Leveraging Artificial Intelligence Tools in Digital Media Development to Lower Development Barriers

Gejian Zhu
Department of Design, Goldsmiths, University of London, London, U.K.

Keywords: Artificial Intelligence, Digital Media Interaction, Low-Code Tools, Creative Technology, User Experimentation.

Abstract: With the widespread adoption of artificial intelligence (AI) tools in digital media creation, whether AI tools have lowered the technical barrier for non-professionals is worth questioning. Taking open source AI platforms ml5.js and Ready Player Me as examples, this study examines whether non-programming users can independently achieve interactive media effects, such as gesture recognition and virtual character control, without conventional programming skills. Experimental observations on two design students were used to assess task completion, perceived usability of the tools, and understanding of system logic. The experimental results show that although participants finished the task successfully, their knowledge of the internal operation of the tool was comparatively more limited. This study suggests that the AI platform significantly lowers the threshold for development at the operational level but does not fully compensate for the gap in users' perception of the system. This study provides a practical reference for creative technology education and AI tool development and points out the possible risk of "black box usage".

1 INTRODUCTION

The rapid development of Artificial Intelligence technology has resulted in a growing use of AI tools in the digital media industry, especially in key technical fields like image synthesis, speech recognition, gesture tracking, and motion capture. AI is increasingly replacing the traditional manual modeling approach and programming development process. In recent years, there has been a large number of open-source or low-threshold AI platforms, like ml5.js, MediaPipe, and Ready Player Me, that have made interactive media content, which previously required specialist programming skills, available to people without technical backgrounds (Billinghurst et al., 2015). This changing trend raises a fundamental question: has AI technology truly lowered the threshold for developing interactive digital media technologies?

The creation of traditional interactive digital media, especially with regard to complex functionalities like mixed reality (MR), gesture recognition, or the manipulation of virtual characters, is often reliant on advanced computer vision algorithms, sensor data processing, and skills in object-oriented programming. For non-professionals, the threshold to building such systems is usually high. However, the development of artificial intelligence technologies has somewhat changed this situation. For example, ml5.js provides a modular gesture recognition model, allowing for image input and recognition processes to be completed with a few lines of code; similarly, Ready Player Me provides for the quick generation of 3D virtual characters from photos, making it possible to integrate them into interactive environments, thereby empowering "non-programmers" to create interactive experiences. These technologies make it possible for "non-programmers" to participate in the creation of interactive experiences.

However, systematic research to confirm the competence and experience of non-professional users in creating digital media interactions with the assistance of AI tools remains scarce. The objective of this research is to examine whether AI technology has significantly reduced the threshold of digital media technology development through empirical experiments based on the observation of the process and feedback of participants with non-programming backgrounds in utilizing AI tools (e.g., ml5.js and Ready Player Me) to accomplish basic interactive tasks.

Zhu, G.
Leveraging Artificial Intelligence Tools in Digital Media Development to Lower Development Barriers.
DOI: 10.5220/0014362800004718

In *Proceedings of the 2nd International Conference on Engineering Management, Information Technology and Intelligence (EMITI 2025)*, pages 556-564
ISBN: 978-989-758-792-4

This research will aim to respond to the following inquiries:

1. Can nonspecialist users utilize AI tools to accomplish interaction tasks within a fairly short time?
2. Do they have to depend on programming skills while using?
3. What are the implications of the usability and cognitive barriers present in AI tools for users from varied backgrounds?

The importance of this research is not merely to learn about the influence of AI on digital media's technical threshold, but also to offer a practical foundation for digital media education and tool design in the future.

2 DEVELOPMENT STATUS OF DIGITAL MEDIA TECHNOLOGY

2.1 Developmental Threshold Levels and Technological Challenges Involving Digital Media Interaction Technologies

With the passage of time, the development of interactive technologies involving digital media like virtual character animation, gesture recognition, and mixed reality (MR) has called for the development of advanced-level algorithms and complex system architectures, and hence posed a serious technical barrier to innovation. During previous eras, for example, systems for gesture recognition normally relied on tools like OpenCV, Kinect, or depth-sensing cameras, together with computer vision approaches to image processing, machine learning, and feature abstraction, as a bid to create recognition systems (Wachs et al., 2011). The development of MR systems involves a form of programming and platform technologies, ranging from Unity, C#, and spatial map algorithms, as demanded by the programmers (Billinghurst et al., 2015). Such a high-level technical barrier has, on numerous occasions, locked out nontechnical persons from the production environment of interactive media content, leading to a situation where content producers are mostly engineers or development groups, as opposed to mostly individual artists or designers.

2.2 AI-Powered Platform Development and the Movement Towards Low-Code Development

During the last decade, progress made on Artificial Intelligence (AI) has gone a long way towards fuelling the growth of "low-code" and "zero-code" projects on digital media production. Several platforms on AI have revolutionized conventional methods, thereby reducing costs associated with learning the abilities needed to construct complex systems. For one:

The ml5.js library includes a range of pre-trained models, including image classification, gesture classification, and audio classification, that can be easily used on the web using JavaScript in applications that do not call for engineering skills, including educational and interactive art solutions (McCarthy, L., 2019).

MediaPipe thus supports end-to-end computer vision solutions developed by Google that include gesture recognition, face tracking, and detection of human skeletal features, and is available on web and mobile platforms (Lugaresi et al., 2019).

Virtual characters' platforms, such as Ready Player Me, combine technologies such as three-dimensional modeling, motion capture, animation binding, and export procedures. Such combinations allow a user to create interactive characters that can be used on different platforms without needing to use Blender or Maya (Wolf3D, 2021).

In recent years, low-code and no-code platforms have emerged as a significant trend in software and digital media development, substantially enhancing the ability of “non-experts” to build applications independently. Yan notes that such platforms enable non-technical users to rapidly construct required systems through visual components and drag-and-drop logic, thus shortening development cycles and reducing technical barriers (Yan, Z., 2021). Similarly, Upadhyaya demonstrates that low-code tools play a critical role in accelerating innovation, enabling faster delivery, and supporting in-house solution development in small and medium-sized enterprises (Upadhyaya, 2023). These findings reinforce the positioning of AI platforms in this study as “creator-friendly tools” and provide a theoretical foundation for their application in the field of digital media interaction.

The arrival of these tools heralds a blurring of the boundary between "technology-creation" and digital media development, which is no longer exclusively the domain of programmers, but has become a creator-oriented platform design.

2.3 The Extent to Which AI Empowers Nontechnical Creators: Synthesis of Research

Despite the claim that tools of artificial intelligence are actually made to reduce development barriers, researchers are divided on the issue of empowerment of the "non-professionals." Certain researchers believe that AI tools increase the autonomy of designers and foster interdisciplinary approaches (Manovich, 2020); e.g., tools allow artists to combine pictures and transform styles without the requirement for programming knowledge, as shown through applications such as RunwayML or DALL-E. However, other researchers refute this notion, declaring that systems of artificial intelligence can cause a new form of a "black-box problem," where, on the one hand, the models are easy to use but, on the other, the essential mechanisms and logic on which the outputs are based remain inaccessible to the users, thereby limiting the system control exercised by them (Burrell, 2016).

Additionally, educational technology experts examined studies on the future use of artificial intelligence when teaching digital media. More specifically, Lee and Ko (2022) recognized that integrating AI tools in interaction design classes can significantly contribute to the value of student outputs; nonetheless, a number of the students found themselves challenged when altering the parameters of the model and setting up file paths (Lee & Ko, 2022). As a result, although usability is improved through the use of AI tools, a gap is observed between usability and comprehensibility.

Previous literature suggests a movement from a traditionally "expertise-oriented" development style to a "creation-friendly" one aided by tools of artificial intelligence, but empirical evidence is needed to validate significant impacts on non-proficient audiences. More particularly, the issue of whether or not platforms based on AI allow for "de-technicalized" development in domains where the barrier to entry is very high, as is the case for gesture recognition and mixed reality interaction, has yet to be adequately examined based on actual behavior and attitudes towards use. The experimental portion of this work takes this as its starting point to assess to what degree platforms based on AI allow non-proficient end-users to create interactive media.

3 EXPERIMENTAL DESIGN

3.1 Purpose of the Experiment

The aim of the current study is to evaluate non-experts' skill in making efficient use of core digital media interaction functionalities through empirical examinations of tools aided by artificial intelligence, including ml5.js and Ready Player Me. The empirical examinations are carried out to find out whether the current AI tools have actually mitigated the problem faced during the practical use of digital media technologies. The core areas of interest include: completion of tasks, understanding of the tools, reliance on knowledge from previous programming, and individual intuitions and perceptions met during use.

3.2 Experiment Participants

This paper recruited two participants without any prior experience in program development, who were both digital media design and interaction design students. They had a bit of creative knowledge but no formal training in developing programs systematically. Before the experiment started, all participants filled out a background form to check on their programming knowledge, experience with the use of AI tools, and knowledge of digital media interaction principles. The whole experiment was video-recorded, and oral permission was obtained from all participants.

3.3 Tool Platform Description

So that the experimental study is carried out on a sustainable scale, two well-known open-source platforms concerning artificial intelligence were selected:

ml5. A client-side machine learning library meant for progressive developers, featuring pre-trained models that can be used for functions like gesture recognition and image classification. The library itself can be called from HTML and JavaScript. Invocation by these technologies is simple, making it suitable for the creation of interactive demos in a browser environment.

Prepared Player Me. A cross-platform virtual character generation tool that supports custom avatar and animation binding. Users can upload selfies to generate 3D character models and can realize simple animation control in Unity and other platforms through the web interface, which is suitable for MR and virtual interactive scene construction.

3.4 Experimental Task Design

Members are obliged to engage in the following two activities:

Task 1 (based on ml5.js): Create a gesture recognition interaction prototype aimed at starting or stopping video playback by waving the hand.

Task 1 (using ml5.js): create a prototype that is operable via hand movement interaction- i.e., "waving a hand to play/stop video playback."

Task 2 from Ready Player Me: Create a digital avatar that can modify its behaviors, like waving or nodding, on a web page based on users' interactions, as when a button is clicked.

Character generation, loading, and the associated logic that drives actions are illustrated and incorporated via a friendly web interface.

In order to reduce information interference, participants only received absolutely necessary training materials and legitimate platform links; no encrypted templates were provided, and participants were expected to figure out the rationale themselves for making use of the tools.

3.5 Methods for Collecting and Assessing Data

Table 1 shows the empirical information will be collected and analyzed using the following methodologies

Table 1: Empirical Data Collection and Analysis Methods.

Data Collection Tools	Recorded/Measured Content	Instructions	Example Questions/Variables	Measurement Methods
Observation Chart Sheet	Time to complete tasks - Problems encountered - Help needed - Frequency of debugging incidents	Researchers recorded the experiment in real time.	"Task 1 took 35 minutes" "I encountered a model loading error"	Process observation + record sheet
Participant Survey (Post-experiment Questionnaire)	Using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), measures: 1. Tool effectiveness 2. Understanding of operating procedures 3. Necessity of programming 4. Perceived creative freedom 5. Overall satisfaction with AI tools	Quantitatively measured participants' subjective feelings.	"I was able to complete the task successfully" "I understood how the interactive features work"	Questionnaire (5-point Likert scale)
Semi-Structured Interviews	Deepen understanding of user experience and perception	The recordings were transcribed and coded for analysis.	Which components were the most difficult? Which areas were the most challenging? What was the main problem that was effectively solved? Have you noticed a decrease in the technical barrier to entry? Are you willing to continue using AI tools in the future?	Face-to-face/online interviews + qualitative analysis

A mixed-methods design will be utilized, combining both quantitative and qualitative data analysis methods.

Quantitative evaluation:

Compare the data for task completion time and the self-assessment scale for the two participants.

Recognize the key aspects, such as the assignment fulfillment, use of the code, and the level of independence observed when carrying out the task.

Qualitative analysis:

Coding interviews aim to detect essential issues, misconceptions concerning thought processes, and positive assessments.

Assessing the validity of people's beliefs related to the claim that "AI diminishes barriers to progress."

Its purpose is to assess the performance of AI-assisted tools for first-time programmers through the analysis of participants' actions and self-assessment.

4 ANALYSIS OF EMPIRICAL RESULTS (FINDINGS AND RATIONALE)

4.1 Brief Description of the Experimental Methodology

This paper recruited two participants with no formal programming backgrounds (hereafter referred to as P1 and P2), one of whom was studying digital media and the other graphic design; neither of the participants had received any formal programming training. After a questionnaire was used to collect basic background information, the participants each went through a step-by-step procedure involving two experimental tasks:

First is using ml5.js to enable gesture recognition for the control of video playback on a web page;

Second is creating virtual characters using Ready Player Me and controlling their actions with web buttons.

4.2 User Task Completion

Table 2 shows the task Completion and Support Requirements of Participants. Observations revealed that both participants completed the tasks on assignment within the duration; however, Participant 2 had rational challenges (like setting up the resource file path) getting through to Ready Player Me, but managed to complete the task with a gentle push from the researcher.

4.3 Analysis of Questionnaire Results

As shown in Table 3, the average score trend graph illustrates that:

Has a high overall satisfaction and ease of use rating (mean value 4.4), indicating that AI tools are effective in reducing the burden of operation.

Has the lowest rating for "understanding of system principles" (mean value 2.5), reflecting that the black-box phenomenon of "only using but not understanding" is common among non-professional users. The lowest rating for "understanding of system principles" (mean value 2.5) reflects that non-professional users generally have the black box phenomenon of "only using but not understanding".

Table 2: Task Completion and Support Requirements of Participants

Indicator	P1	P2
Did Task 1 (Gesture Recognition)	independently completed	Independently completed
Did Task 2 (Virtual Characters)	independently completed	Required some technical assistance
Time spent on Task 1 (min)	35 min	45 min
Time spent on Task 2 (min)	40 min	60 min
Need to write code	(call predefined APIs + modify parameters)	(Try to copy the code and debug the structure.)
Need Documentation or guidance required	Documentation consulted 1 time	Multiple times and in consultation with the researcher

Table 3: The following are the Likert scale scores (1-5, higher means higher agreement)

Questionnaire items	P1	P2
Q1: I was able to complete the main functions of the system independently	5	4
Q2: The difficulty of the task was within my understanding	4	3
Q3: I basically didn't need to write any code	5	4
Q4: The tool interface is user-friendly and quick to get started	4	4
Q5: It's easier than the traditional way	5	5
Q6: I understood how the interactive functions work	3	2
Q7: I was satisfied with the results	4	4
Q8: I'm willing to continue to use it in the future	5	4
Q9: I think that the AI tool lowered the technical threshold	5	4
Q10: I am uncomfortable with the “black box” mechanism	2	3

Table 4: The following key findings were compiled from the semi-structured interviews.

Topics	Excerpts from user feedback
Ease of use of the tool	"It's like putting together building blocks, as long as you know which pieces work."
Main difficulties	"I'm stuck not knowing how to get the model to load."The Documentation is too long, I don't want to read it."
Need to write code	"Although I copied a few lines of code, I didn't write it; I just followed the tutorial and changed the path."
Sense of control and understanding	"The functionality works, but I don't quite know why it works."
Willingness to use in the future	"Very practical! I'd like to use it again in a class project later."

4.4 Generalization of Interviews

Table 4 shows the following key findings were compiled from the semi-structured interviews. Overall, the interviews showed that AI tools have good “task accessibility,” but users generally view them as ‘toolboxes’ rather than “development platforms,” and lack a deep understanding of model parameters and system logic. However, users generally viewed it as a “toolbox” rather than a “development platform” and lacked a deep understanding of the model parameters and system logic

4.5 Testing

Research findings show that those who do not hold specialized knowledge can use tools powered by AI without human intervention to perform simple tasks involving interaction. Additionally, resolutions can be achieved for simple problems by reading Documentation or collecting information from others.

Artificial intelligence tools have significantly reduced the accessibility hurdles of coding and system development, especially in the areas of gesture recognition and virtual character creation.

However, the participants showed limited awareness of the basic principles and logic governing interactions, which is characteristic of an orthodox "black-box use" practice.

AI tools perform well in the aspect of “assisted creation”, but the participants' understanding of the interaction logic and technical principles is still weak; AI tools perform well in the aspect of “assisted creation”, but the participants' understanding of the interaction logic and technical principles is still weak. AI tools perform well in “assisting creation”, but there is still room for improvement in “technical education”.

5 DISCUSSION AND IMPLICATIONS (DISCUSSION AND IMPLICATIONS)

5.1 Whether AI Tools Truly Lower the Threshold of Digital Media Development

Experiment outcomes show that users who had no prior experience with programming were able to successfully run virtual character control and gesture recognition tasks within a short period. This result suggests that artificial intelligence libraries like ml5.js and Ready Player Me have meaningfully reduced the barriers to the use of digital media interaction technologies. In the past, acting out similar functions required a high level of expertise in image recognition algorithms, 3D modeling, and script programming; however, in this case, participants could carry out basic functionalities using built-in APIs and graphical interfaces.

However, empirical data and findings from interviews revealed one other dimension: while participants cited greater convenience when using the tool, they mostly lacked understanding from the ground up of the principles regulating its function, and a lack of information on the motivation behind the inclusion of certain functionalities. Thus, this suggests that tools driven by artificial intelligence mainly reduce the 'barrier to creating superficial results,' but the 'barrier to understanding and learning the technology' endures.

5.2 Usability and Its Connection to the Black Box Problem

The questionnaire results show that a significant percentage of respondents view AI tools as” user-friendly, quick," and significantly better than traditional development methods, since the mean response for question 5 was 5. For question 6,

however, which asked about the statement “I understand how the interaction functions work,” the mean responses were significantly lower at 2.5. This difference highlights the widespread “black box problem” in AI tools: people can use sophisticated models without having an idea of the underlying principles and limitations that drive them.

One promising pathway to addressing the black-box problem is the adoption of Explainable Artificial Intelligence (XAI). Mathew emphasizes that XAI is evolving toward enhancing model interpretability and user cognitive understanding, with the primary aim of making model decision-making processes more transparent (Mathew, 2025). Bauer further finds that providing feature-based explanations significantly improves users’ comprehension and information-building capabilities, thereby altering their trust and usage attitudes toward AI systems. These insights suggest that integrating XAI elements into AI-driven media tools, such as ml5.js and Ready Player Me, could not only improve usability but also strengthen users’ cognitive control and trust in the creative process (Bauer, K., 2023).

The imbalance between the "enthusiasm for application" and the "lack of awareness" can lead to greater adoption of the technology by creators and, in the process, compromise their capacity to apply the required changes for reasons of either complex demands or restrictions from the tools. It is important to recognize this point in both educational and professional environments.

5.3 the Implications for Digital Media Education

Results from this experiment show two major implications for pedagogical procedures:

First is artificial intelligence tools could provide an accelerated verification system for teaching methods and learning experiences.

People who have minimal experience or backgrounds other than engineering can make use of tools involving artificial intelligence to expedite the construction of interactive prototypes over a short period, shortening the amount of time normally needed, indeed, a factor of significant value for innovation and discovery work.

Second is the continuation of the dimension of "technical understanding" is also critical.

Over-reliance upon the use of tools reduces the ability of experienced users to cope with complex technical nuances. Therefore, it becomes necessary for machine learning tools to include unambiguous explanations of algorithmic concepts in pedagogical environments so that learners can grasp essential recognition processes and data-flow reasoning and thus develop into effective "system designers" and not just as "tool operators."

5.4 Considerations for Future Tool Development and Industry Practice

Relative to industry procedures, the fading barriers to the use of tools for artificial intelligence will increasingly promote the democratization of design procedures, consequently making a larger audience for nontechnical creatives to work on projects focused on digital media and interaction design. The development is expected to promote a revolution in team dynamics, where artists and designers handle tasks concerning prototyping, and tech creators focus on refining complex systems.

However, the situation requires additional requirements in the creation of artificial intelligence tools:

Improving transparency: Increased visual feedback during model runs is crucial for supporting users in understanding the underlying functional principles of the tool.

Modularization involves providing "plug-and-play" modules suited for beginners, as well as for others who already have a grounding, to tune parameters with increased specificity. Educational congruity: Convey pedagogical examples and first-hand activities focused on developing innovative learning to minimize the learning process duration.

5.5 Constraints and Potential Directions for Future Research

The constraints on the results are the comparatively small sample size, comprising only two nonspecialist participants, and the relatively simple tasks used. As a future direction, possible expansion can be made in a number of different ways:

Recruiting more diverse user groups (e.g., different professional backgrounds or age groups);

Including increasingly complex task scenarios, which involve multimodal interaction and interaction in mixed reality environments;

Integration of vast observations is needed to study the learning trajectories and competencies development of the users while working on tools embedded with artificial intelligence.

Artificial intelligence technology has greatly reduced the obstacles to the initial creation of digital media interactive technologies, but this feeling of "empowerment" is limited, since it mostly focuses on

rapid implementation and prototyping. While AI is a solid helper for creators, it by no means eliminates the need for technical reasoning and creative control. Educators and tool developers need to strike a balance between "user-friendliness" and "transparency."

6 CONCLUSION AND PROSPECTS FOR FURTHER RESEARCH

6.1 Research Summary

This study investigated whether non-experts can effectively use AI tools, specifically ml5.js and Ready Player Me, to lower development barriers in digital media interaction. Two participants without programming backgrounds were asked to complete gesture recognition and virtual character control tasks, with data collected through observation, surveys, and semi-structured interviews. The results show that AI tools significantly reduced the difficulty of implementing these functions, allowing participants to complete tasks—typically requiring advanced technical skills—quickly and without substantial external support. However, despite their operational success, participants demonstrated limited understanding of the underlying system principles and tended to treat the tools as "black boxes." This indicates that AI tools reduce the operational threshold but not the cognitive threshold, and thus do not fully replace the need for technical comprehension.

6.2 Responding to the Research Questions

The findings respond directly to the three research questions. First, non-experts could complete gesture recognition and virtual character tasks independently or with minimal assistance, confirming that AI tools can support productive outcomes without deep technical skills. Second, while most functions were accessible through graphical interfaces and API calls, basic programming knowledge was still required to understand parameter structures and logical workflows. Third, participants rated the tools highly in usability but low in comprehension of underlying model logic, suggesting a gap between functional use and conceptual understanding.

6.3 Significance and Practical Application of Research

This study provides empirical evidence to address the scholarly question of how AI empowers nontechnical creators. For education, AI tools can serve as effective entry points for beginners in interaction design, provided they are accompanied by instruction in basic technical reasoning to maintain users' creative control. The results highlight tool developers' need to design platforms with more precise feedback mechanisms and greater model transparency to enhance users' cognitive control. The findings suggest that future workflows may increasingly adopt a "creator × tool platform" model in the creative industries. AI tools function as collaborative partners, reshaping production processes and expanding participation.

6.4 Research Limitations and Future Directions

Several limitations must be acknowledged. The small sample size limits the generalizability of the findings, and the tasks designed for this study were intentionally simplified, excluding more complex scenarios involving multimodal interaction, collaborative networks, or persistent data handling. Furthermore, the study was short-term and did not assess participants' skill development over time. Future research should address these gaps by expanding the sample size and diversity, introducing tasks of greater complexity, and conducting longitudinal studies to explore the long-term effects of AI tool use on technical competence, learning motivation, and creativity. Additionally, further work could investigate the integration of speech recognition, natural language processing, and other multimodal AI technologies to extend the scope of AI-assisted digital media interaction.

7 CONCLUSIONS

The advent of technological innovations fueled by artificial intelligence is drastically transforming the ground of digital media creation from a developer-centric model to a creator-centric model. This has significantly reduced the technical barriers that once restricted new creators, enabling them to use sophisticated interactive media technologies without requiring in-depth programming knowledge. The findings of this study suggest that AI-augmented tools

not only enhance creativity horizons but also enhance efficiency at all stages of development, thus enabling users to focus more on design thinking and creating innovative content.

Despite these advantages, a considerable gap exists between usability and a thorough cognitive understanding of the underlying technologies. This means that while artificial intelligence tools have the potential to supplement the skills of authors, they need to go hand-in-hand with pedagogical efforts focused on enhancing technical and critical literacy.

In short, this research highlights the importance of working with AI-powered tools as an insightful turning point and not a definitive result. Introducing such tools to real-world applications and teaching methodologies might develop a more diverse and creative environment for creativity and foster further experimentation, interdisciplinarity, and the continuous evolution of interactive digital media.

Future research activity could investigate the long-term effects of outputs from artificial intelligence on the development of user competencies, independence, and novel methodologies. Comparison of studies across different cultural and disciplinary backgrounds could produce a more sophisticated understanding of these tools' reception, adoption, and reinterpretation across broad user populations.

REFERENCES

Bauer, K., von Zahn, M., & Hinz, O. (2023). Expl (AI) ned: The impact of explainable artificial intelligence on users' information processing. Information Systems Research, 34(4), 1582-1602.

Billinghurst, M., Clark, A., & Lee, G. (2015). A survey of augmented reality. Foundations and Trends® in Human–Computer Interaction, 8(2-3), 73-272.

Burrell, J. (2016). How the machine 'thinks': Understanding opacity in machine learning algorithms. Big Data & Society, 3(1), 2053951715622512.

Lee, H., & Ko, Y. (2022). Integrating AI tools in design education: Opportunities and challenges. International Journal of Art & Design Education, 41(1), 122–135.

Lugaresi, C., Tang, J., Nash, H., McClanahan, C., Uboweja, E., Hays, M., ... & Grundmann, M. (2019). Mediapipe: A framework for building perception pipelines. arXiv preprint arXiv:1906.08172.

Manovich, L. (2020). AI and the future of creativity. AI & Society, 35(2), 173–182. Retrieved from https://api.pageplace.de/preview/DT0400.9781000924787_A46597486/preview-9781000924787_A46597486.pdf

Mathew, D. E., Ebem, D. U., Ikegwu, A. C., Ukeoma, P. E., & Dibiaezue, N. F. (2025). Recent emerging techniques in explainable artificial intelligence to enhance the interpretable and understanding of AI models for human. Neural Processing Letters, 57(1), 16.

McCarthy, L. (2019). ml5.js: Friendly Machine Learning for the Web. Retrieved from https://ml5js.org [Accessed 7 Aug. 2025].

Upadhyaya, N. (2023). Low-Code/No-Code platforms and their impact on traditional software development: A literature review. No-Code Platforms and Their Impact on Traditional Software Development: A Literature Review (March 21, 2023).

Wachs, J. P., Kölsch, M., Stern, H., & Edan, Y. (2011). Vision-based hand-gesture applications. Communications of the ACM, 54(2), 60-71.

Wolf3D. (2021). Ready Player Me: Cross-game Avatar Platform. Retrieved from https://readyplayer.me [Accessed 7 Aug. 2025].

Yan, Z. (2021). The impacts of low/no-code development on digital transformation and software development. arXiv preprint arXiv:2112.14073.