Research on Literary and Art Development
2025, VOL. 6, NO. 5, 31-33
DOI: 10.47297/wsprolaadWSP2634-786507.20250605

Research on the Integration and Application of AIGC and Traditional Painting Techniques in Film and Animation

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ABSTRACT
As the foundation of animation art, traditional painting techniques ensure artistic quality and emotional depth in works. However, their lengthy production cycles and high labor costs have also somewhat constrained industry development. AIGC technology demonstrates immense potential in processing massive datasets, generating initial concepts, and optimizing production efficiency. This paper, therefore, explores the practical integration of AIGC with traditional painting across core animation production stages—pre-production concept design, mid-production animation generation, and post-production lighting/shadow processing—while proposing corresponding optimization pathways. The aim is to provide a valuable reference for film and television animation creation practices.

KEYWORDS
AIGC; Traditional painting techniques; Film and television animation; Concept design; Animation generation

1 Introduction

In film and television animation production, applying traditional painting techniques endows animated works with unique artistic beauty and enables more vivid emotional expression. As market demands for content volume and update speed continue to surge, the reliance on traditional, handcrafted production models has exposed challenges such as time constraints, limited budgets, and insufficient innovation, making it difficult to keep pace with market development. However, opportunity coexists with challenge. Artificial intelligence-generated content technology has made significant progress in recent years, capable of learning from vast amounts of image and video data to generate new content that aligns with human aesthetics. For film and animation professionals, leveraging AIGC technology automates repetitive tasks while sparking creative inspiration. It enables exploration of previously unattainable visual styles, pushing the creative boundaries of the entire industry. This article explores pathways for integrating traditional painting techniques with AIGC technology, aiming to provide insights for production teams. The goal is to enhance production efficiency while preserving artistic quality, thereby fostering the sustainable and healthy development of the entire industry.

2 Overview of AIGC Technology and Its Comparison with Traditional Painting

2.1 Overview of AIGC Technology

Generative AI (AIGC) refers to technological methods based on AI techniques such as generative adversarial networks (GANs) and large pre-trained models. Learning and recognizing existing data generate relevant content with appropriate generalization capabilities. A generative adversarial network consists of a generator and a discriminator. Through iterative adversarial training, the generator progressively produces increasingly realistic results. These technologies train on existing real-world data, analyzing and identifying underlying patterns and distributions to ultimately gain the ability to generate new content [1]. AIGC can replace humans in performing repetitive, mechanical tasks like drafting news reports or product descriptions. It can also create poetry, generate illustrations, or compose musical melodies based on input keywords. The content produced by this technology exhibits remarkable consistency in style and quality. However, at its core, this content merely reorganizes and mimics existing data. AIGC lacks human-level comprehension, emotion, or intent.

2.2 Comparison Between Traditional Painting and AI Painting

Comparing the creative processes: Traditional painting relies on the artist's thought and artistic ability. They first conceive inspiration and define the intended theme, then sketch, select canvas, pigments, and brushes. Through color mixing, layered brushstrokes, and dimensional rendering, they gradually realize their vision—a time-consuming process. The artist's experiences, emotional state, and aesthetic sensibilities directly shape the final work. AI painting offers a faster alternative. Users need only input a textual description or provide a reference image to the AIGC system, and the model rapidly generates one or more digital photos meeting the requirements. Users can repeatedly refine and optimize prompts, achieving satisfying results without painting skills [2]. From a generative perspective, traditional paintings originate from the artist's internal thoughts, emotions, aesthetics, and imagination—an inward-to-outward expression representing an active, conscious creative act.

In contrast, AIGC painting's generation mechanism relies entirely on data and algorithms. When users issue commands, AIGC immediately performs complex mathematical calculations to identify the pixel arrangement most closely matching the textual description from learned probability distributions, thereby synthesizing a new image. It lacks self-awareness and emotional experience; its output merely fuses, mimics, and rearranges existing human artistic styles.

3 Practical Application of AIGC and Traditional Painting Integration in Film and Animation

3.1 Pre-Production: AI-Assisted Concept Design Combined with Traditional Painting

Character design serves as the foundational step in film and animation production. Animators must model characters' limbs according to their requirements, ensuring each part aligns with the character's traits and appearance. Designers can leverage AIGC technology to complete this task efficiently. AI systems instantly generate matching proposals by inputting textual descriptions of a character's appearance, attire, and demeanor. Designers select suitable images for further refinement, producing a concept art piece. For intricate details like facial features, hands, and costumes, character designers should execute standardized 3D painting to establish a solid foundation for subsequent 3D modeling. Subsequently, environment artists integrate, refine, and reinterpret the AI-generated imagery using traditional painting techniques. For scenes requiring strict modeling compliance, each part's modeling specifications must be annotated based on precise material requirements and anatomical diagrams to facilitate subsequent modeling adherence. During the early concept design phase, AIGC technology inspires animators and accelerates the trial-and-error process. Traditional painting, meanwhile, serves to refine and artistically elevate the work. These two approaches complement each other, collectively enhancing concept design's quality and efficiency.

3.2 Mid-Production: AI-Assisted Animation Generation and Traditional Drawing Optimization

During the mid-production phase of film and television animation—involving 3D modeling, rigging, and animation—animators can use AIGC tools to generate foundational motion sequences. They obtain preliminary animation drafts by inputting action types and fundamental parameters, freeing them to focus more creative energy on expressive movements and emotional delivery. However, AI-generated motions often appear formulaic and stiff. This is where experienced animators step in for refinement. They meticulously adjust keyframes frame by frame within animation software, optimizing a character's weight, balance, and fluidity to achieve natural, artistically compelling final animations. AI can automatically analyze voiceover audio for facial expressions and lip-sync animation to generate corresponding lip movements and basic expression animations [3]. Similarly, mechanically generated mouth movements and expressions tend to be stiff and lack emotional precision. Animators must then refine details like the curve of the mouth, the rise and fall of eyebrows, and the focus of the eyes based on their understanding of the character's personality and the narrative context. This ensures the character's expressions match the dialogue and authentically reflect their inner world. This demands exceptionally high standards from animators, requiring profound artistic sensibility and deep familiarity with human movement.

3.3 Post-Production: AI-Assisted Lighting Processing and Traditional Painting Enhancement

Lighting and rendering in film animation decisively shape the overall visual experience. Animators can leverage AI to analyze scene geometry, material properties, and the desired atmospheric mood, thereby assisting in lighting setup and shadow rendering. This includes simulating natural light effects at different times of day and complex lighting environments created by various lighting rig combinations. Subsequently, based on the film's requirements, adjustments are made to the brightness levels of key areas within the frame, and the realism of shadows is controlled. The visual center is brightened, while areas outside the focal point are darkened, effectively guiding the audience's visual focus. Ultimately, the lighting effects appear authentic and accurately convey character personalities and narrative intent, engaging viewers and evoking emotional resonance. Beyond this, AIGC enables rapid camera matching to adapt to different filming equipment's color profiles, maintaining visual consistency across the film. This allows animators to refine images using traditional coloring techniques (masking, brightness adjustments) and add details, enhancing artistic expression while preserving realism. Such manual refinements, grounded in traditional artistic heritage, infuse film and animation with a distinct handcrafted quality and creative flair. Consequently, the visual effects in these works achieve a grand yet authentic scale, delivering intricate and emotionally resonant imagery.

4 Value Presentation and Optimization Directions for Integrating AIGC with Traditional Painting Techniques in Film and Animation

4.1 Core Value

In film and animation production, the interactive application of AIGC technology significantly enhances workflow efficiency, primarily manifested at the process level. First, during character design, AI rapidly generates extensive creative variations and automatically completes foundational textures and detail enhancements. Second, in the animation phase,

AI can produce preliminary motion libraries and perform color/lighting predictions, freeing up more time to advance projects and refine work while reducing costs. Ultimately, this enables the creation of higher-quality output within the same timeframe [4]. Additionally, this technology expands the scope of film and animation creation and artistic expression. Animators can leverage AI tools to explore previously untried styles and spark new creative inspiration through unconventional color palettes. This expansion of creative boundaries lowers the barrier to entry for animation production, enabling individuals with strong concepts but limited technical skills to utilize AIGC technology to realize their visions. This enriches the industry's artistic imagination and delivers more engaging works to audiences.

4.2 Optimization Pathways

4.2.1 Establishing Integrated Copyright Protection Mechanisms

In film and animation production, robust copyright protection mechanisms for applications combining AIGC with traditional painting techniques are essential to maximize their potential. At the project's outset, all participants must sign detailed agreements defining the scope and ownership of copyright between AI-generated works and human-created works. For artists who make substantial modifications to AI-generated content, clear terms for copyright sharing or exclusive rights should be established. This safeguards artists' rights to original content while clarifying the contributions of AI technology providers, enabling fairer revenue distribution between both parties. Upon completion, each work should be assigned a unique digital ID containing copyright holder information, creation timestamps, and revision records. Blockchain technology should be employed to render this copyright information immutable, enabling copyright owners to trace original rights swiftly even after edits or redistribution. The industry must establish a unified copyright database and query system, empowering creators to verify material usage rights and prevent inadvertent infringement, thereby maximizing protection of original authors' legitimate interests.

4.2.2 Strengthening the "Technology Serves Art" Positioning

Technical developers should maintain close communication with artists. Developed AI tools must allow artists to adjust parameters and control outputs according to their creative intent. Tool interfaces should align with artists' usage habits, enabling intuitive operation and understanding of AI functionality. Building on this foundation, this positioning must also be reinforced in team organization and talent development. Establish clear collaboration workflows between artistic direction and technical execution. Art directors and creators should define visual styles and creative direction, while technical teams identify and develop solutions to realize these artistic requirements.

Furthermore, the industry can organize cross-disciplinary exchange activities to foster mutual understanding and communication between technical personnel and artists. This will continuously reinforce the shared consensus among all participants in film and animation production: artistic value and creative thinking are the core pursuits. This approach will maximize the role of AIGC technology in empowering artistic impact [5].

5 Conclusion

In summary, the integrated application of AIGC technology and traditional painting techniques throughout the film and animation production process helps leverage both strengths. During pre-production concept design, mid-production animation generation, and post-production lighting and shadow processing, AIGC technology can handle repetitive and foundational tasks, significantly boosting production efficiency while providing creators with abundant inspiration to expand creative boundaries. However, technological application must always serve artistic expression. The artistic aesthetics, human-centered thinking, and emotional expression inherent in traditional painting remain pivotal to a work's success. Future research should focus on enhancing the controllability and precision of AIGC algorithms, enabling them to interpret and execute artists' creative intentions more accurately.

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