PARTIFICIAL INTELLIGENCE AND THE TRANSFORMATION OF THE FILM INDUSTRY: CREATIVE INNOVATION, TECHNOLOGICAL ADVANCEMENT AND ETHICAL

Viknesh Raja R S*[1], Dr B Senthil Kumar[2],

Research Scholar[1] ,ASSISTANT PROFESSOR[2],

Vels Institute of Science,Technology and Advanced Studies (VISTAS), Chennai,,India

***Corresponding Author E-mail: vikneshraja71@gmail.com**

***Abstract*—The rapid development of artificial intelligence has introduced significant changes to the global film industry, influencing the methods through which cinematic content is conceptualized, developed, produced, and distributed. The integration of intelligent computational systems into filmmaking has created new possibilities for creative experimentation, technical development, and industrial efficiency. This paper examines the growing contribution of artificial intelligence throughout the filmmaking process, particularly in screenplay development, production planning, cinematographic design, digital editing, animation, visual effects, audience analysis, and film distribution. It explores how machine learning, natural language processing, computer vision, and generative technologies support filmmakers in handling complex production activities and developing innovative visual experiences. The study also investigates the economic and creative implications of AI adoption, including production expenditure, workflow optimization, personalized entertainment, and the accessibility of advanced filmmaking technologies. However, technological advancement also introduces important concerns relating to creative ownership, copyright protection, performer consent, employment opportunities, information security, and the preservation of cultural diversity.**

Using a conceptual review of relevant academic literature and developments in digital media, this paper evaluates both the opportunities and limitations associated with intelligent filmmaking systems. The discussion suggests that artificial intelligence should be considered a collaborative technological resource rather than an independent replacement for artistic professionals. Responsible implementation, transparent decision-making, and appropriate human supervision are essential to maintaining creative integrity. The study concludes that the sustainable development of cinema will depend on establishing a productive relationship between technological capabilities and human imagination.

***Index Terms*—Artificial Intelligence, Film Production, Digital Cinematography, Generative Technology, Creative Innovation, Visual Effects, Machine Learning, Human–AI Collaboration, Copyright, Digital Entertainment.**

I. INTRODUCTION

Through the development of technology that have altered how stories are conveyed to viewers, the cinema business has continued to evolve. Cinematic production has evolved as a result of advancements in sound recording, colour cinematography, digital cameras, computer-generated images, and internet streaming. Another significant phase in this technology revolution is represented by artificial intelligence, which brings computer systems that can analyse data, spot trends, create content, and assist with difficult creative choices. The term "artificial intelligence" refers to computer techniques created to carry out tasks like learning, reasoning, language processing, prediction, and visual recognition that often call on human intellectual capacities (Russell & Norvig, 2021). It is used in filmmaking in ways that go beyond technological automation. Contemporary AI systems can help with audience-focused distribution tactics, post-production operations, visual composition, production coordination, and creative development.

Screenplay development, direction, cinematography, sound design, editing, animation, marketing, and distribution are some of the interrelated areas that make up the modern film production ecosystem. Coordination, professional knowledge, and a large financial expenditure are needed to manage these tasks. Production teams can benefit from AI-supported apps that process massive amounts of data, speed up tedious tasks, and offer new creative opportunities. Filmmakers now have more technological options thanks to generative artificial intelligence. While picture and video generating systems can assist in turning written descriptions into visual conceptions, language models can aid in the creation of screenplays. Computer vision technologies are capable of object identification, movement tracking, and aiding in the arrangement of audio visual content. The relationship between computational creativity and conventional filmmaking techniques is evolving as a result of these advancements.

Nevertheless, the increasing presence of AI raises questions about the position of human professionals within creative industries. Concerns include the ownership of machine-generated material, the unauthorized use of performers' identities, the protection of original artistic contributions, and the economic consequences of automation. These issues demonstrate that technological progress must be evaluated not only through efficiency but also through its social and cultural consequences.

Therefore, the current study looks at how artificial intelligence has contributed to modern filmmaking, defines its main industrial uses, and assesses the difficulties in putting it into practice. It highlights in particular how crucial it is to preserve human creative

power while embracing cutting-edge technological solutions. The methodology used in this study is qualitative, descriptive, and conceptual review. It draws from published scholarly works, books, research articles, and institutional studies about digital media, artificial intelligence, the creative industries, and audio visual production. To identify key technological applications, new prospects, and related challenges, a thematic analysis of the gathered literature is conducted. The paper makes no claims about presenting unique insights from primary audience surveys or experiments. Rather, it creates a comprehensive knowledge of the connection between AI and the evolving film business.

2. LITERATURE REVIEW

Artificial intelligence and digital media have become increasingly interconnected areas of academic investigation. Earlier developments in computational intelligence concentrated mainly on data processing, pattern recognition, and automated decision-making. Recent advances in deep learning and generative models have extended these capabilities into creative activities, including image production, language generation, and audiovisual content development (Goodfellow et al., 2016; LeCun et al., 2015).Manovich (2001) explained how digital technologies transformed the production and organization of contemporary media. His work provides a foundation for understanding the relationship between computational systems and cultural production. Similarly, Cunningham and Silver (2013) examined the restructuring of creative industries through digital technologies and changing media distribution systems.

Recent studies have specifically investigated the growing relationship between AI and filmmaking. Azzarelli et al. (2025) reviewed intelligent cinematography and discussed the application of computer vision, automated camera systems, and virtual production technologies. Tsiavos and Kitsios (2025) examined the transformation of the film industry's value chain through artificial intelligence, identifying its influence on creative production, distribution, and exhibition. Hemraj (2025) highlighted the opportunities and challenges of generative AI in creative media, particularly its contribution to production efficiency and the risks associated with originality and creative uniformity. Uddin et al. (2025) also examined the changing filmmaking process and proposed a framework for understanding AI applications across several production activities. The literature indicates that artificial intelligence should be examined as both a technological development and a cultural transformation. Its influence extends beyond individual production tools to the organization of creative labour, intellectual ownership, and the relationship between filmmakers and audiences.

2.1 Artificial Intelligence in Screenplay Development and Story Construction

Screenplay development is one of the foundational activities in filmmaking because it establishes the narrative structure, character relationships, dialogue, and thematic direction of a production. These components typically come from the creativity, experiences, and teamwork of authors and directors. There are now more ways to explore and arrange story concepts because to the development of AI-based language tools. Computer systems can comprehend and produce human language thanks to natural language processing. Character descriptions, alternate dialog, plot outline organization, and narrative consistency analysis can all be aided by modern language models. Modern language-generation systems have benefited greatly from transformer-based architectures (Vaswani et al., 2017).

An AI-assisted writing program might, for instance, examine a screenplay to find recurring phrases, inconsistent character descriptions, or narrative sequence gaps. Additionally, writers can employ generative algorithms to explore different storylines and get dialog improvement suggestions. However, the emotional intelligence, cultural awareness, and first-hand experience needed for meaningful storytelling are not always present in machine created content. Large language models have significant drawbacks, such as the potential to produce information that is convincing yet untrustworthy, as noted by Bender et al. (2021).AI should therefore serve as a writer's assistance. Choosing concepts, establishing the film's message, creating likable characters, and making sure the story represents the intended creative vision are all still the writer's responsibilities.

2.2 AI in Pre-Production and Production Planning

Budgeting, site selection, casting, scheduling, costume planning, storyboard preparation, and production resource coordination are just a few of the tasks involved in pre-production. Because preparation errors can lead to delays and higher production costs, these tasks demand careful planning. Planning systems with AI support can discover schedule issues and arrange data from various production departments. In order to forecast potential resource requirements, predictive models can also look at historical production data. Filmmakers can review sequences prior to real filming thanks to digital storyboarding and pre-visualization tools. Directors can assess scene configurations, lighting, camera placements, and visual consistency using computer-generated environments and virtual representations.

Written descriptions of scenes can be converted into initial visual references using generative picture technologies. Directors can better convey their ideas to production designers, cinematographers, and other creative workers by using these references. Before significant production resources are committed, these applications can enhance collaboration and offer chances for experimentation. However, professional supervision should continue to oversee the final choices regarding production design, practical viability, and artistic direction.

2.3 Intelligent Cinematography and Camera Technology

Cinematography determines how a film communicates its narrative through framing, lighting, camera movement, composition, and visual atmosphere. Artificial intelligence is increasingly being incorporated into digital camera systems and production environments to support these activities. Computer vision enables machines to recognize visual objects, identify movement, and interpret elements within recorded scenes. These capabilities can assist cinematographers in monitoring subjects, organizing camera information, and maintaining visual consistency.AI-assisted camera systems can support automated tracking and camera movement in selected production environments. Intelligent aerial imaging technologies can also help coordinate visual recording in controlled filming situations.

Virtual production represents another important development. It combines computer-generated environments, real-time rendering, and physical performance spaces to create integrated filming environments. This approach can reduce the need for certain location-based production activities while allowing filmmakers to examine visual environments during shooting .The growing role of intelligent technology in live production, virtual production, aerial cinematography, and general production is explained by Azzarelli et al. (2025). Cinematography is still an artistic field in spite of these advancements. Human judgment and artistic interpretation are necessary for camera positioning, visual symbolism, emotional composition, and the choice of suitable imagery.

2.4 AI in Film Editing and Post-Production

Post-production is an essential stage in which recorded footage is transformed into a completed cinematic presentation. It includes editing, colour correction, sound synchronization, visual enhancement, subtitle preparation, and the integration of special effects.Traditional editing requires professionals to examine extensive footage and select suitable recordings for the final narrative. AI-based systems can assist this process by recognizing scenes, identifying repeated shots, organizing recordings, and detecting particular visual or audio elements.

Machine learning technologies can also support automated transcription and subtitle generation. Speech recognition systems convert recorded dialogue into written text, helping editors organize material and prepare captions.AI-assisted editing tools can identify differences in lighting, colour, and visual continuity. They may also provide preliminary suggestions for scene arrangement and assist with repetitive editing operations .In sound post-production, intelligent systems can help reduce background noise, separate audio elements, and improve dialogue clarity. These functions can be useful when working with complex recordings. Nevertheless, the emotional rhythm of a film cannot be determined entirely through automated analysis. Editors must understand the director's intention, narrative timing, dramatic tension, and the relationship between images and sound.

2.5 AI in Animation and Computer-Generated Visual Effects

Animation and visual effects have become important components of contemporary cinema. They enable filmmakers to represent imaginary environments, complex characters, historical settings, and situations that may be difficult to capture through conventional filming. Deep learning and generative technologies have expanded the possibilities of digital image production. Generative adversarial networks introduced a framework for producing synthetic data through the interaction of two neural networks (Goodfellow et al., 2014). Later developments in diffusion models provided additional approaches to generating and modifying visual content (Ho et al., 2020; Rombach et al., 2022).

In animation, AI-assisted technologies can support movement analysis, facial expression development, character consistency, and the synchronization of speech with animated performances. Visual effects professionals can use intelligent tools to assist with background reconstruction, image enhancement, object removal, and the organization of complex digital scenes. Such applications may reduce the time required for certain repetitive operations. Another important application is the development of digital characters and virtual environments. These technologies allow filmmakers to experiment with visual representations that extend beyond the limitations of physical production. However, the quality of computer-generated imagery depends on artistic supervision, technical accuracy, and appropriate visual integration. AI-generated effects must be evaluated carefully to ensure that they support the narrative rather than distract audiences from it.

2.6 AI in Film Marketing and Audience Analysis

Marketing plays an important role in determining how films reach audiences and establish their position in competitive entertainment markets. Artificial intelligence has introduced advanced methods for studying audience behaviour, examining digital engagement, and organizing promotional activities.Machine learning systems can analyse publicly available audience interactions, viewing patterns, search behaviour, and engagement information to identify broader entertainment preferences. These insights may assist film companies in developing promotional strategies for different audience groups.

Streaming services use recommendation algorithms to organize content according to users' interests and previous interactions. Collaborative filtering and content-based recommendation methods are widely discussed approaches in personalized digital entertainment (Ricci et al., 2015).Recommendation technologies can help audiences discover films that correspond to their interests. They also provide distribution platforms with methods for improving content discovery and user engagement.AI-supported marketing systems can assist with promotional material preparation, subtitle translation, audience segmentation, and the evaluation of campaign performance.

However, predictive analysis should not be treated as a perfect method of understanding audience preferences. Individual tastes, social influences, and cultural interests can change over time. Film companies must therefore combine computational insights with creative and professional market evaluation.

2.7 AI in Film Distribution and Streaming Platforms

Digital distribution has changed the relationship between film producers, distributors, exhibitors, and audiences. Online streaming platforms have introduced new methods for delivering audiovisual content across geographical boundaries.Artificial intelligence supports the organization of large digital film libraries through automated classification, content recognition, recommendation systems, and personalized discovery. These technologies can help platforms manage extensive collections and provide relevant suggestions to viewers.Machine learning models can also assist distribution companies in studying audience engagement and evaluating the potential performance of different promotional strategies.

Recommendation systems are particularly important because audiences increasingly depend on digital platforms to discover entertainment content. Koren et al. (2009) discussed the importance of collaborative filtering techniques in recommendation systems, while Covington et al. (2016) examined large-scale video recommendation methods.Although AI improves content discovery, excessive dependence on automated recommendations may restrict the visibility of independent films and culturally diverse productions. Distribution platforms should therefore consider diversity and accessibility when designing their recommendation strategies.

2.8 Ethical, Legal and Cultural Issues in AI-Based Filmmaking

The expansion of AI technologies introduces several questions concerning the rights and responsibilities of creative professionals. One major issue involves the ownership of content produced through generative systems.AI models are trained using large collections of digital information, and disputes may arise when copyrighted materials are included in training datasets without appropriate authorization. The relationship between human authorship, machine-generated content, and intellectual property protection remains an important subject of legal and academic discussion.

Another concern relates to the digital representation of actors and performers. Technologies capable of reproducing facial expressions, voices, and physical appearances create opportunities for visual storytelling but also introduce questions about permission, identity protection, and fair compensation. The use of personal information in audience analysis also requires careful

consideration. Data collection and automated profiling should follow appropriate privacy principles and applicable legal requirements.

Employment is another important dimension. The introduction of automated systems may change the responsibilities of professionals working in editing, animation, translation, visual design, and other production activities. The International Labour Organization (2025) emphasizes the need to consider employment conditions, changing skill requirements, and creative workers' rights during the adoption of generative AI. Cultural diversity must also be protected. If recommendation systems and generative models repeatedly favour dominant cultural patterns, regional languages, independent filmmaking, and minority storytelling traditions may receive less visibility.Responsible AI implementation should therefore include transparency, consent, accountability, copyright awareness, and human oversight.

2.9 Human Creativity and Artificial Intelligence Collaboration

The relationship between artificial intelligence and human creativity should be understood through collaboration rather than competition. AI technologies can process large volumes of information and generate alternative creative suggestions, but human professionals provide the cultural understanding, emotional interpretation, and artistic purpose necessary for meaningful cinema.A director may use AI to explore different visual concepts, while a cinematographer determines which composition communicates the intended emotion. Similarly, screenwriters may obtain narrative suggestions from language models while retaining responsibility for the originality and quality of the screenplay.

This collaborative approach can also encourage emerging filmmakers to experiment with digital storytelling techniques. However, access to technology alone does not guarantee creative excellence. Artistic knowledge, critical thinking, and professional experience remain important.UNESCO (2021) emphasizes the importance of human rights, transparency, and accountability in the ethical development of artificial intelligence. These principles are relevant to film production because creative decisions can influence cultural representation, employment, and public communication.

Therefore, the future of filmmaking should prioritize human-centred technological development. AI can strengthen the creative process when it is used responsibly and when human professionals retain meaningful control over artistic decisions.

3. DISCUSSION

The examination of artificial intelligence across the filmmaking process demonstrates that its influence is not restricted to a single production activity. It affects the entire creative and commercial structure of the film industry.In the development stage, language-processing technologies provide opportunities to organize narratives and examine screenplay structures. During production, intelligent camera systems and virtual environments support visual planning. In post-production, automated recognition and editing technologies assist professionals in handling large amounts of audiovisual material.

Similarly, recommendation systems and predictive analytics contribute to audience engagement and digital distribution. These developments may improve operational efficiency and provide filmmakers with new methods of reaching audiences. However, technological effectiveness should not be measured only through production speed or financial savings. The originality of storytelling, protection of creative labour, cultural representation, and audience trust are equally important considerations.

The literature also indicates that the effects of AI differ according to the type of production, organizational resources, and professional responsibilities. Large production companies may have greater access to advanced technologies, whereas independent filmmakers may experience both opportunities and financial limitations.Consequently, the adoption of artificial intelligence requires suitable training, transparent organizational policies, and cooperation between technical specialists and creative professionals.The most sustainable approach is a human-centred model in which intelligent technologies provide assistance while filmmakers retain responsibility for artistic direction, ethical decisions, and cultural meaning.

4. FUTURE SCOPE OF ARTIFICIAL INTELLIGENCE IN THE FILM INDUSTRY

Artificial intelligence is expected to play an increasingly significant role in the future development of the film industry by introducing advanced technologies and innovative production methods. AI-based applications can support various filmmaking activities, including screenplay development, cinematography, animation, visual effects, automated editing, and virtual production. These technologies may help filmmakers improve production efficiency, reduce expenses, and explore new creative possibilities. Furthermore, advancements in generative video technology can assist in creating realistic digital environments and visual scenes. AI-powered translation, speech recognition, and subtitle generation can also improve film accessibility and encourage international distribution. Recommendation systems may help audiences discover independent films and regional productions, promoting cultural diversity in digital entertainment.

However, the growing adoption of artificial intelligence also creates challenges related to copyright protection, employment opportunities, data privacy, and ethical responsibilities. Therefore, appropriate guidelines and human supervision are necessary to ensure its responsible implementation. Future developments should focus on maintaining a balance between technological advancement and human creativity. Collaboration among filmmakers, researchers, and technology developers will be essential for creating innovative cinematic experiences while preserving artistic originality and cultural values.

5. CONCLUSION

Artificial intelligence is transforming the film industry by improving production efficiency, enhancing visual effects, supporting creative storytelling, and simplifying film distribution. Although AI offers numerous opportunities, challenges related to copyright, data privacy, employment, and human creativity must be addressed. The study concludes that AI should complement rather than replace human creativity. Therefore, maintaining a balance between technological innovation and artistic expression is essential for the sustainable development of the global film industry.

REFERENCES

[1] A. Azzarelli, N. Anantrasirichai, and D. R. Bull, “Intelligent cinematography: A review of AI research for cinematographic production,” *Artificial Intelligence Review*, vol. 58, Art. no. 108, 2025, doi: 10.1007/s10462-024-11089-3.

[2] E. M. Bender, T. Gebru, A. McMillan-Major, and S. Shmitchell, "On the dangers of stochastic parrots: Can language models be too big?" in *Proc. 2021 ACM Conf. Fairness, Accountability, and Transparency*, 2021, pp. 610–623, doi: 10.1145/3442188.3445922.
[3] J. Berg, P. Gmyrek, M. Licata, T. Gwenyaya, and M. Freytes, *Generative AI and the Media and Culture Industry*. Geneva, Switzerland: International Labour Organization, 2025.
[4] R. Bommasani *et al*., *On the Opportunities and Risks of Foundation Models*. Stanford, CA, USA: Stanford Center for Research on Foundation Models, 2021.
[5] T. B. Brown *et al*., "Language models are few-shot learners," in *Advances in Neural Information Processing Systems*, vol. 33, 2020, pp. 1877–1901.
[6] N. Couldry and U. A. Mejias, *The Costs of Connection: How Data Is Colonizing Human Life and Appropriating It for Capitalism*. Stanford, CA, USA: Stanford University Press, 2019.
[7] P. Covington, J. Adams, and E. Sargin, "Deep neural networks for YouTube recommendations," in *Proc. 10th ACM Conf. Recommender Systems*, 2016, pp. 191–198, doi: 10.1145/2959100.2959190.
[8] K. Crawford, *Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence*. New Haven, CT, USA: Yale University Press, 2021.
[9] [9] S. Cunningham and J. Silver, *Screen Distribution and the New King Kongs of the Online World*. London, U.K.: Palgrave Macmillan, 2013.
[10] S. Cunningham and D. Craig, *Social Media Entertainment: The New Intersection of Hollywood and Silicon Valley*. New York, NY, USA: New York University Press, 2019.
[11] L. Floridi and M. Chiriatti, "GPT-3: Its nature, scope, limits, and consequences," *Minds and Machines*, vol. 30, pp. 681–694, 2020, doi: 10.1007/s11023-020-09548-1.
[12] T. Gillespie, "The relevance of algorithms," in *Media Technologies: Essays on Communication, Materiality, and Society*, T. Gillespie, P. J. Boczkowski, and K. A. Foot, Eds. Cambridge, MA, USA: MIT Press, 2014, pp. 167–194.
[13] I. Goodfellow, J. Pouget-Abadie, M. Mirza, B. Xu, D. Warde-Farley, S. Ozair, A. Courville, and Y. Bengio, "Generative adversarial nets," in *Advances in Neural Information Processing Systems*, vol. 27, 2014.
[14] I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. Cambridge, MA, USA: MIT Press, 2016.
[15]] S. Hemraj, "AI and the future of creative development: Redefining digital media production," *AI and Ethics*, vol. 5, pp. 5105–5119, 2025, doi: 10.1007/s43681-025-00765-x.
[16] J. Ho, A. Jain, and P. Abbeel, "Denoising diffusion probabilistic models," in *Advances in Neural Information Processing Systems*, vol. 33, 2020.
[17] H. Jenkins, *Convergence Culture: Where Old and New Media Collide*. New York, NY, USA: New York University Press, 2006.
[18] Y. Koren, R. Bell, and C. Volinsky, "Matrix factorization techniques for recommender systems," *Computer*, vol. 42, no. 8, pp. 30–37, 2009, doi: 10.1109/MC.2009.263.
[19] Y. LeCun, Y. Bengio, and G. Hinton, "Deep learning," *Nature*, vol. 521, pp. 436–444, 2015, doi: 10.1038/nature14539.
[20] L. Manovich, *The Language of New Media*. Cambridge, MA, USA: MIT Press, 2001.
[21] L. Manovich, *Software Takes Command*. New York, NY, USA: Bloomsbury Academic, 2013.
[22] S. T. McClean, *Digital Storytelling: The Narrative Power of Visual Effects in Film*. Cambridge, MA, USA: MIT Press, 2007.
[23] P. M. Napoli, *Audience Evolution: New Technologies and the Transformation of Media Audiences*. New York, NY, USA: Columbia University Press, 2011.
[24] D. B. Nieborg and T. Poell, "The platformization of cultural production: Theorizing the contingent cultural commodity," *New Media & Society*, vol. 20, no. 11, pp. 4275–4292, 2018, doi: 10.1177/1461444818769694.
[25] S. U. Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. New York, NY, USA: New York University Press, 2018.
[26] V. A. Oberting IV, "Generative artificial intelligence and copyright in the film and media industry," *Washington and Lee Law Review Online*, vol. 82, no. 2, 2024.
[27] S. Prince, *Digital Visual Effects in Cinema: The Seduction of Reality*. New Brunswick, NJ, USA: Rutgers University Press, 2012.
[28] F. Ricci, L. Rokach, and B. Shapira, Eds., *Recommender Systems Handbook*, 2nd ed. New York, NY, USA: Springer, 2015.
[29] R. Rombach, A. Blattmann, D. Lorenz, P. Esser, and B. Ommer, "High-resolution image synthesis with latent diffusion models," in *Proc. IEEE/CVF Conf. Computer Vision and Pattern Recognition*, 2022, pp. 10684–10695.
[30] S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed. Hoboken, NJ, USA: Pearson, 2021.
[31] S. Thomas, "'Somebodies' and 'Nobodies': Generative AI and audiovisual performer labor," *The Velvet Light Trap*, vol. 94, pp. 64–75, 2024, doi: 10.7560/VLT9407.
[32] V. Tsiavos and F. Kitsios, "The digital transformation of the film industry: How artificial intelligence is changing the seventh art," *Telecommunications Policy*, vol. 49, no. 8, Art. no. 103021, 2025, doi: 10.1016/j.telpol.2025.103021.
[33] S. M. I. Uddin, R. I. Sumon, M. A. I. Mozumder, M. K. H. Chowdhury, T. P. T. Armand, and H. C. Kim, "Innovations and challenges of AI in film: A methodological framework for future exploration," *ACM Transactions on Multimedia Computing, Communications, and Applications*, vol. 21, no. 7, Art. no. 199, 2025, doi: 10.1145/3736724.
[34] UNESCO, *Recommendation on the Ethics of Artificial Intelligence*. Paris, France: UNESCO, 2021.
[35] A. Vaswani *et al*., "Attention is all you need," in *Advances in Neural Information Processing Systems*, vol. 30, 2017.