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A Generative AI Framework for Enhancing Human-AI Collaborative Creation in Artistic Design Services

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ABSTRACT

Amid information saturation and aesthetic pluralism, artistic design services grapple with inefficient manual workflows and imbalanced creative diversity-semantic fidelity. To address these and advance information system integration in design, this study proposes a two-stage multi-task generative AI framework for artistic design, integrating latent space remapping, hierarchical cross-modal attention distillation, and dynamic resource scheduling. Evaluated on a 30,000-sample dataset, the framework outperforms baselines: 45% lower FID than GAN-based models, 15% higher CLIP-Score for text-image alignment, over 4.3/5 professional designer satisfaction, and 1.2 iterations/second inference on a single 3080Ti GPU. It resolves existing generative AI flaws and advances human-AI collaboration in design services, laying technical groundwork for workflow innovation, design education support, and brand development.

KEYWORDS

Artificial Intelligence, Artistic Design Services, Human-AI Collaboration, Creative Generation Methods

INTRODUCTION

Against the background of information overload and aesthetic diversification, professional designers are facing unprecedented challenges: they need to ensure that their works not only fit the brand image but also accurately stimulate the emotional resonance of the target audience; they also must complete the creative design with high quality and strong visual impact within urgent deadlines (Hou et al., 2025). This increasing complexity has brought great pressure to the traditional design process, which has long relied on human intuition, manual iteration, and expert judgment (Patel et al., 2024). Therefore, it is urgent to build an intelligent system that can effectively expand the creative process and improve efficiency without damaging the artistic authenticity or conceptual clarity.

Just to meet this demand, artificial intelligence (AI), especially generative adversarial networks (GANs; Goodfellow et al., 2020) and the emerging diffusion model architecture in recent years, has demonstrated outstanding capabilities in high-fidelity image synthesis, visual style transfer, and semantic transformation from text to image (Huang et al., 2025). These breakthroughs have promoted the transformation of a creative paradigm: it has changed from a completely human-centered creative model to a new paradigm of human-computer collaboration, in which AI is both a co-creation partner and an empowerment tool. However, despite the continuous progress of technology, the actual

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deployment of existing generation models in professional art design is still subject to some fundamental restrictions. A key problem is that it is difficult to maintain a stable balance between creative diversity and semantic fidelity: many current methods are prone to unexpected style degradation or theme deviation (Wu et al., 2024). In addition, most models lack the ability to accurately control subtle and context-sensitive design interventions (Castañeda et al., 2024; Ray, 2025), and there is a widespread problem of "black box"—its decision-making logic is opaque, which makes it difficult for designers to understand the basis behind AI suggestions, thus weakening trust (Shin, 2023) and hindering deep collaboration.

In order to cope with this core trade-off and related limitations, this study focuses on two key issues: first, how to build a generation architecture so that it can not only support broad creative expression, but also achieve accurate semantic control; and second, how to improve the interpretability of the system without sacrificing computational efficiency or output quality.

Focusing on the above problems, we propose a two-stage, multi-task generation framework customized for design scenarios. The core goal of this framework is meant to coordinate the inherent tension between creative diversity and semantic fidelity. All technical modules are carefully designed around this goal, and all components work together to avoid sacrificing one dimension to improve another. In addition, we also verified the feasibility of the framework through several practical application scenarios, such as integration into a collaborative design platform and application in art education.

By addressing the core challenge of balancing creative diversity and semantic fidelity, this study offers theoretical support for the evolution of the human-artificial intelligence collaborative creation ecosystem. It redefines the role of generative artificial intelligence: from a passive tool that merely executes preset commands to an active collaborator that participates in the creative process. By alleviating designers' most pressing constraints, this framework truly empowers designers to focus on creative practice and unleash their creative potential.

LITERATURE REVIEW

The field of generative AI applied to artistic design has seen a series of significant advancements that have enriched both theoretical foundations and practical applications. Bermano et al. (2022) introduced the StyleGAN model, which enables high-resolution interpolation in the latent space and effectively addresses the challenge of capturing intricate visual textures—features that traditional convolutional architectures often fail to represent accurately. Building upon this progress, Dziuba (2024) proposed AttnGAN, a novel architecture incorporating bidirectional attention mechanisms between textual descriptions and visual features, thereby achieving more precise semantic alignment in text-to-image generation. In parallel, Zheng (2025) proposed ArtStroke-GAN, a novel generative adversarial network framework. It effectively overcomes the limitations of existing computational painting methods in terms of spatial consistency, stylistic coherence, and fine-grained stroke control by employing a modular architecture and semantic-aware stroke optimization strategies, significantly enhancing the quality and diversity of watercolor painting generation. Additionally, Jawad and Al-Bakry (2024) proposed a semantic reweighting variational autoencoder, enabling dynamic trade-off control between theme consistency and detail innovation in generated outputs. Most recently, Dang et al. (2025) designed a conditional diffusion network grounded in principles of color psychology, allowing for emotion-driven color mapping and enhancing the affective expressiveness of AI-generated artwork. Together, these works reflect a growing trend toward more semantically aware, controllable, and emotionally resonant generative models tailored for creative design tasks.

From the perspective of efficiency and interpretability. Rombach et al.'s (2022) latent-diffusion reduced inference cost by compressing the latent space. Tu et al. (2021) further improved text control accuracy by introducing cross-layer semantic constraints in the Imagen model. Nguyen et al. (2024) integrated CLIP supervision into the diffusion process to enable multimodal style binding, and Li et al.