

Research on Visual Transformation and Communication of Ouyue Intangible Cultural Heritage Resources based on Generative AI

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Abstract

To address the issues of digitalization gaps and audience disconnect in the inheritance of Ouyue intangible cultural heritage (ICH), this study focuses on the application of generative AI in the visual transformation and communication of Ouyue ICH resources. It constructs a full-process closed-loop transformation framework: "Deconstruction of Ouyue ICH Resources - Custom Model Training - Diversified Visual Generation - Communication Feedback Optimization," adhering to three core principles: cultural fidelity, technical adaptability, and scenario suitability. Taking Ouyue embroidery, boxwood carving, and fine-line paper cutting as experimental objects, this study compares the transformation effects of three tools: MidJourney V6, Stable Diffusion 3, and Wenxin Yige V4. The results show that Stable Diffusion 3 achieves the best cultural fidelity, while MidJourney V6 excels in visual aesthetics. Based on the experimental findings, optimization strategies for communication are proposed from four dimensions: technical adaptation, cultural fidelity, audience precision, and scenario integration, forming a multi-stakeholder collaborative communication system. The research indicates that generative AI can provide efficient support for the visual transformation of Ouyue ICH, but it must prioritize cultural inheritance, avoid technology-centric tendencies, and compensate for deficiencies in restoring complex craftsmanship and deeply transforming cultural connotations.

Keywords

Generative AI; Ouyue Intangible Cultural Heritage (ICH); Visual Transformation; Communication Strategy; Cultural Fidelity.

1. Background and Current Status

With the development of the digital age, the inheritance of intangible cultural heritage (ICH) faces challenges such as outdated traditional communication methods, low acceptance among young audiences, and insufficient digital transformation of cultural resources. As the core carrier of traditional culture in Wenzhou, Zhejiang, Ouyue ICH covers numerous projects with distinct regional characteristics, including Ouyue embroidery, boxwood carving, and fine-line paper cutting, embodying unique craftsmanship and cultural connotations.[1]

Currently, the communication of Ouyue ICH mainly relies on traditional forms such as offline exhibitions and oral instruction with hands-on demonstration by inheritors. These approaches suffer from limitations including a narrow communication scope, a single form of content presentation, and disconnection from the aesthetic preferences and information reception habits of modern audiences. Meanwhile, the digital transformation of ICH resources mostly remains at the level of simple image and video recording, lacking in-depth extraction of cultural genes and innovative presentation. This

failure to meet the needs of diverse communication scenarios and audiences has led Ouyue ICH into a predicament of intergenerational disconnect among audiences and weakened cultural influence.

The rise of generative AI technology has opened up new possibilities for the innovative transformation of ICH resources. Its efficient content generation capability and diverse visual presentation forms can break the limitations of traditional transformation models, promoting the transition of Ouyue ICH towards digital, youth-oriented, and scenario-based communication. Thus, it has become an important technical support for addressing the challenges in the inheritance and communication of Ouyue ICH.

2. Construction of a Generative AI-Driven Visual Transformation Framework for Ouyue ICH

2.1 Principles for Framework Construction

1) Cultural Fidelity Principle

The core is to preserve the "cultural genes" of Ouyue ICH, such as the "gold thread coiling embroidery" technique of Ouyue embroidery, the "hollowed-out carving" craft of boxwood carving, and the layout principle of "dense yet not cluttered, sparse yet balanced" for fine-line paper cutting. These core features must be accurately extracted during AI model training and content generation to avoid technical distortion.[2]

2) Technical Adaptability Principle

Appropriate generative AI tools and models should be selected based on the visual characteristics of different Ouyue ICH projects. For example, fine-line paper cutting, which centers on lines, is suitable for the Stable Diffusion model that excels in line drawing generation; Ouyue embroidery, with its rich colors, can adopt the MidJourney tool featuring high color reproduction.

3) Scenario Suitability Principle

Visualized content must be adapted to communication scenarios. For instance, content for offline exhibitions should emphasize detailed presentation; content for short video platforms needs to enhance dynamic effects and rhythm control; content for cultural and creative design should balance practicality and aesthetics.

2.2 Design of the Full-Process Transformation Framework

Based on the aforementioned principles, this study constructs a full-process closed-loop transformation framework: "Deconstruction of Ouyue ICH Resources - Custom Model Training - Diversified Visual Generation - Communication Feedback Optimization." The specific process is shown in Figure 1.

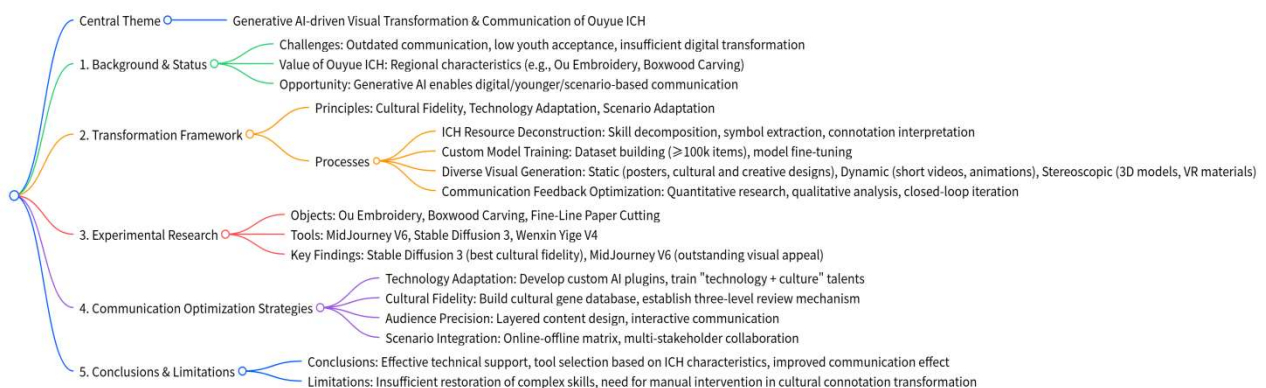


Figure 1. Mind Map of the Full-Process Transformation Framework Design

1) Deconstruction of Ouyue ICH Resources: Laying the Foundation for Transformation

This stage is the core link to avoid cultural distortion. A cross-disciplinary team consisting of ICH inheritors, cultural scholars, and designers should be established to carry out work in three aspects: First, disassembly of craftsmanship processes: Record the key steps of ICH techniques through high-definition shooting and interviews with inheritors, such as the full process of boxwood carving—"material selection - conceptualization - rough carving - refined carving - polishing"; Second, extraction of cultural symbols: Sort out visual symbols in ICH, such as the "phoenix playing with peony" pattern in Ouyue embroidery and the "Eight Immortals" image in fine-line paper cutting, and establish a symbol database; Third, interpretation of connotations: Explore the cultural meanings behind ICH, such as the spirit of "unity and collaboration" embodied in dragon boat racing, to provide an emotional core for visualization.[3]

2) Custom Model Training: Improving Transformation Accuracy

General-purpose generative AI models have insufficient recognition of the specific characteristics of Ouyue ICH, so it is necessary to construct a custom dataset and fine-tune the model. For dataset construction: Collect materials including physical ICH images, screenshots of technique videos, and illustrations from historical documents, with a total volume of no less than 100,000 items, and label the data—for example, marking stitch categories such as "gold thread coiling embroidery" and "flat embroidery" for Ouyue embroidery, and technique types such as "hollowed-out carving" and "round carving" for boxwood carving. For model fine-tuning: Based on general-purpose models such as Stable Diffusion and MidJourney, input labeled data to adjust parameters, thereby improving the model's ability to recognize and generate Ouyue ICH features. For instance, enabling the model to accurately generate "Ouyue embroidery peony pattern with gold thread coiling" instead of ordinary peony patterns.

3) Diversified Visual Generation: Adapting to Communication Needs

Based on the fine-tuned model, three types of visual content are generated according to different communication scenarios: First, static visual content, including ICH posters, cultural and creative product design drawings, and book illustrations—such as generating covers for cultural and creative notebooks based on fine-line paper cutting; Second, dynamic visual content, covering technique animation clips, short videos of ICH stories, and solar term-themed animations—such as transforming Ouyue embroidery techniques into 1-minute popular science short videos; Third, three-dimensional visual content, such as 3D models of boxwood carvings and VR experience materials of ICH techniques, for offline interactive exhibitions. During the generation process, inheritors must conduct reviews to ensure the accuracy of cultural connotations.

4) Communication Feedback Optimization: Achieving Closed-Loop Iteration

Feedback is collected through two methods: First, quantitative research: Design questionnaires to collect data on audiences' satisfaction with visual content and their cultural cognition; Second, qualitative analysis: Understand audience needs through social media comments and offline interviews. Optimize the entire process based on feedback data: If audiences believe that a certain type of visual content has low cultural recognition, return to the resource deconstruction stage to re-extract features; If the generation efficiency is insufficient, optimize model parameters. Improve transformation quality through closed-loop iteration.

3. Experimental Research on Generative AI in the Visual Transformation of Ouyue ICH

3.1 Experimental Design

1) Experimental Objects

Three representative Ouyue ICH projects were selected: Ouyue embroidery (traditional fine art, featuring rich colors and stitches), boxwood carving (traditional craftsmanship, highlighting shape

and texture), and fine-line paper cutting (traditional fine art, with distinct line characteristics). These projects cover different ICH categories to ensure the representativeness of the experiment.

2) Experimental Tools

Three mainstream generative AI visual tools were chosen for comparison of their transformation effects: MidJourney V6 (high color reproduction, suitable for artistic generation), Stable Diffusion 3 (supports custom model fine-tuning, suitable for detailed craftsmanship generation), and Wenxin Yige V4 (good adaptability to traditional Chinese cultural elements).

3) Experimental Tasks and Evaluation Indicators

Unified generation tasks were designed for each ICH project: For Ouyue embroidery, generate a "phoenix playing with peony pattern using gold thread coiling embroidery"; for boxwood carving, generate a "design drawing of a hollowed-out landscape and figure ornament"; for fine-line paper cutting, generate an "Eight Immortals Crossing the Sea pattern". A 5-member evaluation team (including 2 ICH inheritors, 2 designers, and 1 cultural scholar) was invited to score the results based on three indicators:

Cultural Fidelity (degree of restoration of core features),

Visual Aesthetics(conformity to modern aesthetic standards),

Practicality (adaptability to scenarios such as cultural and creative design).

Each indicator was scored out of 10 points, and the average score was taken as the final result.

3.2 Experimental Results and Analysis

The experimental results are shown in the table below. Different tools exhibited varying performances in the transformation of the three ICH projects. Overall, due to its support for model fine-tuning, Stable Diffusion 3 achieved the best performance in cultural fidelity; MidJourney V6 had obvious advantages in visual aesthetics; Wenxin Yige V4 showed certain strengths in adapting to traditional Chinese cultural elements but was insufficient in detail performance, As shown in Table 1.

Table 1. Performance Comparison of Generative AI Tools in Ouyue ICH Visual Transformation

ICH Project	Evaluation Indicator	MidJourney V6	Stable Diffusion 3	Wenxin Yige V4	Average Score
Ouyue Embroidery	Cultural Fidelity	8.2	8.8	8.0	8.3
	Visual Aesthetics	9.0	8.5	8.2	8.6
	Practicality	8.5	8.6	8.1	8.4
Boxwood Carving	Cultural Fidelity	7.8	9.0	7.5	8.1
	Visual Aesthetics	8.6	8.4	7.9	8.3
	Practicality	8.2	8.8	7.7	8.2
Fine-line Paper Cutting	Cultural Fidelity	8.0	8.9	8.1	8.3
	Visual Aesthetics	8.8	8.6	8.3	8.6
	Practicality	8.4	8.7	8.0	8.4

From the perspective of specific projects, boxwood carving presented the highest transformation difficulty. This is because the texture and layering of "hollowed-out carving" are difficult to accurately reproduce through AI—even Stable Diffusion 3, which performed the best, only scored 9.0 points in cultural fidelity. For fine-line paper cutting, due to its distinct line characteristics, the three tools showed relatively balanced performance. As for Ouyue embroidery, the close integration of colors and stitches highlighted the advantage of MidJourney V6 in visual aesthetics.

The experiment indicates that generative AI is feasible for the visual transformation of Ouyue ICH. However, it is necessary to select appropriate tools based on the characteristics of different ICH projects and improve cultural fidelity through model fine-tuning.

4. Generative AI-Driven Communication Optimization Strategies for Ouyue ICH

Based on the aforementioned framework, experimental results, and the current communication status of Ouyue ICH, this study proposes communication optimization strategies from four dimensions—technology, content, audience, and scenario—forming a communication system of "technical adaptation - cultural fidelity - audience precision - scenario integration."

4.1 Technical Adaptation: Constructing a Custom Tool and Talent System

1) Develop Custom AI Tool Plugins for Ouyue ICH

Collaborate with technology enterprises and ICH protection institutions to develop an "Ouyue ICH Visualization Plugin" based on open-source models such as Stable Diffusion. The plugin will embed custom model parameters and symbol databases for Ouyue embroidery stitches, boxwood carving techniques, fine-line paper cutting lines, and other elements. Users can quickly generate qualified content by inputting simple instructions (e.g., "Ouyue embroidery peony pattern"), lowering the technical threshold for ICH practitioners. Additionally, the plugin should include an "inheritor review" module to ensure the cultural accuracy of generated content.

2) Cultivate Interdisciplinary Talents with "Technology + Culture" Competence

Promote cooperation between universities and ICH institutions to offer courses related to "ICH digitalization," cultivating interdisciplinary talents proficient in both AI technology application and Ouyue cultural cognition. On one hand, invite ICH inheritors to teach courses to enhance students' cultural literacy; on the other hand, cooperate with technology enterprises to carry out practical teaching, improving students' abilities in AI tool usage and model optimization. Meanwhile, provide AI technology training for inheritors, enabling them to participate in the entire process of visual transformation.

4.2 Cultural Fidelity: Establishing Content Generation and Review Mechanisms

1) Build an Ouyue ICH Cultural Gene Database

Systematically sort out Ouyue ICH resources and construct a "cultural gene database" covering craftsmanship processes, visual symbols, and cultural connotations, providing precise data support for AI generation. The database should classify and input information: for traditional craftsmanship, record stitches, techniques, and tools; for traditional fine arts, include patterns, colors, and compositions; for folk customs, document scenes, costumes, and rituals. Core cultural characteristics should be labeled, such as "Ouyue gold thread coiling embroidery: outlined with gold threads, strong three-dimensional effect, mostly used in festive scenes."

2) Implement a "Three-Level Review" Mechanism

To avoid cultural distortion, establish a three-level review mechanism: "AI preliminary screening - designer optimization - inheritor final review." AI preliminary screening eliminates content obviously inconsistent with ICH characteristics through preset parameters; designers optimize visual effects based on communication scenarios to ensure the accurate presentation of cultural elements; inheritors conduct final reviews from technical and cultural perspectives and put forward revision suggestions.

Review criteria should be quantified—for example, the restoration degree of Ouyue gold thread coiling embroidery stitches must reach over 90%—to guarantee the cultural quality of generated content.

4.3 Audience Precision: Hierarchical Communication and Interactive Design

1) Design Hierarchical Communication Content Based on Audience Segmentation

Segment audiences by age, occupation, and cultural background to develop differentiated content: For teenagers, create interesting content such as animation clips and interactive games (e.g., "fine-line paper cutting puzzle game"); for young practitioners, provide practical content including cultural and creative design materials and technique tutorials (e.g., Ouyue embroidery pattern design templates); for cultural scholars, produce in-depth content such as high-definition craftsmanship documentaries and cultural connotation interpretation diagrams; for overseas audiences, generate short videos of ICH stories with multilingual subtitles, optimizing visual styles in line with international aesthetics to lower cultural cognition barriers.

2) Strengthen Interactive Communication to Enhance Participation

Leverage the interactivity of generative AI to design communication activities: First, online interaction-launch "AI-Generated Ouyue ICH Pattern" challenges on social media, where users can upload photos to generate avatars integrated with ICH elements; second, offline interaction-install AI interactive devices in museums, allowing visitors to control AI-generated boxwood carving design drawings through gestures and print them as souvenirs; third, co-creation activities-invite audiences to participate in visual content creation, such as collecting public creative needs for Ouyue embroidery patterns, generating designs via AI, and optimizing them for implementation by inheritors, thereby enhancing audiences' sense of belonging and identity.

4.4 Scenario Integration: Building a Multi-Dimensional Communication Matrix

1) Connect "Online + Offline" Communication Scenarios

Construct an online matrix of "social media + e-commerce + digital museum": Publish ICH short videos on Douyin and Xiaohongshu, paired with AI-generated exquisite posters to attract traffic; open Ouyue ICH cultural and creative stores on Taobao and JD.com, using AI-generated product images and promotional videos to improve conversion rates; build a digital museum of Ouyue ICH, enabling immersive experiences through AI-generated 3D models and VR materials. Integrate offline scenarios of "exhibitions + cultural and creative products + cultural tourism": Hold special exhibitions themed "AI and Ouyue ICH" in museums, displaying AI-generated visual works alongside traditional ICH artifacts; develop AI-customized cultural and creative services to generate exclusive ICH products for tourists; integrate AI-generated Ouyue ICH visual elements into cultural tourism scenarios, such as setting up ICH-themed light shows in Wenzhou's ancient streets using AI-generated Ouyue embroidery and paper cutting patterns.

2) Link "Government + Enterprise + Society" Communication Entities

Build a multi-stakeholder collaborative communication system: At the government level, introduce supportive policies to fund ICH digitalization projects and AI tool development; at the enterprise level, leverage technological and market advantages—for example, technology enterprises provide AI technical support, while cultural and creative enterprises transform AI-generated content into products; at the social level, encourage public participation, such as inviting the public to contribute ideas to ICH communication through public welfare activities, forming a communication pattern of "government guidance, enterprise leadership, and public participation."

5. Conclusion

Taking Ouyue intangible cultural heritage (ICH) as the research object, this study explores the application path of generative AI in its visual transformation and communication, drawing the following conclusions: First, generative AI provides efficient and diversified technical support for

the visual transformation of Ouyue ICH. Through the full-process framework of "resource deconstruction - model training - visual generation - communication feedback," the transformation of ICH from traditional forms to modern visual forms can be realized; Second, different generative AI tools exhibit varying performances in the transformation of Ouyue ICH: Stable Diffusion 3 has prominent advantages in cultural fidelity, while MidJourney V6 performs better in visual aesthetics. It is necessary to select appropriate tools based on the characteristics of specific ICH projects; Third, the communication strategy of "technical adaptation - cultural fidelity - audience precision - scenario integration" can effectively improve the communication effect of Ouyue ICH and address the issues of digitalization gaps and audience disconnect in its inheritance.

The study also identifies limitations of generative AI in the transformation of Ouyue ICH: the texture restoration of complex craftsmanship (such as the hollowed-out carving of boxwood carving) needs to be improved, and the in-depth transformation of cultural connotations still requires human intervention. Therefore, the application of technology must always take cultural inheritance as the core and avoid the tendency of "technology supremacy."

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