

Innovative Design Research on Zigong Lanterns based on Generative AI

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Abstract: With the rapid development of artificial intelligence, particularly AI-Generated Content (AIGC) technologies, the digital innovation of intangible cultural heritage has entered a new stage of opportunity. Zigong lantern art, as a representative form of traditional Chinese lantern craftsmanship, now faces an urgent need for transformation in terms of design methods, dissemination channels, and modes of artistic expression. This study takes AIGC as a starting point to explore its application pathways and innovative potential in the design of Zigong lanterns. The paper first reviews the traditional craftsmanship and cultural characteristics of Zigong lanterns, and, in conjunction with current developments in AIGC and image generation mechanisms, proposes a collaborative design model of "AI generation - human selection - craft transformation." In the design practice, the theme "Camel Shadows Along the Silk Road" is used to generate visual design concepts via Midjourney and Stable Diffusion, and the transition from AI-generated images to physical lantern installations is tested. Findings indicate that AIGC can effectively enhance design efficiency and the quality of creative output, offering significant advantages in visual ideation, form expression, and thematic exploration. However, challenges such as cultural misrepresentation and distorted image details persist. The paper concludes by offering strategic recommendations for the application of AIGC in lantern art, aiming to provide a reference for the integrated development of traditional crafts and intelligent design.

Keywords: AI Generated Content, Zigong Lantern Art, Digital Innovation.

1. Introduction

Zigong lantern art, known for its grand scale, exquisite craftsmanship, and rich symbolic meanings, has long been recognized as a representative of Chinese traditional festive culture. With its inclusion in national intangible cultural heritage lists and its widespread popularity both domestically and internationally, Zigong lanterns not only carry profound cultural value but also serve as vital mediums for cultural tourism and night-time economic development. However, as consumer preferences diversify and digital culture continues to evolve, traditional lantern design faces challenges such as prolonged production cycles, high material costs, and aesthetic homogenization. In this context, integrating AIGC technologies into the creative process of Zigong lantern design offers new opportunities. Generative AI can assist designers in rapidly producing concept sketches, generating novel visual compositions, and simulating lighting effects, thereby significantly improving design efficiency and fostering creative diversity. More importantly, this approach enables a deeper fusion of traditional visual language with contemporary aesthetic trends, creating a broader space for cultural innovation.

This study takes the theme of "Welcoming Fortune in the Year of the Snake" as a design practice focus and explores how generative AI tools can be applied to various stages of lantern design—from concept generation to visual rendering—while preserving cultural authenticity and symbolic meaning. The research aims to demonstrate the feasibility and advantages of AIGC-assisted traditional lantern design and contribute to the broader discourse on digital revitalization of intangible cultural heritage.

2. Current Research Status of Zigong Lantern Design

2.1. Overview of Generative AI

Against the backdrop of a new wave of technological revolution and industrial transformation, artificial intelligence has profoundly reshaped the paradigm and trajectory of content creation. As a key branch of AI, generative artificial intelligence (AIGC) is transforming the landscape of artistic production by leveraging large-scale pre-trained models and Generative Adversarial Networks (GANs). Particularly in the realm of image generation, AIGC enables a wide range of creative possibilities including text-to-image synthesis, style transfer, image enhancement, and cross-domain image transformation. GAN models can generate high-resolution images, enhance visual quality, and enable cross-modal content creation. With the rise of Diffusion models and the Transformer architecture, generative AI has further expanded into multimodal creative generation, making content generation more accurate and expressive.

Today, the new generation of AIGC technologies is capable of producing a wide array of multimodal content, including text, synthesized speech, computer code, images, videos, and even robotic motion sequences. This cross-modal and cross-domain content generation ability marks a significant evolution in how information is created and disseminated. Modern AIGC systems can generate vivid images, natural and coherent voice dialogues, sophisticated and efficient programming code, and even automatically produce short videos and animated scripts based on textual prompts. AIGC is widely regarded as the third major wave of content creation, following Professional-Generated Content (PGC) and User-Generated Content (UGC). Compared to its predecessors,

AIGC exhibits distinct technical advantages in areas such as creative ideation, expressive diversity, rapid iteration, broad dissemination, and personalized customization. It significantly enhances production efficiency, reduces costs, and enables highly personalized content tailored to individual user preferences, thereby driving profound transformations across industries such as culture, arts, media, education, and entertainment.



Figure 1. Colored Lantern Design Drawing

Table 1. Three Scheme comparing

AIGC Painting Model	Release Time and Significance
Generative Adversarial Network (GAN)	2014 - Truly "taught" AI to paint by itself
Diffusion Model	2020 - Greatly improved the quality of AI-generated paintings
Stable Diffusion	2022 - Accelerated the commercialization of AI painting

2.2. The Historical Origins and Characteristics

Zigong lanterns, also known as the Zigong Lantern Festival, represent a distinguished form of traditional Chinese lantern art. With a history tracing back to the Tang and Song dynasties, flourishing during the Ming and Qing periods, and continuously evolving into the modern era, Zigong lantern art has spanned over a millennium. As a hallmark of the "Southern Lantern City," Zigong lanterns are renowned for their intricate craftsmanship, vibrant colors, and exquisite artistry. They constitute a significant part of China's lantern culture. During traditional festivals such as the Spring Festival and the Lantern Festival, local households in Zigong illuminate their surroundings with decorative lanterns, creating a festive atmosphere. Over time, the Zigong Lantern Festival has developed into a nationally and internationally recognized cultural event.

However, it must be emphasized that despite the improvements in efficiency and creative diversity brought by computer graphics and AIGC, the intricate and subtle aspects of artistic expression-particularly emotional resonance, material texture, and cultural nuance-still heavily rely on the designer's hand-drawing skills and profound artistic sensitivity. High-level artistic lantern creation typically emerges from the organic collaboration of traditional craftsmanship, digital technology, and AI assistance. Moving forward, artistic lantern design should continue to deepen the integration of technology and art, building upon accumulated practical experiences to explore new pathways for the revitalization of traditional lantern art in the digital era.

From a transnational perspective, scholars such as Morris emphasize the global adaptability of Zigong lantern art. Its success lies not only in its refined craftsmanship but also in its high degree of modularization and export readiness. According to Morris, Zigong's lanterns embody a form of "cultural re-commodification" in which intangible heritage is transformed into tangible, transportable visual experiences that cater to global festival economies.

In sum, the historical development of Zigong lantern art exemplifies a dynamic interaction between culture, society, and industry. With the integration of new media technologies and expanding cultural diplomacy efforts, Zigong lanterns are increasingly becoming a key symbol of China's traditional arts in global cultural discourse.

2.3. Principles of AIGC Technology

Generative AI primarily includes architectures such as Variational Autoencoders (VAE), Generative Adversarial Networks (GAN), and Diffusion Models, which are capable of producing visual content based on input prompts. In the field of art and design, AIGC technologies not only possess powerful image generation capabilities but also support multi-style transfer, complex semantic understanding, and dynamic scene reasoning. These capabilities have been widely applied across creative industries such as concept art, visual design, and game modeling.

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In recent years, AIGC painting models (AI-Generated Content in Painting) have experienced rapid development. From the early Generative Adversarial Networks (GANs) to Diffusion Models and then to representative technologies such as Stable Diffusion, the creative capabilities of AI in the field of painting have been continuously enhanced. Initially, the emergence of GANs truly empowered AI with the ability to autonomously generate images, opening a new chapter for AI-driven artistic creation. Subsequently, diffusion models significantly improved the quality and detail of AI-generated artworks by refining the image generation process, bringing AI paintings closer to the level of human artistic creation. In 2022, the release of open-source models like Stable Diffusion further accelerated the commercialization of AI painting, greatly lowering the threshold for ordinary users to create art with AI. At present, AIGC painting models are widely applied in fields such as art design, illustration, advertising visuals, as well as in the digitalization of cultural heritage, education and training, gaming, and film industries. As technology continues to advance, AIGC-based painting is poised to become a vital part of future digital art, driving profound transformations in both the forms and content of artistic creation.

2.4. Characteristics and Challenges of Zigong Lantern Art Design

In recent years, the traditional craft of Zigong lantern art has actively embraced AIGC (Artificial Intelligence Generated Content) technology, promoting a deep integration between lantern design and light art. This fusion has opened

an innovative pathway that combines "technology and intangible cultural heritage," not only enhancing the visual expressiveness and interactivity of lanterns but also injecting new vitality into the contemporary dissemination of traditional culture. At the 2024 Zigong International Dinosaur Lantern Festival, the "New Year Beast" lantern installation—developed using large-scale AI models—offered visitors a highly engaging interactive experience. Another featured installation, "Smart Dinosaur," integrated humanoid robotics, precision motion control, complex structural design, and high-accuracy sound source localization technology to vividly recreate scenes such as dinosaur predation, offering an unprecedented technological and interactive experience for attendees. Furthermore, the city of Zigong established a Lantern Metaverse Research Center, focusing on the development of digital lantern scenarios and ultra-high-definition video applications such as "cloud-based lantern viewing."

At the "East Rising: Beautiful China" Chinese Lantern Festival held in Tennessee, USA, AI-powered digital lighting technologies were employed to create 35 themed installations, including "Chinese Dragon" and "Bashu Charm: Sanxingdui Mystery," achieving a seamless blend of virtual and physical elements. In addition, Zigong's lantern design teams have embraced concept art methodologies and AI design tools, attracting a new generation of concept artists, particularly those born in the 1990s and 2000s. This influx of young talent has introduced fresh perspectives and creative ideas. At the 30th Zigong International Dinosaur Lantern Festival, several highly creative "viral" installations—such as Blossoms All the Way—garnered widespread acclaim for their striking forms and innovative aesthetics. Through the application of AIGC technology, Zigong lantern art has undergone a transformation from traditional craftsmanship to digitalization and intelligent design. This shift has enriched the immersive experience for audiences and expanded both the expressive forms and communication channels of lantern art. The integration of AIGC has not only elevated the artistic value of traditional lanterns but also provided new strategies and methodologies for the modern dissemination of traditional culture.

Zigong lantern art is characterized by its thematic, scenographic, and narrative features. The production process includes multiple artisanal stages such as hand-drawn design, wireframe welding, surface wrapping, and lighting configuration, all of which contribute to its strong artistic expressiveness and spatial integration. However, traditional design approaches often face challenges such as long design cycles, low efficiency in creative transformation, and outdated visual language, making it difficult to meet the growing demands for personalized and diverse experiences in

contemporary cultural consumption. Furthermore, in the context of international exhibitions and overseas dissemination, the cultural communicative power of traditional graphic symbols encounters limitations due to language and contextual differences.

3. Conclusion

This study systematically explores the innovative application of generative artificial intelligence (AIGC) technology in the design of Zigong lanterns. By reviewing the developmental trajectory and core principles of AIGC, and integrating the artistic characteristics, cultural connotations, and production processes of Zigong lantern art, the research proposes a design pathway based on AIGC. The proposed method is verified through a practical design project themed "Welcoming Fortune in the Year of the Snake." The findings demonstrate that AIGC exhibits strong creative empowerment capabilities in image generation, style transfer, and element reconstruction, effectively overcoming creativity bottlenecks and inefficiencies in traditional hand-drawn design processes, while injecting new expressive languages and technological approaches into traditional lantern art.

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