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Post-Human Perspectives on Film: Exploring Innovative Applications of AIGC

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ABSTRACT

The advent of AIGC(Artificial Intelligence Generated Content) represents a silicon-driven revolution for the carbon-based era of cinema. Human approaches to filmmaking have evolved—from celluloid to digital, from handwritten scripts to computer-generated texts—and are now increasingly oriented toward the development and collaboration with AIGC. During the process of employing AIGC in film production, it has become deeply embedded in cinematic art, whether through the secondary creation of celluloid imagery, collaborative brainstorming with humans, or integration with VR to craft new and enhanced viewing experiences. This study demonstrates that AIGC can significantly enhance the efficiency and creativity of film production, offering innovative solutions for image restoration, facilitating seamless human–machine collaboration, and enabling immersive VR-based cinematic experiences. By systematically analyzing these applications, the research provides a framework for understanding the transformative impact of AIGC on contemporary cinema and highlights its potential to redefine aesthetic and production standards in the film industry.

1. Introduction

In 2014, American directors Michael Rabiger and Mich Hurbis-Cherrier stated in The Complete Directing Handbook: "Film is the greatest art form of our era. It entertains the public and serves as an exceptional medium for exploring ideas and self-expression." This highlights the unique appeal of cinema as both a cultural and artistic phenomenon[1,2].

Filmmaking has always represented a convergence of art and technology. Looking back at the evolution of cinema—from silent films to sound, from black-and-white to color, from 2D to 3D, and from live-action to animated scenes—the development of film art has been driven not only by technological advancements but also by the interplay of humanistic aesthetics, creative philosophies, and evolving artistic practices. As technology continues to advance, the methods of cinematic creation have become increasingly diverse, providing filmmakers with richer and more flexible tools to realize their creative visions[3,4]. Historically, 35mm film was the standard medium for production; later, digital post-production technologies revolutionized filmmaking, offering unprecedented efficiency and flexibility. Today, with the maturation of VR and AI technologies, the industry is entering an era of "virtual production," where the boundaries between physical and digital creation are increasingly blurred, and innovation in filmmaking tools occurs at an accelerating pace.

Artificial Intelligence Generated Content (AIGC) refers to content produced by AI, encompassing natural language processing (NLP), image synthesis, audio generation, and other modalities. In the context of filmmaking—a quintessentially creative cultural industry—AIGC is rapidly becoming a critical technology for innovation[5]. Beyond its demonstrated breakthroughs in image and video generation, editing, and enhancement, AIGC enables filmmakers to explore novel forms of scene composition, create virtual characters, generate complex 3D motion sequences, and integrate automated content creation with personalized artistic decisions. By optimizing production workflows, increasing adaptability, and enhancing imaginative potential, AIGC fosters a new synergy between technology and creative expression, pushing the film industry toward greater technical sophistication and artistic ambition[6,7].

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If cinema was formally recognized as an art form when Canudo called it the "Seventh Art" in 1911, and if the advent of montage and narrative techniques solidified its artistic identity, then the emergence of AIGC in the 21st century represents a profound reconstruction and revitalization of cinematic art. AIGC not only reshapes industry workflows but also opens new possibilities for artistic expression and audience engagement. In combination with virtual production techniques, it has become a central topic in contemporary film discourse[8,9]. This paper explores three key dimensions of AIGC in filmmaking: its role in restoring and reimagining film imagery, its capacity for autonomous creation and human–machine collaborative innovation, and its potential to generate novel viewing experiences. By examining these areas, the study seeks to illuminate the transformative impact of AIGC on cinematic creation and the evolving relationship between technology and artistry.

2.AIGC and image restoration

According to official statistics from the China Film Archive, which is responsible for the preservation and restoration of Chinese films and regularly compiles archival data on nationwide film production and preservation (see the official China Film Archive website https://www.cfa.org.cn/), between 1905 and 1949, 1,625 films were produced nationwide, yet only 252 of these films are currently preserved, with many suffering from mold, contamination, fading, physical damage, or frame loss. Film has a history spanning over a century; for example, the earliest production from the August First Film Studio was the 1952 military education film River Offensive. Revisiting classic films is akin to engaging in a dialogue with history. In the mottled light and shadow of aged films, they carry irreplaceable memories of their era[10]. Restoration not only revitalizes these images but also preserves cultural heritage. AIGC, leveraging intelligent algorithms, reconstructs details and optimizes image quality, breathing new life into historical footage. This process represents both a technological tribute to art and a continuation of cultural legacy, allowing classic works to resonate with contemporary audiences while enriching future storytelling.

2.1.Applications of AIGC in image restoration

Film preservation often encounters issues such as moiré patterns, scratches, mold, or base degradation. During digitization, the quality of scanning equipment, light source stability, and operator skill can all affect the resulting images. Early manual restoration methods focused primarily on enhancing visual perception and overall image quality. With the advancement of digital image processing, scanned images can now be restored on computers, avoiding direct intervention on physical artifacts. This approach preserves the original appearance while reducing labor costs. Traditional restoration techniques, such as removing unwanted objects, subtitles, or watermarks, have been widely applied.

The introduction of large-scale AI models and neural networks has brought new solutions to image restoration, significantly improving realism and quality. Common film damage includes granular noise, scratches, and missing frames. While conventional filtering techniques (e.g., spatial or frequency domain filters) are efficient, they often cause blurring or loss of edge details. Deep learning models—including Convolutional Neural Networks (CNNs), Generative Adversarial Networks (GANs), Transformers, and variants such as DnCNN, FFDNet, and CBDNet—enable restorers to identify different damage types and generate reconstructions that closely resemble the original content. Video restoration additionally employs spatiotemporal filtering, 3D convolutional networks, optical flow estimation, and motion compensation to maintain temporal consistency.

Image restoration aims to reconstruct missing or damaged portions of images and videos seamlessly. Current mainstream methods include variational-based, transform-domain, sample-based, decomposition-based, neighborhood template, and interpolation-based techniques. With AIGC, restoration quality and efficiency have significantly improved. Small or simple damaged regions can now be restored with remarkable fidelity, though challenges remain for larger or more complex areas. Advanced methods, including interactive image algorithms, global feature matching, semantic alignment, and creative image embedding, leverage retrieval techniques to extract similar or matching reference materials and textures, improving the quality of restorations.

2.2.AIGC in restoring classic films

In the color restoration of the classic black-and-white film The Eternal Wave, AIGC played a pivotal role. Using advanced deep learning algorithms, it rapidly and accurately identified and repaired frame-by-frame defects, such as spots, scratches, flicker, and jitter, greatly enhancing both efficiency and quality. In color restoration, AIGC automatically analyzes and optimizes color information, restoring realistic and natural hues and making the restored footage more vivid and visually appealing.

During the restoration of The Founding Ceremony, sound reconstruction involved multiple layers and panoramas to create a grand and immersive acoustic environment. In some scenes, environmental effects were dynamically processed, using mid-frequency audio for core elements and high/low frequencies for surround effects[11]. In dialogue scenes, such as between Mao Zedong and his son, sound was employed not just for auditory clarity but as a creative extension of the visual narrative. Similarly, in Soul of Painting, restorers adjusted sound effects—wind, rain, fire—to metaphorically reflect the tragic fates of three female characters, demonstrating how auditory restoration can enhance both realism and artistic expression.

2.3.AIGC and secondary creation

Secondary creation occurs when restorers reinterpret or enhance the original film during restoration. In this process, AIGC aids in inferring and reconstructing missing details or generating creative embellishments based on historical data and artistic judgment. For example, in The Eternal Wave, beyond easily obtained color references, many objects lacked

sufficient historical data for accurate color determination[12]. Using AIGC, restorers can combine historical research with informed imagination to produce higher-quality visual outcomes while remaining faithful to the original work.

Colorization, broadly defined, refers to computer-assisted techniques for adding color to black-and-white films. The process typically involves: (1) automated pre-coloring using trained datasets; (2) manual historical verification and correction; (3) frame-based algorithmic adjustments; and (4) final manual refinements for lighting and color consistency. The goal is to produce visual effects comparable to true color films, enhancing the viewing experience rather than artificially aging the image. AIGC enables restorers to align colorization with modern aesthetic sensibilities while approximating the original creators' intent. By accurately restoring the film world's colors and environments, audiences can experience a vivid temporal and spatial immersion, reflecting the significant progress of AI technologies in cinematic restoration.

3.AIGC in independent creation and human machine collaboration

With the rapid advancement of artificial intelligence, the field of digital content generation has undergone unprecedented transformation. Generative deep learning frameworks such as Transformers, GPT, and Diffusion models have demonstrated remarkable capabilities across text, images, audio, and audiovisual content. In audiovisual creation, applications combining different AI modules are increasingly integrated into filmmaking processes. Animation, short films, and AI-generated content (AIGC) are gradually becoming key drivers of both creative expression and the evolution of image production workflows. Depending on the degree of AIGC "agency" in production, its impact on filmmaking can be categorized into two primary forms: collaborative creation with humans and fully autonomous generation.

3.1.AIGC and virtual production

Over the past several decades, AIGC has evolved from performing repetitive mechanical tasks to participating in creative artistic endeavors across industries. In filmmaking, the rise of AIGC is reshaping production workflows and modes of expression. Traditionally, films relied on physical sets and green screens to convert 3D worlds into 2D imagery. With the steady advancement of virtual production technologies, the boundary between pre-production and post-production is increasingly blurred, offering creators unprecedented possibilities.

Within virtual production systems, filmmaking often suffers from challenges such as stylistic inconsistencies caused by divided labor, workflow redundancies, and coordination difficulties across parallel departments. By leveraging AIGC, these challenges can be alleviated. In AIGC-driven production environments, the filmmaking workflow has been reinterpreted as a dynamic "centralized–distributed" collaborative model. Digital visualization departments act as core hubs, integrating resources and coordinating the entire process, while "digital previsualization content" serves as a central thread linking all departments. Tasks are distributed with precision across execution stages, breaking the limitations of traditional linear production and establishing a distributed collaboration network centered on technology and guided by content. Production thus evolves into a multi-threaded workflow, with digital visualization as the anchor and AIGC-based previsualization guiding execution.

The COVID-19 pandemic in 2020 further highlighted the need for safety and efficiency in film production. The use of LED walls and virtual production techniques in The Mandalorian offered innovative solutions to the domestic film industry. These technologies not only improved production efficiency but also provided valuable experience and confidence for films such as Song of Long Sky, which integrated high-resolution, wide-gamut LED screens, precise camera tracking, advanced digital asset creation, and real-time virtual imaging engines to establish a revolutionary virtual production system.

AIGC applications further accelerate this transformation. In scriptwriting, character modeling, and scene construction, AIGC significantly enhances creative efficiency and artistic expression. For example, during the production of Beast, integrating Unreal Engine 5 with AIGC reduced character modeling time from three months to one month and rendering time from three days to two hours, demonstrating transformative gains in both productivity and creative capability. Virtual production also heightens actor immersion and performance fidelity. In Song of Long Sky, over 5,000-nit LED panels and curved screens created dynamic lighting environments that allowed actors to experience scene changes in real time, capturing subtle emotional shifts and amplifying narrative impact. The combination of AIGC and virtual production is ushering filmmaking into a new era of digital, integrated, and immersive creativity, unlocking boundless potential for artistic innovation.

3.2.AIGC and short film creation

For AIGC video generation models, creators only need to provide keywords or conceptual prompts to generate desired content efficiently, cost-effectively, and with personalized style. Early in the planning stage, AI is applied to script analysis, market forecasting, and audience feedback prediction. ScriptBook (2015) combines data analytics, machine learning (ML), natural language processing (NLP), and feature selection algorithms (FSA) to conduct deep analyses of submitted scripts, visually presenting character and emotion profiles, commercial potential, box office predictions, and audience ratings. By training on over 6,500 scripts and their market feedback, ScriptBook exemplifies the power of supervised machine learning in supporting creative decision-making[13].

Cinelytic (2016), Disney's 2019 StoryPrint, China's 2021 AgileShot production management system, and the Haima QF Intelligent Creation Platform are further examples of digital tools transforming content creation and distribution. These platforms can intelligently dissect scripts, categorize key

elements, and visually explore content, enabling precise evaluation and market forecasting. Their purpose is to assist, rather than replace, core creative teams, improving both production quality and audience alignment.

With the ongoing maturation of large language models (LLMs) such as Baidu's Wenxin Yiyan in 2023, AI-generated creativity is expected to play an increasingly integral role in film scriptwriting. Generative AI can produce diverse plot developments, enrich storylines, fill narrative gaps, and even generate detailed shot-by-shot storyboards. Its functionality has expanded from assisting decision-making to directly inspiring and producing creative content, empowering screenwriters with unprecedented innovation. Leveraging NLP and ML algorithms, AIGC can rapidly generate scripts aligned with market demand, shortening creation cycles and allowing writers more time to develop narrative depth and character complexity.

3.3.Human–AIGC collaboration

The rapid development of multimodal AIGC tools enables filmmakers to generate vivid animations and visual content using style transfer and multi-modal generation techniques. At the 2022 Cannes Short Film Festival, director Glenn Marshall combined his award-winning dance short Painted with OpenAI's CLIP neural network to explore novel forms of digital reinterpretation. By applying generative adversarial networks (GANs) or diffusion models, he algorithmically generated video frames, creatively transforming and reinterpreting original works while investigating the integration of digital art with traditional cinematic storytelling.

In 2023, Runway Research introduced Runway Gen-2, allowing users to generate compelling short video content from text or visual inputs. This innovation dramatically improved content creation efficiency and quality, signaling a new stage for multimodal AI in creative industries.

While AIGC excels at producing high-quality visual content, it still faces notable limitations in generating complex narratives or long-duration content. For instance, AI-generated scripts or storyboards often exhibit broken plot logic, inconsistent character behaviors, and abrupt scene transitions, which can undermine narrative coherence. Industry experts have noted that fully AI-generated films frequently require substantial human editing to ensure story continuity and maintain character integrity.

Nevertheless, technological advancements demonstrate that AIGC provides clear advantages in enhancing visual effects and accelerating production workflows. These limitations underscore the necessity of human–machine collaboration, where human creators guide narrative structure and character development while leveraging AI for visual generation and stylistic experimentation, enabling a complementary workflow that maximizes both creativity and efficiency.

4.AIGC and VR cinematic experiences

The year 2016 is often marked as the global starting point for virtual reality (VR) development. Significant advances were made in 360° holographic camera language, interactive storytelling, and the enhancement of virtual spatiotemporal dimensions. However, numerous technical limitations continued to constrain artistic imagination. The emergence of AIGC (Artificial Intelligence Generated Content) has brought new possibilities for overcoming these challenges in VR content creation. By 2019, AIGC had entered industrial production, and the release of ChatGPT (Chat Generative Pre-trained Transformer) in 2022 marked the global prominence of AI tools capable of empowering the "human + intelligence" paradigm in VR, particularly in interactive design and high-dimensional virtual world construction.

4.1.Integration of AIGC and VR

VR content empowers audiences to participate actively in narrative construction, forming non-linear "multi-channel" story structures, distinct from the predetermined linear narratives of traditional cinema. In mature VR narratives, viewers are immersed in the story, assuming character perspectives and influencing the narrative in real time. A notable example is the first American VR series, GONE, which follows a mother searching for her missing daughter. Hidden, time-sensitive zones were designed to interact with narrative cues, allowing viewers to influence story development by directing attention to these areas. While this approach introduces interactivity, it remains relatively mechanical, with limited intelligence and imaginative potential.

The integration of AIGC into VR expands these possibilities. Leveraging text learning, memory, and intelligent algorithms, AIGC can analyze story keywords, character profiles, and narrative threads to generate multiple plot permutations[14]. By retrieving highly relevant data from its databases, AIGC provides abundant story paths, vastly surpassing human capacity for storage, editing, and organization, thereby enriching multi-channel VR storytelling with creativity and depth. It is important to note, however, that AIGC cannot replace uniquely human artistic intuition, emotional sensitivity, and aesthetic judgment. Intelligent VR storytelling relies on AIGC for extensive reference material while requiring human creators to filter and shape these inputs. By establishing a "human + intelligence" VR script creation system, a more imaginative and richly constructed virtual story world can emerge.

4.2.AIGC and VR narrative construction

Compared to traditional films, VR content breaks the divide between "creative aesthetics" and "reception aesthetics" through situational interaction, achieving a seamless integration of creation and experience. Recent years have seen significant advances in VR human–computer interaction, yet most interactivity remains mechanical. AIGC, with its databases and intelligent algorithms, enables unprecedented "smart interaction" and improvisational story synthesis, continually expanding the original narrative landscape of VR through data-driven adaptive storytelling.

Current VR interactivity typically falls into two main types. The first involves exploratory viewing, such as "underwater tours" or "space missions," exemplified by works like Journey

to TRAPPIST-1, Moonwalk of the American Astronauts, or Cassini: Saturn Exploration. These experiences primarily offer rudimentary visual responses to the viewer's gaze. AIGC enhances these interactions by designing more diverse perspectives, distances, speeds, and trajectories, using pre-programmed algorithms and real-time graphics rendering. Furthermore, AIGC enables greater audience autonomy through motion capture, allowing users to navigate virtual environments using controllers, adjusting speed, direction, or spatial choice. VR landscapes can also be dynamically generated using AI, similar to the animated design of "Shanhe Sheji Tu" in Ne Zha, where participants' input is captured, matched to a database, and used to display adaptive virtual environments.

In narrative-driven VR experiences, audiences must observe character relationships, dramatic conflicts, and plot developments to make decisions that influence story progression. This creates a convergence of creative and reception aesthetics, exemplifying the autonomy, participation, and constructive potential of intelligent media. For instance, the Emmy-winning US VR production The Flower Room Girl presents a romantic story where users interact with miniature models to advance the plot. While providing a template for interactive storytelling, the narrative choices remain limited. By introducing GPT-3–level AIGC, multiple branching paths could be generated dynamically based on core plot elements. Users can control character actions, paths, and outcomes, producing a networked, non-linear structure rather than a simple branching tree. This dynamic storytelling allows repeated experiences to yield different story versions derived from the same thematic foundation.

4.3.AIGC and multi-dimensional VR spaces

Leveraging intelligent algorithms and high-performance computation, AIGC transforms traditional VR's divergent spatiotemporal structures into complex, networked frameworks. In conventional VR, participants make choices at predetermined "nodes," producing simple branch-like story paths similar to "Life AB dramas." AIGC, however, uses code orchestration, data computation, and automated recognition to generate intricately interwoven narrative networks. In the VR short The Dream Collector, users' choices influence not only the immediate path but also intersect with other characters' stories, creating a dynamic and integrated narrative web.

AIGC supports "spiral-loop" temporal structures, enabling non-linear narratives where subtle variations yield different outcomes, analogous to the VR adaptation of films like Run Lola Run. Motion capture, tracking, and improvisational AI functions allow users greater autonomy in repeated interactions. Databases track prior interactions to generate optimized scenarios, as seen in Alive to the Last, where users can re-enter time-altered sequences, making choices that affect subsequent outcomes and gradually uncovering the narrative truth.

Circular and nested spatial designs, inspired by the multi-layered dreamscapes of Inception, enable task-driven narrative progression. In the VR series Universe 67, participants explore layered virtual universes in first-person perspective, completing tasks that reveal clues or restore narrative coherence. AIGC dynamically constructs successive layers based on participant interactions, ensuring each experience is unique. This integration of intelligent algorithms and database functions delivers fully immersive, task-oriented VR storytelling, allowing users to collaboratively construct rich narrative worlds alongside the creators.

5.Conclusion

This paper has explored in depth how Artificial Intelligence Generated Content (AIGC) is redefining the boundaries of cinematic art, spanning from the restoration of classic film reels to virtual production and the immersive experiences enabled by virtual reality. AIGC is ushering the film industry into a fundamentally new era. As Rudolf Arnheim observed in Art and Visual Perception, "A visual image is never a mechanical reproduction of sensory material; it is a creative apprehension of reality, a richly imaginative, inventive, and perceptive representation." Indeed, it is the human mind that endows artistic and intellectual endeavors with their nobility.

Looking ahead, AIGC offers boundless potential in future filmmaking. When humans and AIGC achieve seamless collaboration, the possibilities for creative exploration, narrative innovation, and technological integration will expand exponentially. From a future vantage point, the investigations and projections presented in this paper represent only a preliminary glimpse into the unfolding epoch of cinematic creation, hinting at the transformative synergy between human ingenuity and artificial intelligence.

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Conflict of interest The authors declare no conflict of interest.

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