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Voices Now: Contemporary Soundscapes

Research on the Digital Activation and Innovative Dissemination of Zhaoqing Folk Songs in China Empowered by Artificial Intelligence: A Case Study of 'Yuanlongling Hakka Mountain Songs'

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Abstract

Under the contemporary backdrop of rapid digital technology iteration, artificial intelligence (AI) music technology has emerged as a crucial means for the creative transformation and innovative development of traditional intangible cultural heritage (ICH) music. This article examines the digital revitalization and innovative dissemination of Zhaoqing folk songs in China, utilizing the 'Yuanlongling Hakka Mountain Songs' as a core case study. Integrating AI-assisted creative practice with case-based reflection, this study explores the algorithmic sound generation, platformized circulation, and contemporary revitalization of local folk music, focusing on the 'Yuanlongling Hakka Mountain Songs' of Zhaoqing, China.

The analysis demonstrates that AI technology does not dissolve the regional cultural characteristics of traditional folk songs; rather, under manual aesthetic control, it compensates for the limitations of traditional music production through efficient and controllable digital means. This process significantly enhances the acoustic texture, stage visual appeal, and cross-media adaptability of local folk songs, helping construct a multi-dimensional and modernized dissemination system. By documenting this specific case of technological mediation, the study offers practical insights into how interactive human-AI workflows can adapt local musical traditions for contemporary digital culture.

Keywords: Artificial Intelligence; Local Folk Songs; Yuanlongling Hakka Mountain Songs; Digital Revitalization; ICH Dissemination

1. Introduction

1.1. Research Background

With the rapid integration of artificial intelligence (AI) into music production and media communication, the transmission of traditional folk music is undergoing a significant transformation. Today, the digital revitalization and cross-media communication of intangible cultural heritage (ICH) music have emerged as core propositions in cultural and media studies.

Folk music carries irreplaceable historical, artistic, and social values (Yang & Yu, 2025). However, under the waves of globalization and modernization, its original ecological context has gradually dissolved, its core practitioners are aging, and many precious musical forms face the risk of disappearing (Yang & Yu, 2025). Within the Zhaoqing region, native music culture comprises genres such as tea-picking songs, Qiaotou mountain songs, and crying marriage songs (Wu, 2022). To safeguard this local heritage, research must move beyond static musical

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ontology—such as temperament and notation—toward active, creative practices that reconstruct and expand its communication channels (Wu, 2022).

As a prominent genre in the Lingnan traditional music system, Zhaoqing folk music encompasses Hakka mountain songs, water folk songs, and mountain ditties. Among these, the 'Yuanlongling Hakka Mountain Song' from Sihui preserves a relatively complete monophonic notation score, offering high research value. However, traditional folk music's reliance on oral instruction has led to contemporary dilemmas, including thin acoustic forms and simplified structures that struggle to engage younger audiences. Therefore, utilizing digital technology to accomplish auditory reshaping and communication innovation has become urgent.

1.2. Research Status

Existing domestic research on local folk music mostly concentrates on static theoretical dimensions, such as historical tracing and vocal techniques, while specialized research based on AI technology for systematic digital reconstruction remains in its infancy. In the current field of digital folk music transmission, issues such as inconsistent resource standards, insufficient depth of technical application, and weak innovation drivers persist (Yang & Yu, 2025). Zhao & Lu (2026) also point out that while AI drives the transformation of traditional music to "digital-intelligent revitalization," it simultaneously triggers new challenges regarding cultural preservation.

Meanwhile, international AI music research mostly focuses on algorithmic composition, intelligent mixing, and commercial pop music, rarely targeting regional dialect-based pentatonic songs. Consequently, a distinct academic blank remains in interdisciplinary research addressing AI-assisted auditory reshaping and localized platformized communication.

1.3. Research Significance

This paper constructs a three-dimensional research framework of 'AI technology empowerment — auditory dimension optimization — cultural communication reconstruction,' providing a practice-based case for the contemporary adaptation and digital circulation of local ICH folk music. It enriches the theoretical system of the intersection between ethnomusicology and digital media, providing a brand-new research perspective for the modernization and intelligent transformation of traditional folk music.

On a practical level, this paper executes a full-workflow AI auditory adaptation attempt centered on the 'Yuanlongling Hakka Mountain Song,' aiming to resolve the realistic pain points of thin acoustic textures and high cross-media communication difficulty in traditional Zhaoqing folk music. Promptly researching, preserving, and recording Zhaoqing's intangible cultural heritage to enter the ranks of long-term social preservation is not only the protection and inheritance of Zhaoqing's native culture but also a theoretical summary and refinement following the activation of local music culture research (Wu, 2022). The premium digitalized music products generated by this research can be directly applied to university music pedagogy, stage exhibitions, and cultural tourism promotion, providing a replicable practical paradigm for the living transmission and digital revitalization of Lingnan local folk songs.

1.4. Research Methods and Innovation Points

1.4.1. Research Methods

This paper primarily adopts literature research, case analysis, and artistic practice methods. By systematically reviewing interdisciplinary literature related to ICH folk music transmission and AI music technology, and taking the 'Yuanlongling Hakka Mountain Song' as the core case, this study conducts systematic applied research spanning from the full-workflow AI adaptation and auditory reshaping to the construction of innovative communication pathways.

1.4.2. Innovation Points

- **Methodological Reflection:** Suggesting a possible pathway for incorporating collaborative human-AI workflows into local folk music adaptation.
- **Practice Innovation:** Adhering to the principle of 'cultural authenticity priority,' this study achieves an intelligent artistic upgrade of traditional mountain songs while fully preserving the core melodic motifs, dialect lyrics, and national modes of the original tracks.
- **Communication Innovation:** Relying on the premium digital results generated by AI technology, this study reconstructs a multi-dimensional, youthful cross-media communication system for local folk music in the new media era.

2. Artistic Characteristics and Current Development Dilemmas of Zhaoqing Local Folk Songs

2.1. Original Artistic Characteristics of 'Yuanlongling Hakka Mountain Song'

Hakka people reside throughout the entire territory of Zhaoqing, and wherever there are Hakka people, Hakka mountain songs exist. The mountain songs sung by the Hakka people in Jingkou Town of Sihui City, Fenghuang Town of Dinghu District, and Shuinan Town of Gaoyao District are particularly unique (Fan, 2022). The Hakka mountain songs in Jingkou Town, Sihui City, feature lyrics structured in nine-character sentences, where the melodic intonation and lyrics harmonize naturally. The melody is composed of four tones, 'mi, re, do, la,' exhibiting a simple and rustic character (Fan, 2022).

The 'Yuanlongling Hakka Mountain Song' represents a typical Lingnan Hakka pentatonic folk song with no complex modulations, presenting a stretched, smooth melody and a free, loose rhythm, which demonstrates distinct characteristics of rustic improvisational vocalization. Its lyrics are colloquial and life-oriented, centered around the Hakka dialect vocal style with a dense rural flavor, serves as an intuitive musical vehicle for the regional folklore culture and folk aesthetics of Sihui, Zhaoqing. The Sihui Hakka mountain song is a branch of Sihui folk songs, which have been inscribed on the provincial intangible cultural heritage list. Li Chongming is the primary torchbearer of Sihui Hakka mountain

songs and has been designated as a Guangdong provincial-level practitioner of Sihui folk songs (Fan, 2022). Teacher Li Chongming spent six years transcribing hundreds of handwritten folk songs collected from different regions over several decades into volumes. Currently, among the more than one thousand mountain songs he has compiled and collected, tracks such as 'Bringing You Back to My Home Tomorrow' have been selected for the 'Guangdong Hakka Mountain Song Canon' (Fan, 2022). The original version is dominated by a cappella solo singing, lacking a fixed arrangement, harmonic texture, or instrumental accompaniment. It preserves the authentic texture of outdoor folk singing to the maximum extent, possessing immense ethnomusicological research value and ICH protection value. This native folk song was orally taught, gathered, and recorded by Mr. Li Chongming, a representative practitioner of intangible cultural heritage, constituting the most core cultural matrix and source material for digital revitalization in this study.

2.2. Modern Auditory Aesthetic Limitations of Traditional Folk Songs

2.2.1. Monophonic and Thin Musical Texture

The original track presents a monophonic, pure vocal structure, lacking modern harmonic support, accompaniment layering, and dynamic contrast. The acoustic topology of the entire song is relatively flat, with weak visual and three-dimensional auditory fluctuations and singular artistic expression techniques, making it difficult to directly satisfy the stereoscopic auditory aesthetic demands of modern stages or contemporary digital audio streaming media.

2.2.2. Improvisational and Random Rhythmic Structures

Traditional mountain songs rely on native, raw improvisational singing habits in the wild, resulting in high rhythmic freedom, irregular phrase sections, and randomized phrase endings. This form, which lacks a stable groove or beat rhythm, creates an aesthetic gap with the standardized musical forms of modern music, to some extent increasing the adaptation difficulty for cross-media stage exhibitions and new media audio communication.

2.2.3. Raw Acoustic Quality Lacking Modern Industrial Quality Control

Constrained by folk recording or singing environments, the original audio files often exhibit breath fluctuations, dry vocal timbres, substantial environmental noise, and a centralized, singular sound field. Due to the lack of professional digital mixing and acoustic spatial design, the listening experience is rough, presenting a massive gap with the modern digital music aesthetics accustomed to by contemporary audiences.

2.3. Cross-Media Communication Dilemmas of Traditional Folk Songs

2.3.1. Singular Communication Carriers and Scarcity of Digital Resources

Traditional folk songs have long relied on the enclosed inheritance of oral instruction and offline folklore activities, severely lacking standardized digital audio resources, standardized music scores, and high-quality modern adapted versions, which leaves them without an effective carrier medium in the modern digital communication system. Fengkai mountain songs, under the impact of contemporary popular music and changes in people's lifestyles, have seen the complete disappearance of traditional performances by mountain song artists even during festive celebrations; the habit of singing mountain songs in daily life to relieve boredom and enjoy leisure has been entirely replaced by singing pop music in KTVs (Yuan, 2023).

2.3.2. Severely Aging Audience Base and Intergenerational Fracture

Constrained by obsolete auditory forms and traditional communication channels, local folk music struggles to reach younger demographics, leading to a critical intergenerational fracture. Today, the traditional habit of singing mountain songs in daily life or during festive celebrations has been largely replaced by commercial pop music (Yuan, 2023). Younger generations show little interest in inheriting these indigenous art forms, often perceiving them as outdated artifacts (Wang, 2019). This disinterest is compounded by a severe demographic crisis among practitioners. The representative singers—historically praised as "living fossils" of traditional singing—are diminishing due to advanced age (Wang, 2019). Because the social and agricultural soils that originally sustained these outdoor, improvisational songs have vanished under rapid industrialization, the survival of Zhaoqing folk music is deeply threatened by a generational fault (Wang, 2019; Yuan, 2023). To prevent these unique sonic traditions from disappearing entirely, it is imperative to implement immediate digital intervention, adapting and reconstructing local folk music to fit contemporary digital media environments.

2.3.3. Restricted Application Scenarios and the Cultural Island Effect

Because they cannot be organically integrated into mainstream mainstream scenarios—such as new media cross-media communication, university aesthetic education classrooms, modern stage competitions, and cultural tourism brand promotion—traditional folk songs have long remained in a niche, peripheral, and regionally enclosed state, making it highly difficult for them to enter the modern digital streaming media ecosystem.

3. Technical Logic of AI-Empowered Auditory Optimization for Local Folk Songs

3.1. Technical Advantages of Applying AI Music Technology to Folk Music Adaptation

Compared with traditional manual music production, artificial intelligence (AI) music technology possesses two core advantages: high-efficiency production and low-cost trial and error. AI can deeply learn and deconstruct the stylistic features of modern musical genres and mature artists, creatively recombining them with the melody, mode, and rhythmic genes of native folk songs. The booming development of digital technology opens up a new dimension for the rescue protection and innovative inheritance of folk and traditional music, providing a powerful tool that breaks through temporal and spatial limitations to achieve permanent resource preservation and widespread communication (Yang & Yu, 2025). Under the premise of manual control over the overall style, emotional trajectory, regional characteristics, and artistic depth, AI technology can rapidly generate multi-dimensional adaptation schemes, providing a broader exploration space for the cross-media revitalization of traditional folk songs. Yuan (2025) noted that AI technology, through high-precision audio acquisition and intelligent analysis, can deconstruct the melody, rhythm, and timbre of ICH music in multiple dimensions, achieving automatic score transcription and dynamic digital storage, thereby providing precise support for technique restoration. Concurrently, intelligent teaching systems can customize schemes based on learners' foundations, breaking the temporal and spatial constraints of master-to-apprentice transmission through real-time audio comparison and virtual scenario simulation.

3.2. Core Principles of AI Folk Music Adaptation

3.2.1. Cultural Authenticity Principle

Local folk songs are cultural crystallizations highly refined through oral traditions across specific regional communities, and their core ICH essence is rooted in melodic intonations and regional cultural imprints. Zhao & Lu (2026) pointed out that although AI technology has gradually matured in mimicking and generating formal elements such as pitch, rhythm, timbre, and musical form, it remains fundamentally incapable of understanding and conveying the profound cultural and spiritual core of traditional music. The aesthetic essence of traditional music is often embodied in an unquantifiable charm ('Shenyun'), which makes AI-generated works highly susceptible to the dilemma of having 'form' but lacking 'spirit,' thereby facing the risk of cultural hollowization. Therefore, AI adaptation must unfold under the premise of fully preserving the core motifs, scalar characteristics, and cultural genes of the original track, strictly preventing the erasure of the folk song's 'cultural fingerprint.' During this process, manual aesthetic quality control and proofreading mechanisms must be introduced to ensure that the melodic backbone and emotional core of the original track are not subverted, aiming to empower new expressions with digital technology and facilitate the dynamic revitalization of classic symbols.

3.2.2. Moderate Innovation Principle

Innovation should be predicated upon respecting the cultural foundations of the original work. AI technology is the means, while the cultural matrix is the fundamental root. Overly pursuing the 'traffic' of modern streaming media while ignoring cultural depth will cause the adapted work to lose the soul of ICH music. True innovation lies in achieving 'powerful communication' under the premise of a 'soulful tradition.' Because generative AI exhibits the characteristic of indiscriminately generating diverse styles—including overly disruptive or homogenized versions—the editor must rely on profound cultural sensitivity and musical aesthetic literacy to precisely define the reasonable boundaries of innovation.

3.2.3. Aesthetic Adaptation Principle

AI adaptation needs to precisely fit the auditory aesthetic demands of contemporary audiences, but it must never do so at the cost of sacrificing the emotional expression and artistic depth of the music. A musical work capable of triggering cross-generational resonance should use familiar regional melodies as a bond, presented in a stereoscopic manner through an arrangement language that conforms to modern aesthetics. Meanwhile, AI adaptation should avoid falling into deliberate 'elitist' or 'niche' misunderstandings, striving to find the optimal balance point between professional artistry and mass acceptance.

3.3. Technical Path and Tool Chain of AI Auditory Optimization

This study divides the overall technical workflow into three primary stages: native music data deconstruction, digital technological reshaping, and high-quality digital audio output. Each stage relies on the industry's cutting-edge professional software and AI generative platforms, constructing a complete digital music production workflow.

Table 1. Technical Workflow of AI Auditory Optimization

Stage	Task	Tools Used	Specific Function & Input/Output
Phase I: Transcription	Melodic & Score Standardization	Sibelius	Converts orally transmitted local melody into digital staff notation and MIDI data.
Phase II: Vocal Synthesis	Lead Vocal Generation	Synthesizer V	Synthesizes a realistic vocal track with fine-tuned parameters (breath, dynamics).
Phase II: Algorithmic Generation	Arrangement Drafts	Suno 5.5	Generates diverse arrangement concepts based on prompt engineering of ethnic instruments and genre tags.
Phase II: Revision	Orchestration, Sampling, & Editing	Fender Studio Pro (DAW)	Overlays high-quality virtual instrument samples (Erhu, Zhudi); manually corrects midi velocity, pacing, and section structure.
Phase III: Mixing	Spectral Balancing	Sonible Bundle	Automatically detects and resolves frequency masking between synthesized vocals and instrumental tracks.
Phase III: Mastering	Intelligent Sound Field Optimization	Ozone 11	Executes automated EQ correction, multi-band compression, and loudness maximization to commercial standards.

3.3.1. Phase I: Native Music Data Compilation

The original musical materials, historic notations, and lyric variants of the "Yuanlongling Hakka Mountain Song" analyzed in this study were obtained from published academic records documenting the work of Mr. Li Chongming, a prominent representative practitioner of Sihui Hakka mountain songs. Specifically, these foundational materials were sourced from the transcriptions and heritage studies published in the scholarly article: "Study on Zhaoqing Hakka Mountain Songs and Their Inheritance" (Fan, 2022). All sources have been strictly documented and cited in accordance with academic referencing standards.

Utilizing these historical notation records, the researcher employed the professional notation software Sibelius to convert the documented local melody into structured digital staff notation and MIDI data, establishing precise benchmarks for pitch, rhythm, and national pentatonic modes. This step successfully resolves a critical technical pain point in traditional folk music research—namely, the lack of standardized, machine-readable music scores—thereby providing a calculable digital underlying layer for subsequent AI algorithmic processing.

3.3.2. Phase II: Digital Reshaping

This stage is the core adaptation link, involving the collaborative interaction of multiple AI tools and Digital Audio Workstations (DAWs).

High-quality vocal synthesis was executed using Synthesizer V, an AI music tool integrating cutting-edge vocal synthesis models. This tool can deeply simulate the delicate dynamics of human singers' vocal lines. Through manual parameter fine-tuning, acoustic details such as articulation, breathiness, and vibrato are precisely controlled. While fully preserving the vocal characteristics of the Hakka dialect, it integrates the performance techniques of popular singing, achieving a creative transformation of the traditional voice.

Regarding the artificial synthesis of vocal tracks, this study strictly adhered to digital copyright and ethical guidelines: no voice-cloning technology or unauthorized physical voice replicas of the tradition bearers were utilized. Instead, the lead vocal tracks were generated using a commercially licensed, standard virtual singer database within Synthesizer V. This approach ensures full copyright compliance, respects the personal and artistic rights of the traditional practitioners, and demonstrates how commercial-grade generative tools can ethically revitalize public-domain intangible cultural heritage without marginalizing the agency of its original keepers.

Structured prompt engineering was designed leveraging Large Language Models. The researcher translated the pentatonic modal characteristics, Hakka stylistic imagery, and the instrumentation directions of characteristic Lingnan folk instruments—such as the Erhu, Zhudi (bamboo flute), and Yangqin—into text prompts, which were input into the generative music foundation model platform Suno 5.5. The system rapidly generated multiple sets of arrangement drafts based on the latest algorithmic models, providing rich creative origins for subsequent manual refined adjustments. Yang & Zhang (2026) pointed out that by training generative models based on regional musical features, it is possible to create musical works that maintain traditional flavor while conforming to contemporary aesthetics.

The premium drafts generated by Suno 5.5 were imported into the next-generation DAW, Fender Studio Pro. In this environment, the researcher executed manual refined corrections: overlaying highly accurate sampled timbres of Lingnan ICH instruments such as the Erhu, Zhudi, and Hakka gongs and drums, thereby constructing a two-layer orchestration matrix dominated by traditional folk music and supplemented by modern timbres; concurrently, modern lyrical strings and atmospheric piano were integrated to widen the high- and low-frequency layering of the sound field. The built-in AI assistive functions of Fender Studio Pro effectively deconstructed the preceding drafts and optimized sectional transitions, significantly enhancing artistic production efficiency.

Liu (2024) indicated that with the help of high-precision microphones and professional audio interfaces, we can accurately record every subtle detail of music, whether it is a low drumbeat or a soaring melody, allowing them to be perfectly reproduced. Voice restoration involves correcting issues such as noise, distortion, and damage appearing in the sound... through techniques like denoising and spectral analysis, precise voice identification and noise cancellation are achieved, thereby restoring the original sound quality.

3.3.3. Phase III: Mixing, Mastering, and Standardized Output

After the details of the arrangement engineering were finalized, the project entered the post-mixing and mastering stage. The researcher deployed Ozone 11 (AI Intelligent Mastering Assistant) to execute intelligent equalization, dynamic control, stereo imaging expansion, and loudness maximization processing, ensuring that the audio waveform and loudness meet international publishing-grade audio quality standards. Meanwhile, the Sonible Bundle intelligent plugin suite was introduced to perform spectral balancing and dynamic correction on vocal and

various instrumental frequency bands, with algorithms automatically detecting and eliminating frequency masking and transient blur phenomena. The collaborative operation of these two AI tools allowed the final modern adapted version of 'Yuanlongling Hakka Mountain Song' to retain its retro rural dialect flavor while possessing the professional auditory quality of contemporary mainstream audio streaming media. Yang & Zhang (2026) pointed out that multimodal data collection achieves precise preservation of subtle artistic features such as 'Haha Qiang'; deep learning models provide a new paradigm for the quantitative study of performance formulas; virtual reality technology reconstructs the exhibition space of ICH; and AIGC technology opens up an innovative path for the contemporary transformation of traditional arts.

4. AI Auditory Optimization and Adaptation Practice of 'Yuanlongling Hakka Mountain Song'

4.1. AI Data Deconstruction of the Original Track

As shown in Figure 1, the researcher first utilized the professional notation software Sibelius to perform precise notation and digital entry of the raw ecological melody of the 'Yuanlongling Hakka Mountain Song' orally transmitted by Mr. Li Chongming, generating a standardized MIDI file containing pitch, duration, rhythmic patterns, and modal characteristics. On this basis, through manual analysis, the framework and melodic trajectory features of its pentatonic Yu mode (or Gong mode, adjusted according to the actual situation) were further deconstructed, precisely locking in the core artistic genes of the original song. This step established a clear aesthetic and emotional reference benchmark for subsequent algorithmic generation, ensuring that technological innovation does not detach from the indigenous style of local folk culture.

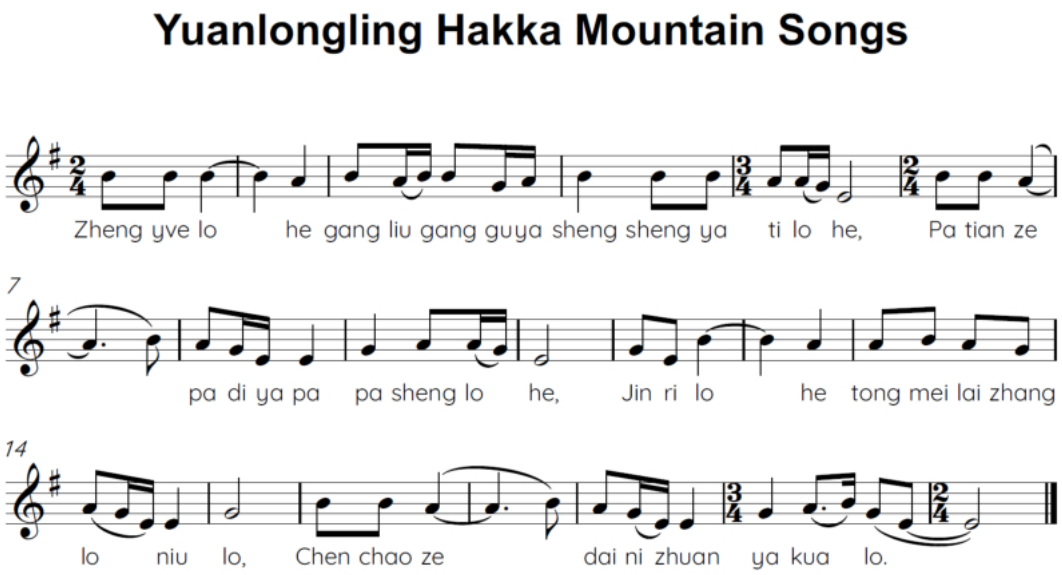


Figure 1. The Original Materials of Mountain Songs

4.2. Intelligent Regularization of Musical Form

Addressing the attributes of blurred sections and loose structures present in traditional mountain songs during outdoor improvisational singing, this study performed a structured reshaping conforming to modern auditory psychology within the Fender Studio Pro DAW, combined with the diverse arrangement drafts generated by Suno 5.5. The adapted version intelligently designed an introduction (prelude), interlude, transitional phrases, and an outro that facilitate modern streaming media communication and stage exhibitions. The regularized musical form was established as: Prelude → Verse A → Chorus A → Interlude → Verse B → Chorus B → Outro. This structure possesses distinct sectional layers and balanced duration distribution, enhancing the dynamic tension of the music without destroying the narrative logic of the original track, effectively adapting to the golden time law of contemporary cross-media communication.

4.3. Layered Optimization of Orchestration and Texture

To balance the 'authenticity' of traditional folk songs with the 'richness' of modern hearing, this study constructed a two-layer orchestration matrix of 'traditional folk music as the base, supplemented by modern timbres.'

4.3.1. Traditional Folk Music Base

Relying on AI algorithms to intelligently match characteristic Lingnan ICH instruments such as the Erhu, Zhudi, Yangqin, and Hakka gongs and drums, this study solidified the original ecological rural background of Zhaoqing Hakka mountain songs. The aforementioned ethnic timbres were realized by importing high-precision real sample libraries via Fender Studio Pro, and the researcher manually performed refined modifications on performance velocity, duration micro-adjustments, and expression control, effectively eliminating the mechanical and cold feeling of algorithmic generation while preserving the unique sense of breath and agility of folk instruments.

4.3.2. Modern Timbre Empowerment

On top of the traditional folk music base, lyrical string sections, atmospheric piano, and lightweight national-style electronic pads were moderately integrated. By expanding the frequency response at both the high and low ends of the audio, the vertical acoustic layers of the texture were enriched, significantly enhancing the overall fullness of the song, the depth of the acoustic space, and modern artistic expressiveness.

4.4. AI Harmony Arrangement and Refined Modification of Vocals

4.4.1. Nationalized Adaptation of Intelligent Harmony

The original 'Yuanlongling Hakka Mountain Song' features a monophonic a cappella structure, presenting a thin acoustic form. Based on the modal harmony framework generated by Suno 5.5 and guided by Chinese pentatonic modal harmony theory, the researcher manually composed two-part and three-part harmonies. The arrangement primarily adopted ethnic-colored harmonic techniques of the same Gong system, supplemented by moderate fourth and fifth structural stackings. While filling the acoustic blank of the traditional single voice and enhancing the emotional driving force of the music, this approach effectively avoided the excessive dissolution of Chinese national modes by Western traditional major and minor functional harmony.

4.4.2. Refined Vocal Processing

Addressing the realistic problem that the vocal preservation of traditional ICH music contains numerous flaws, this study adopted the core lead vocal generated by Synthesizer V (Figure 2). The digital vocal project first underwent spectral equalization correction and masking elimination through the Sonible Bundle intelligent suite, and was subsequently imported into the intelligent dynamic processing module of Ozone 11 to microscopically polish the audio's compression ratio, dynamic range, and de-esser. The final output vocal is clear, warm, precisely imaged, and naturally articulated, eliminating the acoustic defects in the original ecological recording and achieving a balance between technical quality control and dialect aesthetics.



Figure 2. Lead Vocal Generated by Synthesizer V

4.5. Post Intelligent Mixing and Mastering Treatment

In the closing stage of the audio project, the researcher comprehensively utilized intelligent mastering systems equipped with cutting-edge AI analysis technology, such as Ozone 11 (Figure 3), to perform overall sound field optimization. The system automatically identifies the frequency distribution of audio samples to execute intelligent equalization (EQ) counterbalancing, multi-band dynamic compression, stereo field expansion, and maximizer control, ensuring that various acoustic indicators reach modern digital publishing-grade audio quality standards. The final output 24-bit/48kHz high-resolution WAV audio file possesses the standardized technical quality to directly connect with mainstream domestic and international music streaming platforms, large-scale stage sound reinforcement systems, and radio and television broadcasting platforms, achieving a paradigm shift from traditional oral forms to modern digital music finished products.



Figure 3. Ample Sound Erhu VST Plugin and AI-Driven Mixing Plugin Ozone 11

4.6. Reflective Analysis on Human Aesthetic Control

While generative AI tools offer high technical efficiency, they cannot autonomously negotiate the delicate balance between traditional heritage and modern commercial appeal. In this project, human aesthetic control acted as a crucial decision-making and corrective mechanism.

First, regarding vocal styling, the creative objective was to adapt the rustic folklore song into a highly accessible, modern pop format to maximize its dissemination potential. Consequently, instead of strictly replicating the original raw Hakka dialect vocalizations, the author intentionally translated and adapted the lyrics into Standard Mandarin to achieve a clean, contemporary pop aesthetic. However, to counteract the typical mechanical stiffness and artificial "flatness" of raw AI generation in Synthesizer V, the author manually micro-adjusted key parameters—such as pitch transition curves, vibrato depth, and breath distribution—ensuring the synthesized vocals sounded fluid, organic, and emotionally resonant with human-like phrasing.

Second, concerning orchestration and harmonic structure, the initial drafts recommended by Suno 5.5 exhibited highly formulaic, template-like pop patterns, which lacked high-quality ethnic instrumental integration and proper counter-melodies (secondary melodies). To address this, the author deactivated Suno's generic instrumental tracks within Fender Studio Pro and manually composed and overlaid refined secondary melodies using high-definition virtual instruments of traditional Lingnan instruments, including the Zhudi (bamboo flute) and Erhu. This manual intervention successfully bridged the gap between the rigid structural constraints of algorithmic pop templates and the lively, expressive texture of authentic local musical heritage.

5. Reconstruction of Innovative Communication Pathways for Zhaoqing Folk Songs Empowered by AI

5.1. Matrix-Based and Diversified Digital Audio-Visual Derivatives

Relying on the final digital audio track optimized by AI hearing, this study constructs a digital content derivative mechanism of 'single source, multiple states, and full matrix distribution.' According to the auditory psychology and consumption scenarios of different media audiences, multiple forms of audio derivatives are systematically derived: including the full-length industrial track oriented toward streaming platforms (satisfying immersive listening needs), the fast-paced micro-version targeted at lightweight mobile media such as short videos (utilizing the Hook effect of the golden first 30 seconds to lock the audience's attention), the pure instrumental accompaniment version for mass singing, and the segmented pure vocal demonstration version for ICH pedagogy. Yang & Yu (2025) indicated that relying on databases, cloud storage, and network transmission technologies breaks through the spatial, temporal, and linguistic barriers of traditional communication, allowing precious resources scattered among the folk to be integrated and achieve instant access and sharing on a global scale. This diversified content production mode breaks the single, solidified physical form of traditional folk songs, laying a solid content foundation for their full streaming media matrix communication in the modern digital media ecology.

5.2. Youth-Oriented Cross-Media Communication Driven by Algorithmic Recommendation

Taking the optimized short-video micro-version audio as the core cultural symbol, it is precisely deployed to digital audio-visual platforms highly clustered by contemporary youth demographics, such as TikTok, Douyin, Bilibili, and WeChat Video Accounts. In cross-media communication practices, the refined modern AI auditory products are organically and high-frequently fused with the ecological landscape scenery of Sihui, Zhaoqing, and modern national-style visual effects, completely deconstructing and reshaping the youth circle's stereotyped impression of traditional folk music as 'old and singular,' thereby achieving a vertical breakthrough from a 'niche cultural island' to a 'youth mainstream cultural circle.' Liu (2024) noted that through the clever utilization of social media, some traditional orchestras successfully extended their market influence to broader and more diverse audiences... by shining on popular social platforms like Weibo and Douyin... successfully capturing the attention of the younger generation. Meanwhile, relying on platform algorithmic recommendation mechanisms and community interactive characteristics, multi-platform linked topic challenge matches are initiated to activate users' User Generated Content (UGC) enthusiasm, driving the fission-style communication of ICH symbols in youth online communities through socialized deconstruction methods such as 'covers, secondary creations, and remixing.' Wu (2022) pointed out that under the context of the new media era, universities should fully utilize the communication modes of new media to set up official accounts for local Zhaoqing music culture on network platforms and create mobile apps for appreciating local Zhaoqing music culture, forming an online communication chain for local Zhaoqing music culture.

5.3. Standardized Intergenerational Transmission via Campus Aesthetic Education

The ultimate destination of digital revitalization lies in living transmission. This study organically embeds the standardized folk song versions, digitalized music scores, pure vocal demonstration audio, and supporting teaching guides optimized and adapted by AI into the college music general education and primary and secondary school local school-based aesthetic education curriculum systems in Zhaoqing. By constructing a standardized campus aesthetic education streaming media resource library, the traditional 'Yuanlongling Hakka Mountain Song' is transformed from a field ditty into an educational resource possessing a modern pedagogical paradigm. Through classroom listening, singing practices, and art competition interactions, students imperceptibly establish a sense of identity with native national music culture, thereby effectively blocking the intergenerational fault crisis of ICH music within the educational field and achieving the living retention of traditional culture.

5.4. Scenario-Based Symbiotic Communication under Local Culture-Tourism Integration

This study is dedicated to promoting the scenario-based application of AI revitalization results within the context of 'Culture-Tourism Integration.' High-quality adapted versions of the 'Yuanlongling Hakka Mountain Song' are comprehensively injected into physical cultural tourism spaces such as Sihui rural tourism, digital ICH exhibition halls, and folk festivals in Zhaoqing, serving as exclusive spatial acoustic background music (BGM). By deploying 'cultural creative audio QR codes' at core scenic landmarks and embedding digital audio tracks in

tourism promotional films as 'soundscape' design methods, traditional folk songs are transformed into highly recognizable regional cultural acoustic business cards. This move significantly enhances the emotional tension and immersive experience of cultural tourism spaces while achieving mutual nourishment, co-prosperity, and symbiosis between the living transmission of local ICH culture and the development of the rural modern cultural tourism industry.

6. Conclusions and Future Prospects

6.1. Research Conclusions

Taking the 'Yuanlongling Hakka Mountain Song' of Zhaoqing as the core practical sample, this paper systematically explores the realization path and core value of artificial intelligence technology in empowering the auditory dimension reshaping and cross-media innovative communication of local folk songs. The research indicates that AI technology can, under the logical premise of fully respecting the authenticity of ICH culture, effectively crack the realistic pain points of traditional folk songs—such as singular acoustic textures, a lack of quality control in original ecological audio, loose musical form and rhythmic structures, and enclosed cross-media communication—significantly enhancing the modern aesthetic adaptability, artistic expressiveness, and multi-dimensional communication efficiency of local folk songs.

Relying on cutting-edge tools such as Sibelius, Synthesizer V, Suno 5.5, Fender Studio Pro, Ozone 11, and the Sonible Bundle, this study successfully constructed an end-to-end digital audio production and intelligent aesthetic control workflow, achieving a seamless connection from the deconstruction of folk original materials to high-quality modern digital audio output. Practice proves that the intervention of AI technology in the field of ICH music is not an alienation or subversion of traditional culture, but rather a dynamic reconstruction and creation of ICH genes under the guidance of manual aesthetic quality control. Rather than claiming a universal model, this study offers a specific, localized case of AI-assisted creative practice. It serves as a reference point for future research exploring how collaborative human-AI music production can negotiate the tensions between algorithmic generation, cultural authenticity, and digital platform circulation.

6.2. Research Limitations and Prospects

Constrained by multiple objective conditions, this study currently mainly executes deep applied practice and path deconstruction taking the typical case of the Sihui 'Yuanlongling Hakka Mountain Song,' leaving room for improvement in the coverage breadth of sample types. In subsequent research, the team will further expand the ICH music sample database, widening the research horizon to multiple genres and dialect categories of folk music such as Zhaoqing water folk songs (fishermen's songs), Huaiji mountain songs, and Gaoyao folk songs, dedicating efforts to extracting a local folk music AI matrix-based digital revitalization paradigm with higher universality and migration topology capabilities.

Meanwhile, future technological application prospects will no longer be confined to singular auditory dimension optimization, but will deeply integrate cutting-edge multimodal interactive technologies such as AI digital human multimodal performance, AI-driven visual MV generation, and generative 3D virtual stage exhibitions (XR/metaverse space). By constructing an integrated 'visual-auditory-performance-communication' panoramic digital revitalization ecology, this approach will further widen the cross-cultural innovative communication boundaries of local folk songs, continuously driving the deep evolution of Lingnan local intangible cultural heritage music toward modernized, youthful, and internationalized contexts.

Author Contribution

Conceptualisation: Ziqi Shi; Methodology: Wenyao Hua, Jianwei Liang; Formal analysis and software investigation: Wenyao Hua; Fieldwork and data curation: Jianwei Liang; Music transcription and notation: Jianwei Liang; Audio engineering and AI workflow deployment: Wenyao Hua; Writing – original draft preparation: Wenyao Hua, Jianwei Liang; Writing – review and editing: Ziqi Shi, Wenyao Hua; Project administration and funding acquisition: Ziqi Shi. All authors have read and agreed to the published version of the manuscript.

Compliance with Ethical Standards

This study is based on published academic materials concerning the "Yuanlongling Hakka Mountain Song" as documented in Fan (2022). No new field recordings, interviews, or experiments involving human participants were conducted; therefore, formal ethics approval was not required.

The AI-assisted vocal production used commercially licensed virtual singer databases and did not involve voice cloning, biometric voice replication, or unauthorized use of the tradition bearer's physical voice. All source materials have been properly cited, and the authors affirm that the creative practice was conducted with respect for the cultural integrity of the original folk song and the agency of its tradition bearers.

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Competing Interest Declaration

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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