Centrality	21.71	25.92	27.98	24.71
Normalization	21.64%	25.83%	27.90%	24.63%

with 0, 1, 2, 3, and 4 as the hierarchical relationship. 0 has no effect, 1 has a slight effect, 2 has a small effect, 3 has a moderate effect, and 4 has a great effect on professional vocal performers, professional vocal performance educators, and professional vocal performance learners. A total of 10 subjects were interviewed. The direct impact matrix X^d is obtained by scoring the relevance of each item.

The normalized direct influence matrix X is obtained by normalizing the direct influence matrix X^d by X^d as in

$$X^d = \begin{bmatrix} 0 & A_{1,2} & \cdots & A_{1,j} \\ A_{2,1} & 0 & \cdots & A_{2,j} \\ \vdots & \vdots & \vdots & \vdots \\ A_{i,1} & A_{i,2} & \cdots & A_{i,j} \end{bmatrix}. \tag{1}$$

Among $1 \le i \le n, 1 \le j \le n$, n is the total number of influencing elements.

A comprehensive influence matrix T is calculated. According to the formula, as shown in formula (2), the obtained comprehensive influence matrix is shown in Table 2.

$$= X(1 - X)^{-1} = (t_{ij}). \tag{2}$$

And calculate the influence degree (R), the influenced degree (D), the centrality ($R + D$), and the cause degree ($R - D$) in the comprehensive influence matrix. Centrality ($R + D$) is a direct manifestation of the influence of a factor. As shown in Table 3, cause degree > 0 indicates that the element has great influence on other elements, which is called cause element. The result element means that the cause degree < 0 indicates that the element is greatly influenced by other elements, which is called the result element, as shown in

$$R = \sum_{j=1}^{n} T_{ij}(1 \le i \le n, 1 \le j \le n), \tag{3}$$

$$D = \sum_{j=1}^{n} T_{ij}(1 \le i \le n, 1 \le j \le n). \tag{4}$$

Establishing the comprehensive influence weight of voice health care. Because the centrality is used to calculate the comprehensive impact value of each criterion layer element on the whole, the comprehensive proportion is shown by the numerical value. "Therefore, the weight of the first-

TABLE 5: Grading table of influencing factors of voice health care in professional vocal performance.

Ladder level	Element set	Level description
L1	Diet habit A1; work and rest habit A2; exercise habit A3; voice habit A4; health degree of vocal organs A6; mental health degree A7; thinking and mental recognition degree A8; speaking degree A13; social pressure intensity A15; social demand degree A16	Surface influencing factors
L2	Scientific degree of phonation A9; frequency of practice A10; level of vocal singing A12; daily workload A14	Middle-level influencing factors
L3	Physical fitness and health A5; daily performance frequency A11	Root cause influence factor

level evaluation index can be obtained by normalizing the centrality of each index," and the weight vector formula of the comprehensive influence matrix index is shown in

$$A = (a_n | \text{fund},$$ (5)

$$\sum_{n=1}^{4} a_n = 1 \boxtimes 0 \leq a_n \leq 1 \boxtimes n = 1, \cdots, 4),$$ (6)

where a_n is the weight of the index U_n. The calculation results are shown in Table 4.

The calculation of the reachability matrix is based on the comprehensive influence matrix T, and the overall influence matrix H is obtained through the publication calculation, as shown in

$$H = I + T.$$ (7)

A reachability matrix K is calculated; the calculation publication of a given threshold value is shown as

$$K_{ij} = 1, \text{if } h_{ij} \geq \lambda \quad (i, j = 1, 2, \cdots, n),$$ (8)

$$K_{ij} = 0, \text{if } h_{ij} < \lambda \quad (i, j = 1, 2, \cdots, n).$$ (9)

The determination of the threshold λ will divide and stratify the structure of the influence reachability matrix. The specific value is obtained according to the analysis of multiple values to obtain a satisfactory result in line with the basic level. After multiple values, $\lambda = 0$ is finally selected. A multilevel hierarchical ISM model is established, and each level is divided according to the K matrix and the corresponding conditions (public notice 9).

$$R_i \cap S_i = R_i \quad (i = 1, 2, \cdots, n).$$ (10)

R_i is a reachable set and S_i is the set of preceding items. Construct the grading table of comprehensive influencing factors of voice health care in professional vocal music performance, as shown in Table 5.

5.3. Result Analysis of Influencing Factors of Voice Health Care in Professional Vocal Performance. Through the calculation of the above model method, it can be seen that various factors have great influence on voice health care in professional vocal music performance. No factor is independent, it

is through mutual influence to finally affect the sound, only long-term attention to these issues affects the voice, to form a systematic voice care thinking and voice health effects. Some of them evolve gradually because of various temporary environments and endogenous changes. Through the relevant research and questionnaire survey, the relevant analysis model is established. Among various factors, professional vocal music performance training factors and body factors are the key factors affecting voice health care. Physical fitness, frequency of daily performance, and social needs are the three major causal factors, which are the key factors affecting voice health care. In order to apply AI technology to the construction of sound health care in professional vocal music performance, we need to consider the training elements and the establishment of body elements. At the same time, three important factors should be considered in the key indicators, namely, the physical quality of vocal performers, the frequency of daily participation, and the change of social needs. Through these three factors, a systematic comprehensive algorithm system is constructed to create a professional vocal performance voice health artificial intelligence technology. The scale of influencing factors constructed by ISM tells researchers that physical fitness and daily performance frequency are the fundamental influencing factors. Scientific vocal method, practice frequency, vocal level, and the reasonable arrangement of daily work are the median factors; other factors belong to the surface factors. In the vocal health care of professional vocal music performance, the physical quality and daily performance frequency of the performers are the key factors affecting their voice health. Therefore, in artificial intelligence settings, this one can be used as a key factor to judge whether the health of voice care is fully considered and judged, when one of the two settings is higher. At the same time as feedback, remind the performers concerned to make corresponding adjustments to maintain a healthy voice.

Compared with other disease management, vocal management in professional vocal music performance is more affected by many complicated factors, such as various living habits, using voice habits, physical quality, and frequency of use. Therefore, when constructing the assessment system of artificial intelligence, we need to think systematically, holistically, and integrally with various factors, and we cannot ignore the important value and significance of various factors to voice management. According to the expert guidance of this method, what is constructed at present is a way in accordance with a certain color of human evolution. With

the deepening of research and the participation in the evolution of scholars and thinking, the value and significance are relatively recognized and revised. This research needs to be further optimized and promoted in the future.

6. Conclusion

Artificial intelligence technology in intelligent medicine is of great value to human health in the future. Artificial intelligence algorithms are used to scientifically plan and manage people's daily lives, studies, and work. Through the artificial intelligence technology, it carries on the order management to everybody's health and proposes the scientific guidance. Avoiding further deterioration of the singers and the environment is a promising technical direction. Combined with the professional vocal actor's voice health management environment, it can effectively distinguish the relationship between singers and environment from both internal and external aspects. AI settings can avoid deviations. This paper fully respects the relevant laws of professional development, from the professional vocal performance of the internal and external elements constituting a large number of evolution factors. Finally, the weight relation of the system is formed by identifying these subtle factors, and the root factors, intermediate factors, and surface factors are calculated by the ISM structural equation model. An artificial intelligence algorithm system is composed of different weights, which scientifically and reasonably combines professional theory and practice. We hope that the future of intelligent health care in vocal performance will provide a new perspective for vocal health management and vocal enthusiasts and professionals around the world will provide a scientific voice health management program.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Acknowledgments

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