

Film Production Artificial Intelligence Use

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Abstract

This paper aims to thoroughly review the current and emerging applications of AI throughout the entire filmmaking pipeline, taking a close look at how Hollywood is grappling with these technological shifts, and also spotlighting some significant global initiatives that are really leaning into AI in creative fields. By bringing together insights from academic literature, industry reports, and various case studies, this review attempts to unpack the complex ways AI is integrating into contemporary cinema. AI is steadily becoming a part of pre-production, production, and post-production stages, offering both incredible opportunities for transformation and some pretty significant challenges for established industry practices and, importantly, for the people who work in film. Hollywood's reaction, perhaps unsurprisingly, seems to be a complex dance between eagerly adopting innovation and, at times, a cautious resistance. Ultimately, while AI clearly holds immense potential to redefine how films are made and what creative possibilities exist, its successful and truly fair integration demands ongoing, critical assessment of things like creative control, ethical considerations, and how the industry's economic structures will need to adapt.

Keywords

Artificial Intelligence (AI), Film Production, Filmmaking, Hollywood, Creative Industries, Generative AI

1. Introduction

Artificial intelligence has subtly permeated various aspects of our daily lives, from navigation systems to smart home devices and numerous mobile applications. Concurrently, film production itself has become increasingly accessible through digital tools, with AI now enhancing capabilities in recording, editing, and distribution on platforms like smartphones by offering features such as automated stabilization, smart editing suggestions, and content optimization. This research delves

into the integration of AI technologies into cinematic art, exploring their origins and current applications.

Research Structure:

This study is organized into sections examining the foundational development of AI relevant to creative industries, Hollywood's engagement with AI, the evolving stages of AI application in film production, and concluding remarks on the implications and future trajectory.

Methodology:

This paper employs a comprehensive literature review approach, synthesizing existing academic research, industry reports, and publicly available data. The analysis identifies key trends, common practices, and emerging challenges related to AI adoption in film production, drawing insights from global case studies to provide a broad understanding of the field.

Research Findings:

The international adoption of AI in daily film production is increasing, driven by efficiencies and creative opportunities. To effectively navigate this rapid development, the film industry must address challenges such as adapting to new AI-driven workflows, enhancing the technological literacy of creative professionals, and establishing ethical guidelines for AI integration.

2. The Genesis of Artificial Intelligence Relevant to Creative Industries

The term "Artificial Intelligence" (AI) signifies a transformative era in technology. To grasp its profound application in creative fields like film, it helps to take a quick look at how it all began. While early computational networks, such as ARPANET (Archana & Kingsly Stephen, 2024), laid the crucial groundwork for massive data infrastructure, less focus is needed on their technical evolution than on the subsequent breakthroughs in machine learning that directly empowered AI for creative tasks. The true leap for AI in creative industries came with large-scale data processing and sophisticated algorithms capable of learning from vast datasets.

Crucially, the rise of "Generative Artificial Intelligence" (Generative AI) has been the game-changer for creative contents (Inie et al., 2023). Unlike earlier AI systems that primarily analyzed or optimized, generative AI can actually create new content. This innovation truly bridges the gap between raw data processing and artistic output. These systems learn from large datasets of text, audio, images, or video, allowing them to produce novel works in those same mediums.

Examples of this generative capability directly relevant to the creative sector include early natural language processing models that could generate simple text summaries, leading to more advanced systems that can compose narrative structures. Similarly, early advancements in image recognition paved the way for tools that could generate visual elements. While well-known general-purpose AIs, such as ChatGPT, demonstrate impressive conversational abilities and information synthesis, their significance for film lies primarily in their underlying generative

architectures that can be adapted for specific filmmaking tasks rather than their general consumer applications. The essence here is the transition from AI that processes to AI that produces artistic elements, a shift that fundamentally changes the possibilities for filmmakers.

3. Hollywood Confronts AI

Hollywood has long been fascinated by artificial intelligence (AI), often exploring its potential and perils on screen. Before AI became a daily reality in production offices, filmmakers had already envisioned complex AI narratives. Renowned director Steven Spielberg's films, for example, have vividly depicted futuristic scenarios involving advanced AI and virtual realities. *A.I. Artificial Intelligence* (Spielberg, 2001) presented a sentient robot child grappling with human emotions, prompting audiences to consider the definition of consciousness. *Minority Report* (Spielberg, 2002) explores the use of precognitive AI to prevent crime, raising ethical questions about free will and surveillance. More recently, *Ready Player One* (Spielberg, 2018) delved into immersive virtual worlds in which AI plays a crucial role in shaping interactive experiences. These cinematic explorations were not merely entertainment; they served as a cultural mirror, reflecting societal anxieties and hopes about what AI could become, effectively preparing audiences, even unknowingly, for the technological shifts that would soon arrive in their own world.

However, the transition of AI from a fictional concept to a real-world tool in film production has not been without challenges, particularly in Hollywood. The proliferation of AI-driven tools and software throughout the filmmaking pipeline, from initial script concepts to final visual effects, has naturally stirred significant anxieties among traditional film professionals. Questions about job displacement, the fundamental nature of creative control, and intellectual property rights have become central to heated debate.

Labor Disputes for AI Integration

The most visible manifestation of these anxieties occurred during the unprecedented joint strikes by the Writers Guild of America (WGA) and the Screen Actors Guild (SAG-AFTRA) in 2023 (Li et al., 2021). This wasn't just a general protest; it was a direct response to specific studio proposals regarding the use of AI. The WGA strike, which began in May 2023, was triggered largely by studios' initial proposals that included using AI to generate script drafts with no clear compensation or credit for the original writers, whose work trained these models (Abd-Elsalam & Abdel-Momen, 2023). There was a fear that AI could be used to create "re-writes" of existing scripts or generate new material based on existing intellectual property without proper attribution or residuals.

Following this, SAG-AFTRA joined the strike in July 2023, largely because of concerns over digital likeness rights (Peinado et al., 2003). Studios, it was revealed, were proposing terms that would allow them to scan actors, including background performers, and then use their digital likenesses to create new performances in-

definitely, sometimes for a single day's pay. This raised alarm bells about "digital immortality" without consent or ongoing compensation and the potential for AI-generated synthetic performances to replace live actors, stunt doubles, and even voice artists. The fear was that a studio could scan a performer once and then use their digital twin in countless projects without ever hiring them again.

The strikes, which lasted a combined 148 days for SAG-AFTRA and even longer for the WGA, brought Hollywood to a virtual standstill, costing the California economy an estimated \$6.5 billion (Sookhom et al., 2023). This widespread disruption forced studios and AI companies to reconsider their stances. In November 2023, a tentative agreement was reached and later ratified, which included groundbreaking AI protections. The agreement limited synthetic performers' use and prohibited unauthorized voice cloning (Salamon, 2023).

Key provisions of the WGA agreement regarding AI included:

- AI cannot write or rewrite literary material; it can't be considered "source" material. This means a writer's credit cannot be diminished because AI was used.
- Writers can use AI if the company agrees, but the company cannot require a writer to use AI.
- Companies must disclose if any material given to a writer was generated by AI.
- AI models cannot be trained on WGA members' scripts without explicit consent and compensation.

For SAG-AFTRA, the agreement featured significant protections related to digital replicas and voice synthesis:

- Strict consent requirements.
- For the creation and use of digital replicas. Studios must obtain a performer's informed consent for digital doubles, specifying the scope, duration, and type of use. Negotiated compensation.
- For the use of digital replicas. The agreement establishes a framework for payment when a performer's digital likeness is used, moving away from one-time buyout proposals. Limitations on the use of AI-generated synthetic performers.
- While AI can be used, the agreement aims to prevent AI from completely replacing human actors, particularly for principal roles or for generating stunt performances without human involvement. Protection against the unauthorized use of voice clones.

This was particularly important for voice actors, as it ensured that their vocal performances could not be synthesized without their permission.

These agreements represent a crucial, albeit early, attempt to regulate AI's integration of AI into creative industries, setting precedents for future labor negotiations globally. While a complete picture of AI's economic impact on Hollywood is still emerging, industry figures offer some insights. Reports from major studios indicate a strategic push towards AI adoption to achieve significant budget savings. For instance, some entertainment executives, such as Jeff Katzenberg, have

publicly speculated that AI could reduce animation production costs by as much as 90%. While exact figures for live-action blockbusters are less transparent, industry analysts suggest that AI's efficiency gains in areas like pre-visualization, VFX, and post-production could potentially shave tens of millions, possibly hundreds of millions, off the budget of a \$200 million film, theoretically bringing down production costs by a substantial margin, perhaps even to the \$40 - 50 million range for certain aspects (Benner & Waldfogel, 2020). Companies like Sony Pictures Entertainment have openly stated their commitment to leveraging AI to reduce overall production expenses, indicating a clear industry trend towards leaner, more technologically augmented film sets. This pursuit of efficiency and cost reduction is a powerful driver behind AI adoption, even amidst labor concerns.

4. Global AI Applications in Film Production

While Hollywood has, for understandable reasons, approached the full integration of AI with some caution, other regions globally are actively embracing AI as a significant opportunity for industry growth and competitive advantage. The development in this sector is, frankly, continuous; you see entities like OpenAI constantly pushing out new research and advancements. The economic impacts of global events, such as the COVID-19 pandemic, have also, in their own subtle way, nudged AI adoption forward. For example, the European Audiovisual Observatory reported a rather unfortunate 47% decrease in the number of feature film directors between 2016-2020 and 2022-2023 (Butt, 2024), suggesting a shift in production landscapes that AI could potentially address through new efficiencies or necessitate new skill sets.

The global landscape truly reveals diverse and often more aggressive approaches to AI integration in film. Developed countries like Singapore, South Korea, and the United Arab Emirates are particularly noteworthy for their proactive engagement with AI in their creative industries. Take Singapore's "AI KATANA" (Sookhom et al., 2023) training center, for instance. It's fully focused on re-skilling film artists, really enhancing their capabilities through AI-driven training and constantly sharing the latest technological advancements. In environments like that, practical applications of AI are already quite common. We're talking about things like generating film outlines from simple synopses, developing detailed financial plans, and calendaring shooting schedules using tools like ChatGPT. Beyond that, some specialized AI websites are even making it easier to create striking film concept posters and even animated moving posters, which just goes to show AI's incredible potential in visual development.

Increasingly, AI models are specializing, moving beyond generalized applications to really focus on various film production roles. These tools often start with free access periods—a smart move, really, to encourage users to get comfortable before they transition to paid models. And it's not just about ideation or visual design anymore; AI is making significant strides in other surprising areas. In South

Korea, for example, CJ ENM, a major film production company, has actually developed LAIVE (Kim et al., 2023), an AI tool capable of composing and performing music, allowing for AI-driven musical scores and even virtual singer selection. Such a tool could be a game-changer for students making short films, potentially saving them from needing to hire expensive composers. Specific AI tools are undeniably set to revolutionize various aspects of film production. It's quite exciting, if a bit daunting, to consider their potential. Some key areas include:

- Pre-production optimization (Script analysis and casting):

- Script analysis (e.g., ScriptBook):

This is a fascinating area of research. Tools such as ScriptBook (ScriptBook, 2025) use AI to go beyond simple text analysis. They can evaluate screenplay structure, analyze emotional arcs, track character development, and even, quite remarkably, predict a script's potential box office success or audience reception before a single frame is shot. It offers a data-driven counterpoint to what has traditionally been a highly subjective process of human judgment. For instance, ScriptBook claims an 84% accuracy rate (Inie et al., 2023) in predicting box office hits and flops. This capability provides producers with valuable insights, helping them make more informed decisions about which projects to "greenlight."

- Casting optimization (e.g., Cinelytic):

Imagine having an AI help you choose your cast. Cinelytic helps studios forecast the marketability of actor combinations. They analyze vast amounts of data on actor performances, their box office draw in different markets, and how various cast combinations perform in specific genres. They can then predict a film's potential box office success based on these casting choices, among other script elements. In 2020, Warner Bros. Pictures International famously signed a deal with Cinelytic to utilize its AI-powered platform for predictive analytics in their greenlighting and distribution decisions, aiming to optimize their global market strategies (Inie et al., 2023). This kind of data-driven approach aims to reduce financial risks in an inherently high-stakes industry.

- Production and postproduction efficiencies:

- Generative video models (e.g., OpenAI's Sora, RunwayML Gen-2, Luma Dream Machine):

(Liu et al., 2024) These are perhaps the most talked-about advancements right now. These cutting-edge models can create incredibly realistic and imaginative video scenes from simple text prompts or even static images. Machine enable directors to pre-visualize scenes or producer entire sequences from text or images. Sora, in particular, has really turned heads, showing off its ability to generate minutes-long, high-fidelity video clips complete with complex camera movements and nuanced character interactions. It holds immense potential for pre-visualization, allowing directors to rapidly prototype scenes, test out different creative ideas, and even generate entire sequences without needing extensive physical sets or actors in the early planning stages. It could also drastically reduce costs and production time typically associated with traditional animation and visual effects, potentially de-

mocratizing complex visual storytelling for independent creators too. While they're certainly not ready for prime-time feature film final outputs just yet, their rapid development strongly suggests a future where they could directly contribute to generating background plates, simulating crowds, or even creating entire short films. The pace of improvement here is just staggering.

- AI editing tools (e.g., Runway ML, Magisto, Adobe Sensei):

AI is increasingly stepping into the editing suite, automating many laborious tasks. Platforms like RunwayML (Runway, 2025) offer features such as "Inpainting" (removing unwanted objects from video) and "Rotoscoping" (isolating subjects from backgrounds without green screens), all powered by AI (Ge et al., 2024). Tools like Magisto, owned by Vimeo, specialize in automated storytelling, analyzing footage and selecting the best moments to create coherent, mood-based edits with integrated music, making professional-looking videos accessible even to novices (Magisto, 2025). Adobe Sensei, Adobe's AI framework integrated into tools like Premiere Pro and After Effects, assists with tasks like intelligent auto-color correction, audio leveling, automatic transcription (Speech-to-Text), and smart metadata tagging, which dramatically boosts workflow efficiency by allowing editors to quickly find specific clips or moments within vast libraries of raw footage. Reports suggest AI editing can reduce post-production time by up to 40% for certain tasks (Mohamed et al., 2024).

- Deepfake tools for visual effects (e.g., Synthesia, Flawless AI):

This is where AI gets both exciting and ethically complex. Deepfake technology can recreate actors' faces or voices with startling accuracy. This has been used for "de-aging" actors, making them appear younger for flashback scenes (famously seen with Robert De Niro and Al Pacino in Martin Scorsese's *The Irishman* (Katsumi et al., 2021), where Industrial Light & Magic utilized AI and CGI to achieve the effect). It has also enabled posthumous performances, such as the digital recreation of Peter Cushing as Grand Moff Tarkin in *Rogue One: A Star Wars Story*, and even Carrie Fisher as a young Princess Leia in the same film. While offering incredible creative flexibility, the ethical and legal implications surrounding consent, ownership of likeness, and potential misuse (e.g., creating non-consensual content) are immense and actively debated, making it a frontier requiring careful ethical guidelines and potentially new legislation, as highlighted by the SAG-AFTRA strike. Flawless AI is an example of a tool designed to allow filmmakers to change an actor's performance in post-production, including subtle lip-sync adjustments for foreign language dubs, ensuring the new dialogue matches the actor's original mouth movements (Sun, 2024).

- AI-generated music and sound design (e.g., AIVA, Amper Music, OpenAI's Jukebox, LAIVE):

AI is now capable of composing original scores. Tools like AIVA (AIVA, 2025) and Amper Music (Amper Music, 2025) can generate musical compositions tailored to specific scenes, moods, or emotional arcs, often within seconds. They allow users to specify genre, instrumentation, and desired emotional tone. AIVA

was actually the first AI composer to be officially recognized by a music copyright organization (Susnjak et al., 2023), marking a significant milestone. OpenAI's Jukebox, while more experimental, can generate entire songs, including vocals and lyrics, in various musical styles. For sound design, AI can also generate realistic Foley sounds (e.g., footsteps, rustling clothes) and environmental effects that precisely match on-screen physical movements, streamlining a traditionally labor-intensive post-production process. This significantly reduces the need for extensive sound libraries or laborious manual recording sessions, particularly beneficial for independent filmmakers or those on tighter budgets. As mentioned earlier, South Korea's LAIVE is a direct example of a company developing AI to compose and even "perform" music, offering practical applications for filmmakers seeking custom scores without traditional human composers.

- Virtual production enhancements (e.g., Unreal Engine with AI plugins):

While virtual production itself is already a huge leap forward, relying on real-time rendering, AI is steadily enhancing its capabilities. AI can now assist in generating incredibly realistic virtual environments much more quickly from limited data, optimizing complex lighting scenarios, and even helping to track actors and props with remarkable precision within those elaborate LED volume stages. This all contributes to creating more seamless and immersive virtual sets, really pushing the boundaries of what can be captured in-camera and, importantly, reducing the need for extensive post-production visual effects. Unreal Engine, a leading platform for virtual production, is continuously integrating AI features, including tools for generating realistic foliage (Nanite Foliage), assisting in animation workflows, and even enabling the creation of AI-powered NPCs within virtual worlds for pre-visualization or interactive experiences.

In animation, for instance, AI is already being leveraged for character creation, generating motion, and even scanning humans to create detailed 3D characters. Tools like Adobe Character Animator (Adobe, 2025) and CrazyTalk Animator (Reallusion Inc., 2024) make it possible to generate animated figures from just text or images, truly opening up new avenues for content creators. The strategic use of AI in character-based businesses has the very real potential to significantly accelerate production timelines and scale, drawing parallels, perhaps, to the long-term accomplishments of established studios like Disney. It's a brave new world for animators. Overall, it's estimated that approximately 70% of movies now integrate some form of AI technology, from subtle post-production enhancements to more explicit generative content.

5. Conclusion

The rapid advancement and widespread adoption of AI technologies really mark a pivotal moment for the film industry. The sheer public availability of AI knowledge bases, as shown by ChatGPT's truly explosive growth to 1.6 billion users since November 2022 (Duarte, 2024), speaks volumes about how globally embraced AI has become. AI's integration into film production is showing up in so many dif-

ferent ways, from genuinely enhancing creative workflows to just plain streamlining logistical tasks. For example, streaming platforms like Netflix are famously using AI to analyze user behavior and viewing preferences, essentially optimizing content recommendations and engagement strategies to keep us all glued to our screens. And looking closer to home, emerging trends, such as Mongolian filmmakers already leveraging AI for scriptwriting, signal that AI-assisted productions are truly on the cusp of a much wider screen presence. It's happening, whether we're fully ready or not.

However, as exciting as the transformative potential of AI is, it certainly comes with some significant challenges, especially within the educational sphere. There's a pressing, almost urgent, need to develop curricula that genuinely teach students how to interact with AI tools effectively, how to grapple with the ethical considerations, ensure data privacy, and navigate the tricky waters of intellectual property rights, particularly with new licensed technologies. What's more, bridging the generational gap in understanding AI, especially among older generations who might still see AI as something exclusively for "technology engineers," is absolutely crucial for fostering broader industry acceptance and integration. It's about showing everyone that these tools can empower, not just replace.

As the AI sector continues its breakneck development, its integration into the film industry and broader creative production will only deepen and diversify. The industry's readiness, and indeed the readiness of its human talent, for advanced AI technology hinges on a few key things: proactive adaptation, continuous skill development, and robust policy frameworks that can keep pace with innovation. While AI offers unprecedented tools for efficiency and creative expansion—evidenced by potential budget savings of up to 90% in animation or tens of millions in live-action VFX—its successful implementation will always require careful consideration—a constant balancing act, really—to preserve artistic integrity and ensure equitable opportunities for human talent. It's a journey we're just beginning. The global AI in film market is projected to reach USD 14.1 billion by 2033, from USD 1.8 billion in 2024, demonstrating a compound annual growth rate (CAGR) of 25.7% (Market Research Report, 2024). This significant growth forecasts AI's indispensable role in the future of cinematic arts.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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