Commentary

Qualitative Analysis of Technical Aspects of Filmmaking Processes in Hollywood, Asian Cinema, and the Award-Winning AIFF

Kareem Mohamed Abdelhafeez Mahfouz Hussein[1], Bahire Efe Ozad[2]

1. Faculty of Communication and Media Studies, Eastern Mediterranean University, Turkey; 2. Radio, Cinema & TV Department, Eastern Mediterranean University, Turkey

The research study explores the transformative role of AI technologies in enhancing technical aspects like editing, lighting, visual effects (VFX), computer-generated imagery (CGI), and sound design in filmmaking and cinema production. Through a comprehensive qualitative comparative analysis, the study examines 30 selected films from Hollywood, such as I, Robot (2004) and The Creator (2023), the Asian cinema industry, including After Yang (2021) and Jung-E (2023), and winners of the Artificial Intelligence Film Festival (AIFF) like PLSTC (2023), Expanded Childhood (2023), E^(IPi) + 1=0* (2024), and Dear Mom (2024). This analysis highlights significant transformations in pre-production, production, and post-production processes. The study traces the evolution from early CGI developments, manual editing, and complex simulations to AI-driven techniques and tools. These advancements include real-time rendering, automated content recognition, intelligent cut detection, real-time light adjustment, AI-driven storyboarding, predictive editing, AI-based motion capture, realistic particle simulation, deep-learning for texture synthesis, enhanced 3D modeling, CGI neural rendering, and AI-powered audio environments. Ethical considerations such as balancing creativity between human and AI technologies, intellectual property rights, and data privacy are also discussed. The study suggests developing frameworks and guidelines to ensure the best implementation of AI in cinema production. However, the research is limited by the number of films analyzed, the time frame, lack of quantitative methodologies, and challenges in conducting interviews with stakeholders. The findings aim to contribute to understanding AI's integration in cinema production by analyzing technical aspects, possibilities, limitations, guidelines, and ethical considerations.

 doi.org/10.32388/MIW542

1. Introduction

Artificial intelligence (AI) is in line with all aspects of life and has entered into cinema production at the outset of the new millennium. AI is capable of filmmaking through generated scripts, storytelling techniques, assistance with editing, lighting, visual effects, computer-generated imagery or computer graphics interface, sound design modulation, and even deepfake artistry, which enables filmmakers and producers to enhance their efficiency, creativity, complex processes, reduce production costs, and enhance the overall cinematic experience[1]. AI-driven techniques analyze extensive datasets of existing films, real-time content personalization, predict trends, brainstorm with generative and creative ideas, and innovate visual artistic appeals, valuably transforming the pre-production and post-production workflow efficiency[2].

[3] conducted a systematic literature review between 2000 and 2024 to investigate the integration of artificial intelligence in film festivals, emphasizing the massive transformation through virtual reality, 360 degrees of panoramic cinema, and different enhancements in technical aspects of filmmaking, management, and marketing for pre-production, production, and post-production processes. The key findings of the research study demonstrated that there are a lot of ethical considerations and risks to developing film festivals entirely dependent on AI technologies, and they recommended a crucial need to balance the integration of technologies in film festivals. In[4] systematic literature review on the rising landscape of digital and artificial intelligence film festivals, they critique that these advanced technologies are enhancing the events through management, storytelling, production dynamics, audience engagement, and workflow efficiency, recommending further research and investigation in the future to minimize the gaps of AI integration's impact on society, culture, and cinema production. [5] explore a deep analysis of a variety of film festival landscapes and the role of artificial intelligence tools subsequent from machine learning (ML), natural language processing (NLP), neural networks and deep learning (DL) through the Cinando platform, which is providing valuable database access to lots of advanced techniques in the filmmaking production process within a sponsorship of Cannes Film Festival and the Berlin International Film Festival as a framework that supports the impact of AI on providing new dimensions in technical aspects such as editing, lighting, visual effects, content creation, predictive analysis, sound engineering and possibilities of networking opportunities for media professionals. [6] analyses specific film festivals such as the Sundance Film Festival in Utah and Colorado in the USA and the Venice Film Festival in Italy through the transformative role of AI technologies through company's

techniques and tools like Runway, Deep Voodoo, Beeble, Nvidia, and Respeecher, showcasing a variety of new visual narrative dimensions by utilizing machine learning and generative adversarial networks (GANs) algorithms.[7] explores the integration of AI in cinema production through specified film festivals, such as the Sci-Fi London Film Festival in the United Kingdom and the New York Tribeca Film Festival in the USA, through employing GPT4 in writing scripts, Cap Cut for more accessible and automated editing, Eleven Labs, Deep Dub, and Play.ht for voice-overs, Pika Labs, Wonder Dynamics, MARZ, and IMAX for animations, CGI, and motion graphics showcasing in award-winning films like The Young Man and The Star, balancing human creativity and innovations and offering enhanced workflow efficiency and several new possibilities in filmmaking processes.

With the considerable rise of AI integration in movie production and the emergence of a new wave of film festivals around the globe showcasing the recent innovations of AI storytelling techniques and cinema production, such as the AI Film Festival in Amsterdam, the AI International Film Festival in Hollywood, the Burano AI Film Festival in Italy, and the Runway ML Film Festival, alongside workshops and discussions about the social, cultural, and ethical implications.

AI representation in cinema is not only subjective, but also the recent innovations, techniques, and tools that have been assisting filmmaking through editing, lighting, directing, VFX, CGI, and sound design modulations where movies utilize animatronic-CGI hybrids that combine computer-generated imagery and the physical animatronic models that allow filmmakers to achieve a balance between creativity, freedom, and authenticity (lifelike seamlessly integrated effects, backgrounds, environments, and characters), leveraging the tangible realism and flexibility.[8] mentions that LED visual interface technologies render interactive hyper-realistic in real-time, immediate conditions during the different processes of directing and filmmaking rather than green chroma configurations and arrangements, facilitating engaging and captivating landscapes to interact with different camera transitions, lighting, and motions, improving aesthetic dimensional accuracy, saving time, and enhancing workflow productivity performance.[9] evaluates Refik Anadol's works where the leverage of machine learning (ML) algorithms and neural networks in cinema through Data Tunnel and Machine Memoirs V.2. techniques and models to create dynamic, data-driven arts and immersive environments challenges the traditional storytelling techniques as a new visual narrative balancing human creativity and the technological advances of artificial intelligence.

Assistance in editing techniques, lighting, VFX (visual effects), sound design modulation, and CGI (computer graphics interface or computer-generated imagery) has revolutionized cinema and movie

production where analyzing these technical aspects helps to reveal a granular examination of its possibilities and limitations as new modes of storytelling, audience engagement and cultural meaning-making[10]. The variety of AI enhancements technically in cinema production through scriptwriting, scenes and environment designs, predictive analytics for actor performance and directing assistance, automation in lighting, and editing settings, offering valuable insights about the rapidly evolving landscape of AI-human developments in filmmaking[11].

In editing, AI-driven tools through Adobe Sensei and tailored algorithms enhanced processes like scene transitions and automated shot selection by analyzing hours of footage and shots. In directing, AI assists in storyboarding and virtual actor direction where scene compositions, character placements, and simulating performances. In lightning, AI helps in dynamic lightning and AI-driven colour grading through ARRI (Real-time conditions) and machine learning techniques for real-time grading.[12] and[13].

In visual effects (VFX), AI-based compositions and procedural environment generation through ML and Nvidia Omniverse utilize realistic backgrounds, environments and layering effects.[14] noted in the Story Futures Virtual Production Skills Reports the integration of artificial intelligence in virtual production (VP) through Unreal Engine, Unity, Blender, 3D Max, and other software optimizing and enhancing different technical aspects of cinema production such as editing, lighting, and visual effects, while, ethical considerations such as the required skills, research and development gap, limited workshops and training, and collaboration of experts to implement the best practices of AI in cinema production.

Prajapat[15] explores the impact of AI technological advances in transforming cinema production through different technical aspects. These advances enhance the automation of several settings in video editing, colour grading, animations, motion graphics development, camera controls, in-camera visual effects and computer-generated imagery, and sound engineering in movies like Avatar and The Matrix, showcasing new possibilities and dimensions in filmmaking.

In CGI (Computer Generated Imagery),[16] and[17] stated that deep learning and neural network tools and techniques such as deep motion and unreal engine software enable character animation and photorealistic rendering, enhancing quality and reducing time and cost.[2] explore the integration of AI in intelligent cinematography (IC) and in-camera virtual effects (ICVFX) through automation in controls, enhanced 3D modelling and acquisition, LED stages, and neural radiation fields (NeRFs) to enhance storytelling and visual narrative techniques, enabling massive transformation in reshaping filmmaking production.[18] analyze the impact of AI in documentary filmmaking through smartphone techniques

and programs, augmented reality (AR), and virtual reality (VR) advanced software enabling user-friendly accessibility, editing automation, interactive, immersive environments, voice-overs, sound settings, informative script writing and content creation, and audience engagement, reshaping the landscape of film documentary production and the necessity for media professionals and producers to utilize and understand those tools experimentally.

In Sound Design Modulation[19] discussed that AI-advanced algorithms assist in audio-mixing, sound effects, and balancing dialogue and music through tools such as LANDR, AIVA and Google Magenta. [20] defines the AI Jam technique through Google's Magenta and tone.js as an interactive tool enabling sound designers for real-time music settings such as generation, waves, VFX, background, drumbeats, and tracking.[21] explore the AI technological advances in sound design, such as Creative Support Tools (CSTs) enabling immersive environments, auditory experiences, and enhanced quality of music, while ethical considerations like the crucial need to understand AI techniques experimentally to predict the output and modify it for adaptable workflow efficiency.

In his thesis, Momot[22] identified three key trends in the technological advances of artificial intelligence (AI) in cinema production: minimal integration of AI techniques, limited collaboration and balancing between AI and human creativity, and dependency and reliance on AI in most filmmaking processes. He also discussed ethical considerations regarding job displacement, balancing creativity and automation, required technical skills, quality of AI-driven outputs, intellectual copyrights, data privacy, and security.

The core areas of concern are the common questions and gaps about the ethical implications and considerations of AI integration in cinema production through creativity, intellectual property rights, and technological bias in the rapidly evolving AI technologies, innovations, and developments impacting the different filmmaking processes in the production and post-production challenging the medium[23], and[24]

The research study focuses on demonstrating AI applications in different technical aspects to enhance the filmmaking processes narratively and experimentally as a notable shift in reshaping and defining cinema production, emphasizing the trends, possibilities, limitations, distinctions, commonalities, and ethical considerations as a comprehensive understanding and framing through a qualitative comparative analysis between 30 selected films in Hollywood, Asian cinema, and the Artificial Intelligence Film Festival (AIFF).

The research study aims to answer the following research questions:

1. How does AI evolve between mainstream AI-themed movie production in Hollywood and Asian cinema (2001-2023) and experimental films of AIFF award-winners (2023 and 2024)?
2. What are the possibilities, limitations, distinctions, commonalities, and ethical considerations from the comparative analysis findings?

2. Methodology

2.1. Research Design

The research employs two comparative analysis phases through qualitative methodology to analyze AI's enhancements in editing, lighting, visual effects (VFX), computer-generated imagery (CGI), and sound design modulation in filmmaking and cinema production on ten selected AI-themed films, such as AI (2001), I. Robot (2004), Wall-E (2008), Her (2013), Ex-Machina (2014), Chappie (2015), After Yang (2021), Jung-E (2022), M3GAN (2022), and the Creator (2023), highlighting unique contributions in different technical aspects.

Additionally, Runway-ML (an applied AI research company building tools for human imagination) has established twenty different Artificial Intelligence Festival Films (AIFF) for more advanced investigation evaluating the role of AI in advancing technical aspects and assessing the rapidly evolving progression of artificial intelligence through trends, possibilities, and limitations in film production.

2.2. Sampling

The sampling method for the research was purposive based on thematic narrative visuals, societal and cultural impact, and critical perspectives related significantly to artificial intelligence through 10 selected AI-themed movies from 2001 to 2023, ensuring a broader range showcasing the revolution of AI cinema over almost 2 decades.

For the Artificial Intelligence Film Festival (AIFF), twenty award-winning films were selected for their advanced integration of narratively and experimentally as a core component in movie production and filmmaking through scripting, directing assistance, editing, lighting, visual effects (VFX), computer-generated imagery (CGI), and sound design modulation, enabling a nuanced analysis and understanding for AI integration in cinema production.

2.3. Data Collection

The data collection for the research for the selected 10 AI-themed films was mainly through secondary data and publicly available on the cloud of Web 2.0 through reviews, documentation, databases, film critiques, and archives. Additionally, for the 20 AIFF winners, the Runway ML website provides submitted projects, reviews, summaries, trailers, and full movie links. Also, producer profiles on different platforms for more nuanced filmmaking details, blog discussions, reports, and interviews offer an in-depth analysis of AI integration in cinema production.

2.4. Data Analysis

The data analysis utilized a qualitative comparative analysis to evaluate the rapidly evolving AI integration in cinema production through a notable shift in visual storytelling narratively and experimentally through main key technical aspects such as AI-editing techniques, data-driven sound design modulation, and visual effects during production and post-production in the collected data for the 30 selected movies from Hollywood, Asian cinema, and the Artificial Intelligence Film Festival, identifying trends, workflow efficiency, distinctions, commonalities, possibilities, limitations and ethical considerations within AI integration in filmmaking progressively transformed offering understanding and comparative analysis of the rapidly evolving landscape in the industry.

3. Results and Discussion

3.1. AI Technical Aspects in 10 AI-Themed Films in Hollywood and Asian Cinema

Movie Title	***Directing Assistance, Editing & Lighting***	***VFX and CGI***	***Sound Design and Voice Modulation***
The Creator (2023)	*Gareth Edwards' naturalistic approach, Handheld camera work, and Natural lighting with high dynamic range.*	*CGI enhances practical digital hybrid effects, LED wall technology, the integration of in-camera effects, and accurate location shooting.*	*Rich ambient soundscape, Subtle AI voice processing, Organic-synthetic sound blend.*
After Yang (2021)	*Kogonada's minimalist direction, Static, composed frames, Soft natural lighting, and Muted colour palette.*	*Subtle memory sequence effects, Minimalist UI displays, and Understated digital enhancements.*	*Quiet, contemplative design; Natural voice processing for Yang; Subtle mechanical undertones.*
Jung-E (2022)	*Sang-ho Yeon's dynamic style, High contrast lighting, Cyberpunk aesthetic.*	*Heavy CGI environments, Detailed robotic designs, Advanced battle sequences, and Futuristic interface animations.*	*Industrial sound effects, Processed robotic voices, Intense combat audio design.*
M3gan (2023)	*Gerard Johnstone's horror-comedy blend, Dynamic lighting transitions, and Tension-building camera work.*	*Animatronic-CGI hybrid; Practical effects for close-ups; CGI for complex movements; Uncanny Valley design.*	*Distinctive voice modulation, Creepy musical elements, Subtle mechanical sounds.*
Ex Machina (2014)	*Alex Garland's precise framing, Clinical lighting design, and Controlled environment shots.*	*Seamless, transparent components, Subtle mechanical movements, and Award-winning effects work.*	*Minimalist sound design; Ethereal score integration; Natural-synthetic voice blend.*
Her (2013)	*Spike Jonze's warm palette, Intimate framing, and Soft diffused lighting.*	*Minimal visual effects; Sophisticated UI design; Screen interface integration.*	*Scarlett Johansson's processed voice; Subtle OS interface sounds; Emotional sound design.*

Movie Title	*Directing Assistance, Editing & Lighting*	*VFX and CGI*	*Sound Design and Voice Modulation*
I, Robot (2004)	*Alex Proyas' dynamic style, High-key lighting, and Action-oriented cinematography.*	*Groundbreaking robot CGI; Digital environment creation; Motion capture integration.*	*Mechanical movement sounds, Processed robot voices, Action sequence sound design.*
AI (2001)	*Spielberg's emotional approach, Dramatic lighting, and Kubrick-influenced frames.*	*Pioneering CGI work, Practical animatronics, and Underwater sequences.*	*Detailed robot sound design; Childlike voice processing; John Williams score integration*
Chappie (2015)	*Neill Blomkamp's gritty style, Documentary-like approach, Natural lighting*	*Motion capture integration; Detailed robot animation; Environmental effects*	*Unique robot voice design; Urban soundtrack Combat sound effects*
Wall-E (2008)	*Andrew Stanton's animated direction, lighting inspired by sci-fi classics, and Virtual cinematography.*	*Full CGI animation; Pixar's advanced rendering; Detailed texture work.*	*Minimal dialogue designable Burtt's sound effects; Robot communication sounds.*

Table I. Comparative analysis of technical aspects of 10 AI-themed movies in Hollywood and asian cinema

The table illustrates a comparative analysis of AI as an integral part of the technical aspects as the assistance in directing, editing, lighting, visual effects, computer-generated imagery, sound design modulation, and visual narratives in film-making through ten selected films between Hollywood and Asian cinema, framing the producer's range of creative decisions that impacted cinema production narratively and experimentally.

Figure 1. Collective AI-themed film posters

The findings of the comparative analysis between the selected 10 AI-themed movies have applied a wide range of directing techniques. Naturalistic, warm, and soft lighting was displayed in films such as Her (2013), After Yang (2021), and The Creator (2023). In contrast, movies such as Jung-E (2022) and M3GAN (2023) embrace futuristic sci-fi visuals, styles and designs, applying dramatic high-contrast lighting effects and motion-driven cinematography and shot compositions enhancing narrative tensions within dystopian themes of fearful environments. Ex-Machina (2014) employs precise and minimalistic visuals reflecting the movie's philosophical perspective on consciousness, awareness and decision-making. Chappie's (2015) film roots its storyline in a raw, realistic, documented tone. Meanwhile, Wall-E (2008) showcase a shift from naturalistic to CGI visuals derived from legendary sci-fi movies, blending nostalgia with creativity, innovation and science fiction, highlighting the animation's power to AI portrayals and the emotional depth.

doi.org/10.32388/MIW542

A diverse range of cinematic narrative visual and CGI effects has been demonstrated in the selected 10 AI-themed movies. LED technology and computer graphic interface animations have been employed within real-world effects, merging a sense of naturalistic reality and sci-fi, enriching the credibility of The Creator's (2023) movie. A combination of digital effects, graphics, animations, and robotics as CGI techniques bridging the uncanny valley matching dark humour, horror, and suspense genres in M3gan (2022) film.

The applications of minimalist basic visual augmentations and digital effects, centred on memory visuals and interactive interfaces, in After Yang (2021) and Her (2013), highlight emotional arcs rather than large-scale visuals. Advanced CGI and VFX techniques and innovations were employed for AI portrayals and robotics representing futuristic sci-fi environments, prototypes, and atmospheres in AI (2001), I. Robot (2004), and Jung-E (2022). Andrew Stanton utilizes advanced CGI and VFX techniques through Pixar (an animation studio in California), which impacted AI's character's portrayals and representations in Wall-E (2008) film.

Sound design modulation in the post-production process enhances the representation of cinematic visual narratives, AI portrayals, and robotics, impacting audience engagement. Merging natural and artificial sound compositions and effects reflects the AI's complex portrayals, where Samantha's voice (Scarlett Johansson) in Her (2013) movie boosts the emotional bond and connection in their human-AI relationship. An exceptionally warm, evoking, thoughtful self-reflection (introspection) was employed in the After Yang (2021) movie.

The mechanical audio and sound environments showcase AI's roots, horror, and futuristic sci-fi dystopia in Jung-E (2022) and M3gan (2023) movies. A surreal, mystical composition and revolutionary sound design in films like Ex-Machina (2014) and Wall-E (2008) demonstrate nuanced emotional and philosophical themes. Vibrant music compositions and rhythms have been utilized in movies like I, Robot (2004) and Chappie (2015), enhancing the visual narratives and storyline's resilience and dynamism.

The comprehensive comparative analysis between 2001 and 2023 AI-themed movies highlights a diverse range of visual narratives and technical aspects in cinema production through a mixture of technological advancements in editing, lighting, CGI and VFX, AI portrayals and character representation, and auditory strategies revealing possibilities, limitations, and ethical considerations reshaping societal and cultural engagement and perceptions.

Representing and visualizing AI's dual nature from minimalistic, realistic, warm, and soft environments to highly advanced CGI, animations, visual effects, and sound settings compositions from ARRI digital cameras, pioneered motion capture, CGI photorealism, real-time rendering and virtual production, machine learning VFX, the physical-based rendering (PBR) lighting techniques, the digital audio workstation (DAW), neural audio processing, and hybrid realistic 3D audio experiences enabling spectral processing, representing a notable shift from the dystopia themes of fear to the companionship between humans and AI narratively and experimentally.

3.2. AI Enhancement in Editing, lightning, VFX, CGI and Sound Design Modulation through AIFF (Artificial Intelligence Film Festival)

A broader comparative analysis of 20 films awarded at the Artificial Intelligence Film Festival (AIFF), The Artificial Intelligence Film Festival was developed by Runway ML Company in 2022, which can be considered a celebration of the emerging AI tools for filmmaking for art and artists, showcasing a new creative era in cinema production. This analysis would provide additional insights into the evolution of AI's influence on directing, editing, lighting, VFX, CGI, sound design, and voice modulation, offering a more comprehensive examination of AI's transformative role in film production.

Figure 2. Artificial Intelligence Film Festival (AIFF)

Many technological advancements in AI have been utilized in the Artificial Intelligence Film Festivals through Runway ML, I-Max AI tools, and Adobe Sensei for editing and visual effects. Techniques such as Dall-E 2, Mid Journey, Nvidia Omniverse, UnReal engine's Metahuman creation, and Wonder dynamics

have been utilized for arts, graphics and CGI. Tools such as Synthesia, Elevenlabs, Deepmind's WaveNet, and Judedeck (ByteDance) for sound design modulation, effects, voice-over, and narrations, Deepface lab for deepfakes, and LucidPix AI for 3D effects and designs. Monk AI innovations and Goldmansachs's AI integrations have been utilized for AI analytics and sentiment. Filmmaking's rapidly evolving technological advancements have enhanced cinema through its production and post-production processes.

Figure 3. Collective of AIFF's film winners

doi.org/10.32388/MIW542

Movie Title	*Directing Assistance, Editing& Lighting*	*VFX and CGI*	*Sound Design and Voice Modulation*
Generation (2023)	*Real-time Editing feedback and lightning adjustments by utilizing AI.*	*Creating surreal imagery with AI-generated visuals*	*AI-generated soundscapes (Enhancing emotional impact)*
Checkpoint (2023)	*AI transitions (Scene pacing) optimizing narrative flow*	*Dynamic background and environments (AI-generated)*	*AI-Modulated voices (Enhancing character identities)*
Given Again (2023)	*Scene Selection and Color Grading (AI Algorithms)*	*Simulations of environments (AI-realistic)*	*AI-Sound effecting matching tone of emotions*
Original Voice (2023)	*Pacing & Clarity AI suggested edits and script analysis*	*Virtual spaces and character interactions by AI.*	*Distinct voice for characters by utilizing AI*
PLSTC (2023)	*AI Drama effect for Synchronizing lightning-on-screen action.*	*Animated sequences and fluid motion by AI.*	*Dialogue applied AI effects for Audio Clarity.*
Landscape (2023)	*Cuts and transitions by AI-driven editing (Storytelling)*	*Environmental effects and breathtaking landscapes utilizing AI.*	*Ambient sounds using AI (enhancing immersive experience)*
I want 1000 rabbits (2023)	*AI-assisted colour correction and Lighting design.*	*AI Characters and Elements.*	*Character Interactions by adding AI-voice modulation layers.*
AI Artist (2023).	*AI-assisted Refining shots and editing for artistic expressions.*	*Creating Synthetic visuals by leveraging AI.*	*Soundtracks adapting narrative flow generated by AI*
ASAP Rocky (2023)	*Music Video Pacing and Editing by AI-Assistance*	*Live-action animations and visual effects by AI.*	*Matching music's vibe by AI-voice modulating effects.*
Expanded Childhood (2023)	*Editing, highlighting emotional beats and Pacing using AI.*	*Imaginative visuals by AI reflect childhood themes.*	*Enhancing nostalgia and warmth through Audio layers generated by AI.*
Get Me Out (2024)	*Claustrophobic atmosphere by AI lighting choices.*	*Enhanced the Surreal nature of the house through visual effects utilized by AI.*	*Amplifying tension and emotion through AI-generated soundscapes.*

Movie Title	*Directing Assistance, Editing& Lighting*	*VFX and CGI*	*Sound Design and Voice Modulation*
Pounamu (2024)	*Maintaining the pace of Kiwi Bird's journey through AI-assisted editing.*	*Vibrant Animated wilderness Settings AI-generated.*	*Immersive experience using Enhanced AI Sound of Nature.*
E^(I*Pi) + 1=0 (2024)	*Visualizing complex mathematical equations through AI-assisted editing.*	*Digital comics and visual representation using AI.*	*AI-Modulated voices for children reflecting their personalities.*
Where does grandma go? (2024)	*AI-assisted editing suggestions for a whimsical narrative flow*	*AI-Playful Animations illustrating storytelling.*	*Whimsical sounds enhance the original childlike voice and perspective.*
L'eveil ala creation (2024)	*AI-Color grading enhances Tahiti's mystical atmosphere.*	*Gauguin's Art Stunning Visual Representation by AI.*	*Ambient sounds by AI reflecting the spiritual journey*
Animatas (2024)	*AI aids in editing to convey the emotional depth of the protagonist's story.*	*AI-enhanced visual effects evoke the scene's limbo and transformation.*	*AI-sound design and effects reflect the tragic nature of the tale.*
A Tree once grew here (2024)	*AI-assisted editing, balancing narrative and visuals.*	*Captivating animations is a storytelling technique used by AI.*	*Enhancing the environmental landscape with nature sounds generated by AI.*
Dear Mom (2024)	*Reflecting personal emotions through structured narrative by AI.*	*Subtle Visual effects by AI enhance emotional moments.*	*AI-voice overs modulation conveys impactful messages.*
Lapse (2024)	*AI-assisted editing to create a reflective tone throughout the movie.*	*Representing time and memory by AI-generated Abstract Visuals.*	*AI-Sound scapes, revealing feelings of loneliness and nostalgia.*
Separation (2024)	*AI-assisted editing is used to create a cohesive narrative about distance and emotions.*	*AI-Enhanced Visual Effects Symbolizing Separation.*	*AI-enhanced sound effects and design reflect the character's emotional turmoil.*

Table II. Comparative analysis of technical aspects of 20 AIFF award-winning in 2023 and 2024

The AI enhancements to directing assistance and editing technically showcase a notable shift through AI-driven storytelling boards from text scripts and previsualized sequence enhancing planning efficiency, shot composition optimization through camera angles, framing, and movements to real-time scene analysis providing live feedback of performances, scene compositions, and continuity. Automated cut scenes align clips, audio synchronization, and the emotional tone matches through suggested settings and setups using tools such as Nvidia RTX AI produced in films like "Generation" and "Get Me Out."

In Lighting, AI integrates through dynamic light mapping through real-time setups and settings aligning with scene changes, different scenarios and director's preferences to virtual light simulations and environments, natural light prediction such as sunlight angles and shadows, and light synchronization with motions such as enhanced effects with camera and actor movements through movies such as "M3GAN", "Where Do Grandma go?", "Animatas", and "Separation" through major programs developed by and Flawless AI, and Runway ML such as Gen-1 and Gen-2.

The award winners of the Artificial Intelligence Film Festival depict a vast utilization of AI through VFX and CGI in filmmaking through AI-driven animation and rendering through ocean simulations and underwater visuals, humanoid robots, and surreal landscapes in films such as PLSTC (2023), Animatas (2024), and LAPSE (2024). Advanced scene composition through AI simulation of tree growth over time combing biology knowledge and computer-generated imagery in Tree Once Grew Here (2024). Creating virtual humans through AI-based facial rigging and human-like features enhances the emotional depth in AI Artist (2023) and Where Do Grandma Go? (2024) films. AI-generated environments blending Maori character cultural motifs within a futuristic atmosphere in the Pounamu (2024) movie to mathematical calculations visualization merging algebra and geometry with visual narratives in the E^(I*Pi) + 1=0 (2024) film. Ethical storytelling and deep learning through reimagination of childhood memories, historical settings and archival footage through CGI and neural style transfer techniques in movies such as Expanded Childhood (2023) and L'eveil a'la Creation (2024). The enhanced capabilities of sound design modulation through adaptive soundscapes within AI-generated ambient underwater and environmental sounds such as wind, water, and birds in PLSTC 2023 and landscape 2023. Voice synthesis, modulation through voice-overs, and effects blending human and robot tonality, as in AI Artist's (2023) movie. Dynamic audio mixing through modulated frequencies and diegetic sounds such as breathing, footsteps, and soft, filtered tones in movies like Get Me Out (2023) and Expanded Childhood (2024). Procedural

sound generation through the synchronization of robotics with character's movements in Animatas (2024) film and the mathematical sound synthesis aligning with the geometrical calculations visualization in E^(I*Pi) + 1=0 (2024) film. The noise reduction, clarity, and speech-to-music conversion through transformed dialogue and emotional montages layering with AI-generated harmonic effects blending nature with narratives as in Dear Mom (2024) and A Tree Once Grew Here (2024) movies.

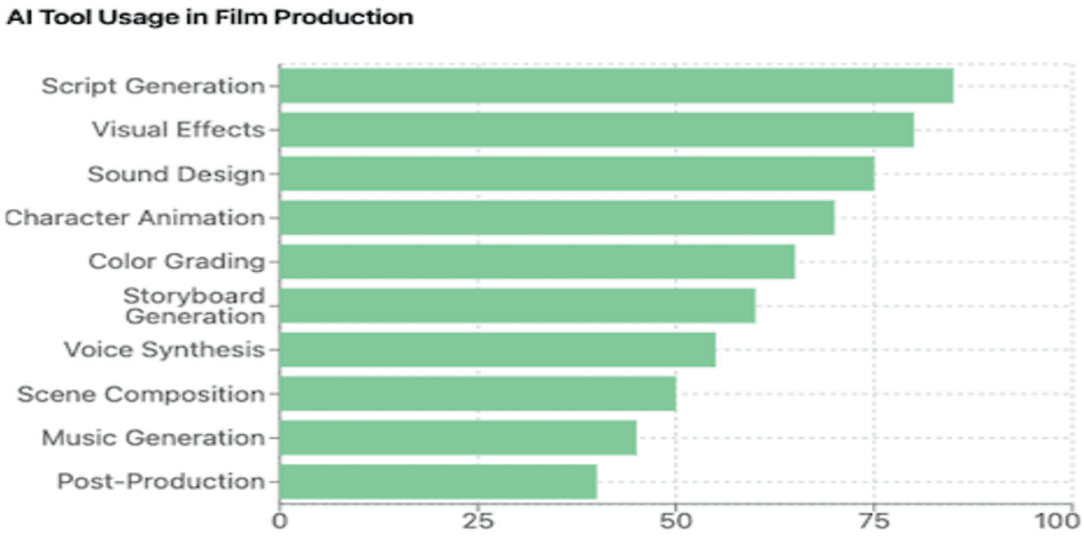

Figure 4. AI Tools Usage In Film Production

The hierarchical analysis of AI enhancements in film production reveals a sophisticated ecosystem of technological integration. Script generation and analysis tools emerge as the predominant application, followed by visual effects generation and sound design enhancement. This hierarchy reflects the current state of AI technology and the industry's prioritization of different aspects of the filmmaking process. Including character animation, colour grading, and storyboard generation in the middle tier of typical applications suggests a balanced approach to production's creative and technical aspects. The lower-tier applications, including scene composition, music generation, and post-production automation, represent emerging areas with significant potential for future development.

doi.org/10.32388/MIW542

3.3. Suggested guidelines and ethical frameworks for filmmakers and media professionals

3.3.1. Guideline for learning and utilization of AI technologies in filmmaking

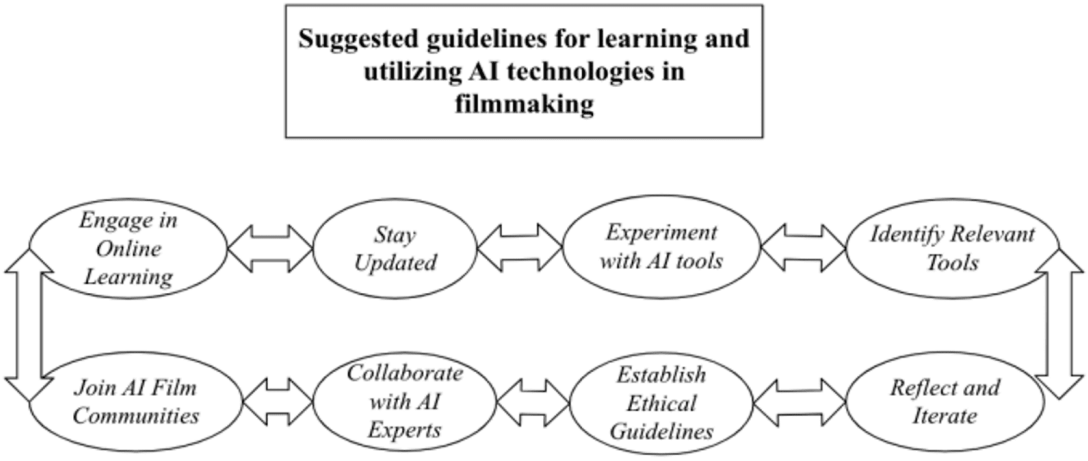

Figure 5. Suggested guidelines

The suggested guidelines can be the following:

1. Classify applicable and suitable AI techniques for different technical aspects of cinema production, such as editing, visual effects, CGI, and sound design. Investigate, employ, and utilize AI tools experimentally through small projects and collaborations with experts and peers in big projects.
2. Joining relevant webinars, tutorials, online discussions, and online courses through Coursera, YouTube, and Udemy platforms. Engage with filmmaking and cinema communities through different platforms on the cloud of Web 2.0 and 3.0, grasping knowledge, techniques, valuable feedback, partnerships, networking, and collaboration opportunities.
3. Follow recent modifications and notifications about the developed techniques and tools through news, blogs, announcements, publications, and newsletter subscriptions; attend artificial intelligence film festivals and conferences; and explore companies′ websites like Runway and Nvidia.
4. Constructing ethical guidelines for transparency, disclosure, and intellectual property rights through collaboration between AI experts, specialists, and developers to reflect and iterate the

possible valuable implementation of technologies, techniques, and tools in future projects, balancing human creativity and innovations.

3.3.2. Ethical framework for AI integration in cinema production

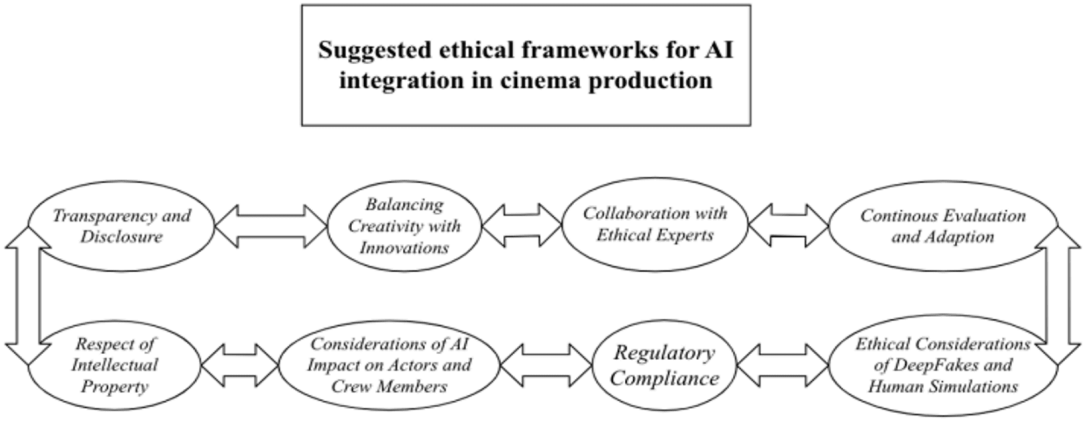

Figure 6. Suggested ethical frameworks

The suggested ethical frameworks for AI in filmmaking can be the following:

1. Transparency and disclosure about employing AI technologies in production processes, maintaining trust and awareness in how and when techniques and tools were utilized while verifying and securing that the developed contents are not violating existing credits, authorship, and copyrights.
2. Balancing and moderating the creativity of media professionals' advanced technical skills and AI innovations without complete replacement or dependency, securing the best enhancement practices.
3. Partnerships and cooperation with ethical experts in media science studies, arts, cinema, developers, producers, and filmmakers to address the evolving concerns of AI integration in production processes.
4. Evaluating AI's impact on actors, artists, crew members, and creative professionals through stabilizing the reliance on AI technologies and considering the profound skills gap evolving by innovations in the film industry.

5. Complying with legal and regulatory obligations and standards through data privacy and security regulations, primarily through the misuse and limitations of deepfakes, AI portrayals, and simulations.
6. Ensuring the dynamic development of sustained continuous analysis and understanding of AI innovations, modifying protocols, frameworks, and guidelines to the most effective integration of artificial intelligence in film and cinema production.

4. Conclusion

The comprehensive analysis of AI's integration into cinema production reveals a profound technological evolution spanning from early pioneering works like AI (2001) and I, Robot (2004) to contemporary productions such as The Creator (2023) and innovative entries in the Artificial Intelligence Film Festival. This transformation demonstrates the increasing sophistication of AI applications across all technical aspects of filmmaking, fundamentally reshaping traditional production methodologies.

The revolutionary transformation in VFX and CGI has been analyzed where the use of digital domain's VFX, Autodesk Maya, and Weta digital in creating 600 effects shots, and futuristic Chicago skyline, physical greenscreens, manual matching and practical sets of CGI elements for motions and animations in I, Robot (2004) film requiring long rendering times for producing high-quality CGI to leveraging machine learning techniques and AI-driven techniques through the innovative developments by companies as Runway, NVIDIA, Media Monks, IMAX, Tribeca Festival (Collaborations), Flawless AI, and Goldman Sachs (Data Integration for AI Models) in The Creator (2023) movie, and the award winners of the Artificial Intelligence Film Festivals of 2023 and 2024 for animations, environments, VFX, photogrammetry, use of drones, and real-time rendering emphasizing greater efficiency, lower cost production, and enhanced workflow processes where visual effects and computer-generated imagery playing a central role in storytelling and visual narratives.

AI-assisted editing, featuring intelligent colour correction, automated scene detection, facial recognition and tracking, content-aware editing, automated subtitling and translation, and identifying key moments and emotional rhythms, demonstrates AI's capacity to transcend conventional techniques and enhance narrative structure flow. A diverse range of directing assistance techniques and tools enhanced by AI through script analysis, storyboarding, shot planning, scene composition, casting and performance guidance, and real-time feedback during shooting enable innovative approaches while maintaining the creativity of producers and artists. This is particularly shown in the reviews, summaries, interviews, and

blogs. AI-advanced algorithms transformed lighting settings into interactive narrative drivers and dynamic storytelling elements, transcending the traditional adjustments through real-time lighting levels, determining the best setups, and responding to environment and atmosphere changes within optimal feedback as a notable shift in cinematography.

For AI integration in Visual effects (VFX) and Computer-generated imagery (CGI) techniques where a quantum leap in computational creativity was visualized through deep learning-based face replacement and ageing, AI-powered motion capture enhancement, neural rendering for environmental generation, AI-driven character animation and crowd simulation, AI-enhanced rotoscoping and compositing enhancing the visual narratives landscape. Utilizing neural character interaction frameworks, AI-driven procedural metamorphosis and contextual space generation and adaptation, semantic image synthesis within multiple style domains, enhanced AI virtual spaces, character interactions, and animated motions, elements, and sequences were developed and visualized through complex environments challenging traditional adjustments and settings showcasing new visual languages beyond imaginations. A new level of simulations through dynamic environmental response systems, Generative adversarial networks (GANs), and Neural style transfer evolution within neural-based non-photorealistic animation visualizing dynamic atmospheres and sci-fi visual spaces are yet realistic.

AI-generated sound, music, and audio are core narrative mechanisms that enhance on-screen action, audio environments, and emotional landscapes. Developing character voices able to generate vocal performances and creating sonic landscapes, effects, and AI-modulated voices reveals new levels of characters′ depth, emotions, and narrative significance. Immersive storytelling and audio experiences are created through innovative tools such as NVIDIA Audio2Face, Audionamix′s AI, AI Adobe Audition techniques, Sonible′s smart, IZotope RX 10, and Accosonus, which was developed by ERA bundle pro.

Overall, artificial intelligence through machine learning, natural language processing, neural linguistic processing, deep learning, computer vision, robotics, speech recognition, generative AI, predictive analysis, cognitive computing, and AI ethics and fairness systems are rapidly evolving and advancing each second in our lives, where companies such as NVIDIA, Runway, Adobe, Epic Games, Flawless AI, Open AI, Autodesk, IBM Watson Media, Google DeepMind, Media Monks, Weta Digital, Unity, and Sony Pictures are integrating AI developments in editing, lighting, visual effects, CGI, and sound design, offering new dimensions and possibilities to advanced techniques accessibility, workflow, creativity, time, and cost efficiency, playing a vital role in shaping the future of filmmaking and cinema pre-production,

production, and post-production processes redefining how films are developed, perceived, and distributed.

The main ethical concerns, as always, are balancing human creativity with AI's rapid technological advancements, intellectual property rights, potential displacement of roles and job positions, authenticity, data privacy, and security, necessitating the development of guidelines and frameworks to ensure the best implementation and possibilities of utilizing artificial intelligence through technical aspects in cinema. Suggested guidelines for learning and utilizing AI techniques in the filmmaking and cinema production processes were identifying relevant AI tools, engaging in online learning platforms, experimenting with AI techniques, joining AI film communities, staying updated with recent advancements, and collaborating with experts and peers to establish valuable ethical guidelines and frameworks where creative media professionals can reflect and iterate. While the suggested ethical frameworks were ensuring transparency and disclosure, balancing creativity and AI enhancements, respecting intellectual property rights, considering AI's impact on actors and crew members, adhering to compliance rules and regulations, deepfakes and human simulation's ethical considerations, and a continuous evaluation and adaption of recent AI technologies.

The limitations of the research study can be summarized as the following: Only 30 movies from Hollywood, Asian cinema, and the artificial intelligence film festival have been analyzed, which could not capture the entire scope of AI's integration in cinema globally. The absence of quantifiable measures, metrics, and methodologies, the study's duration limited between 2001 and 2024, may not accurately illustrate the continuous progress and developments of AI and the obstacles in reaching and conducting interviews with stakeholders, actors, producers, and film crews, which will provide more accurate investigation about the practical implementation of AI and Its applicability through pre-production, production, and post-production processes of cinema and filmmaking.

The following suggestions can be recommended for future research:

1. Employing longitudinal studies to analyze the long-term effects of artificial intelligence innovations and technologies on creativity and decision-making processes through cinema and filmmaking pre-production, production, and post-production.
2. Cross-cultural studies will demonstrate the differences in the adaptation and implementation of AI technologies through the divergence of the worldwide film industries.
3. Applying quantitative methodology through numerical measures will reveal a nuanced analysis of AI technologies that boost workflow, time efficiency, and cost production in filmmaking processes.

4. Investigating emerging technologies such as augmented, virtual reality, and 3D environments as the metaverse, offering new potential and fresh capabilities to enhance dynamic storytelling and visual narratives that impact audience engagement, emotions, and attention.

About the Authors

Kareem Mohamed is a Ph.D. candidate in the Faculty of Communication and Media Studies at Eastern Mediterranean University, Turkey. His research focuses on media, graphic design, journalism, AI, public relations, marketing, film semiotics, and digital culture studies. His current work examines the intersection of AI narratives and cultural meaning-making in contemporary cinema.

Prof. Dr. Bahire Efe Ozad is the Department Head of Radio, Cinema & TV in the Faculty of Communication and Media Studies at Eastern Mediterranean University. Her research spans media studies, communication theory, and educational technology, with highly cited publications on social media, media literacy, and digital learning. She has extensively published on media representation, communication technologies, and pedagogical methodologies in prestigious journals.

References

1. ^*Ashton D. "Creative Work and Artificial Intelligence: Imaginaries, Assemblages and Portfolios." Transform ations 36 (2022): Article 14443775.*
2. a, b*Azzarelli A, Anantrasirichai N, Bull DR. "Reviewing Intelligent Cinematography: AI Research for Camera -Based Video Production." arXiv preprint arXiv (2024): Article 2405.05039.*
3. ^*Jurado-Martín M. "Gone with the Wind: From Virtual Reality to the Metaverse at Film Festivals." In The Fu ture of Digital Communication, 145-158, 2024.*
4. ^*Chen Z, Yu T. "Festivals and Digitalization: A Critique of the Literature." Tourism Critiques: Practice and Th eory (2024).*
5. ^*Zemaityte V, Karjus A, Rohn U, Schich M, Ibrus I. "Quantifying the Global Film Festival Circuit: Networks, D iversity, and Public Value Creation." PLoS One 19(3) (2024): Article e0297404.*
6. ^*Hales C. "Artificial Intelligence: The Latent Revolution in Filmmaking." ADAM ARTS 2 (2021).*
7. ^*Naji AK. "Employing Artificial Intelligence Techniques to Make Films." Al-Academy (2024): 171-180.*
8. ^*Aslanyürek Y, Aycan E. "Cinematic Futures: The Impact of AI on the Cinematography." Inonu University Fa culty of Communication Electronic Journal (INIF E-Journal) 9(1) (2024): 75-94.*

9. ^Cavdar D. "Reimagining In/Visibility, Archival Practice and the Emergence of AI Cinema: An Exploration through Refik Anadol's Artworks." PhD diss., Concordia University, 2024.
10. ^Ong V. "Artificial Intelligence in Digital Visual Effects." 2021.
11. ^Deng J. "Governance Prospects for the Development of Generative AI Film Industry from the Perspective of Community Aesthetics." Studies in Art and Architecture 3(2) (2024): 153-162.
12. ^Bhatt D, Patel C. "Architecture into Theatre and Film Making Process." International Journal of Innovative Research in Engineering & Management 9(2) (2022): 276-282.
13. ^Song J, Wang B, Wang Z, Yip DKM. "From Expanded Cinema to Extended Reality: How AI Can Expand and Extend Cinematic Experiences." In Proceedings of the 16th International Symposium on Visual Information Communication and Interaction, 1-5, 2023.
14. ^Bennett J, Heath C, Kilkelly F, Richardson P. Virtual Production Skills Report 2023. StoryFutures Virtual Production Skills Report, 2023.
15. ^Prajapat S, Singh AK, Banerjee A, Bhatnagar K. "Role of AI and Video Technology in Sci-Fi Cinema." 2023.
16. ^Filimowicz ME. AI and the Future of Creative Work: Algorithms and Society. 2023.
17. ^Reddy VS, Kathiravan M, Reddy VL. "Revolutionizing Animation: Unleashing the Power of Artificial Intelligence for Cutting-Edge Visual Effects in Films." Soft Computing 28(1) (2024): 749-763.
18. ^Schleser M. "Smart Storytelling." Studies in Documentary Film 16(2) (2022): 97-113.
19. ^Caballero J, Sora-Domenjó C. "Automation and Creativity in AI-Driven Film Editing: The View from the Professional Documentary Sector." Communication & Society (2024): 201-218.
20. ^Chang JR. "AI_Jam: 23rd Advanced Imaging Festival (2022)." In AIIF Advanced Imaging International Festival-International Conference, 2022.
21. ^Kamath P, Morreale F, Bagaskara PL, Wei Y, Nanayakkara S. "Sound Designer-Generative AI Interactions: Towards Designing Creative Support Tools for Professional Sound Designers." In Proceedings of the CHI Conference on Human Factors in Computing Systems, 1-17, 2024.
22. ^Momot I. "Artificial Intelligence in Filmmaking Process: Future Scenarios." 2022.
23. ^Figueroa-Armijos M, Clark BB, da Motta Veiga SP. "Ethical Perceptions of AI in Hiring and Organizational Trust: The Role of Performance Expectancy and Social Influence." Journal of Business Ethics 186(1) (2023): 179-197.
24. ^Pradeep A, Satmuratov A, Yeshbayev I, Khasan O, Iqboljon I, Daniyor A. "The Significance of Artificial Intelligence in Contemporary Cinema." In 2023 Second International Conference on Trends in Electrical, Electro

nics, and Computer Engineering (TEECCON), 2023.

Declarations

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.