



# Generative Artificial Intelligence and Metaverse: Future of Work, Future of Society, and Future of Humanity

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**Abstract.** The rapid development of Generative Artificial Intelligence (GenAI) and the emergence of the Metaverse are dynamically reshaping our lives and societies. GenAI can enhance the development of Metaverse and empower the applications in Metaverse. Metaverse is also an excellent environment for GenAI to demonstrate its power and usefulness. This interwoven relationship fuels the potential of integrating GenAI and Metaverse. The paper discusses the integration potential of GenAI and Metaverse from four aspects. We further investigate how GenAI, Metaverse, and the integration of GenAI and Metaverse can reshape our future across the realms of work, society, and humanity. This paper offers theoretical and practical contributions by proposing research directions and specific research questions. Academic researchers can glean insights for future research and generate novel topics based on our findings. Policymakers, technical experts, and professionals across industries can gain a comprehensive grasp of GenAI and the Metaverse, enhancing their ability to adapt and contribute effectively to this emerging wave of innovation.

**Keywords:** Generative AI · ChatGPT · Metaverse · Research directions

## 1 Introduction: Generative Artificial Intelligence and Metaverse

### 1.1 Generative Artificial Intelligence

Artificial Intelligence (AI) is advancing exponentially and reshaping our world in unprecedented ways [1, 2]. Various AI applications, like virtual voice assistants, autonomous vehicles, and AI translators, have been integrated into our daily lives [3]. People are increasingly accustomed to interacting with these transformative technologies. However, a groundbreaking advancement in the ongoing AI revolution has emerged that has once again subverted our imagination – ChatGPT. ChatGPT represents the latest frontier of AI technologies and has become a hot topic since its advent. The impact of ChatGPT has extended far beyond conventional AI applications, leading us to the concept of Generative AI (GenAI).

GenAI is defined as a class of AI technologies that can generate new content in various forms, such as text, images, and audio, from existing training data [4, 5]. Compared to

traditional AI algorithms that mainly focus on prediction, classification, or optimization tasks, GenAI shows superior abilities and great potential in terms of creativity and intelligence. Currently, the text-generation capability of GenAI is the most well-known. Represented by ChatGPT, which is built based on large language models (LLMs), GenAI applications can engage in dynamic conversations with humans to constantly learn from users and adapt responses to users. The text generation ability of GenAI not only supports a more interactive and human-like conversation between AI and human but also provides great help in code writing, literary creation, and many other fields.

Although the ability and potential of GenAI promise a bright future, the evolution of GenAI remains in its nascent stages, facing realized and unrealized challenges. Concerns about the accuracy and originality of AI-generated content encompass various domains. The ability of current GenAI algorithms to generate images, audio, and other forms of content also remains relatively constrained. Beyond these technical aspects, broader considerations such as organizational adoption and integration, trust, ethical considerations, legal framework, and other social concerns (e.g., labor force substitute) are critical subjects that demand attention and research [6, 7].

## 1.2 Metaverse

The concept of Metaverse has gained prominence with Facebook's rebranding to Meta, signaling the emergence of a new digital frontier. However, Metaverse's precise definition and contours remain subjects of ongoing exploration among practitioners and researchers. Despite this evolving landscape, the swift evolution of information technologies—spanning Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), Generative Artificial Intelligence (GenAI), cloud computing, and blockchain—has paved the way for the promising potential of the Metaverse to be realized.

The definition of the Metaverse varies from a narrow lens to a sweeping landscape. It encapsulates everything from immersive virtual environments that mimic the real world to expansive, interconnected digital realms that transcend physical constraints [8]. This breadth signifies the potential for the Metaverse to reshape many aspects of our lives, including social interactions, entertainment experiences, healthcare provisions, education systems, and economic activities [9–11].

Metaverse and its predecessors, such as Second Life, describe a unique and transformative vision of our future [12, 13]. GenAI, along with other advanced technologies, can provide strong support to build the expansive canvas of Metaverse. Simultaneously, the broad landscape of Metaverse serves as a dynamic arena that can guide the development of GenAI and other technologies. This research is dedicated to unraveling the potential integrations of GenAI and the Metaverse, investigating their capacity to reshape facets of our future encompassing work, society, and humanity. We identify and highlight key challenges that might emerge throughout the process, providing directions for both practical implementations and future research directions.

## 2 Current Development of GenAI and Metaverse

### 2.1 Practical Applications

**GenAI.** While Open AI commands considerable attention because of the development of ChatGPT, a variety of other GenAI companies and startups (e.g., Hugging Face, LangChain, AssemblyAI) are also dedicated to creating a diverse array of GenAI applications [14]. These applications span an extensive spectrum, ranging from AI assistants and code generation tools to character animation in media and even drug discovery in healthcare.

The adoption of GenAI in organizations is experiencing an accelerated surge. In a span of less than a year since the debut of many of these tools, one-third of companies have utilized GenAI in at least one business function [15]. However, this adoption trend is still concentrated in a few specific business domains. While this surge of innovation holds considerable promise, it also introduces a range of accompanying risks that companies may find challenging to navigate. Some factors include addressing employee training and reskilling, the recruitment roles performed by AI, managing shifts in workforce size, and dealing with various other complexities of transition. These considerations demand substantial attention and commitment from both companies and employers.

**Metaverse.** The Metaverse's defining characteristic is its expansive and interconnected nature, encompassing a diverse array of virtual spaces, social platforms, and digital ecosystems that facilitate user creativity, exploration, and interaction [16]. This interconnectedness fosters new pathways for social interactions, content creation, commerce, and even work [17].

Businesses and industries are recognizing the potential of the Metaverse. Companies are exploring how to leverage the Metaverse for marketing, brand enhancement, virtual events, and customer engagement [18]. The entertainment industry is embracing the immersive storytelling and interactive experiences of the Metaverse that blur the lines between fiction and reality. However, the current state of Metaverse development is still somewhat constrained, with its full potential as a broad and interconnected landscape yet to be fully realized due to technological limitations. While certain companies like Gucci, Adidas, Puma, and Prada have utilized the Metaverse concept to build virtual commerce and entertainment platforms, achieving a fully immersive experience and an interconnected virtual society remains challenging. Other challenges also remain, including concerns about privacy, data security, ethical considerations, and accessibility. As the Metaverse continues to develop, addressing these challenges will be essential to ensure responsible and inclusive growth of Metaverse.

### 2.2 Research Topics

Researchers are actively investigating emerging research topics within the realms of GenAI and the Metaverse. Both fields are witnessing substantial attention in technological innovation, adoption, and utilization, as well as their impacts across different domains, including education, economy, healthcare, and society. Moreover, identifying emerging opportunities and challenges has become a focal point.

From the IT design perspective, efforts extend beyond algorithm enhancements to encompass the integration of multiple technologies. A strong emphasis is placed on human-centered design [19], ensuring that the interfaces of GenAI, Metaverse environments, and user avatars are carefully designed to enhance user experience.

One of the transformative effects of GenAI and Metaverse is the reshaping of social interactions. This includes interactions between humans in both the real world and the Metaverse and between humans and AI applications in both contexts. Research focusing on these evolving social dynamics is also gaining significant attention [20, 21].

The combined influence of GenAI and Metaverse introduces novel opportunities and challenges to various industries. Take education as an example. As educational institutions adopt varying strategies concerning AI and GenAI emergence, the question of how to effectively harness AI and GenAI's potential for education while ensuring proper education integrity and quality becomes an urgent area of research [22].

### **3 Potential of Integrating GenAI into Metaverse**

#### **3.1 Harnessing Rich Data in Metaverse**

GenAI is built and evolved based on a large amount of training data. The quality and quantity of data impact the quality of AI-generated content. Metaverse, as a vast landscape of interconnected digital worlds, encompasses immense data that can serve as foundations to support diverse GenAI applications.

Available data in Metaverse covers user behaviors, social interactions, user-generated content, economic transactions, and many others. Compared to the real world, data in Metaverse has some advantages that differentiate it from its real-world counterparts, including accessibility, comprehensiveness, real-time nature, accuracy, and low cost. For instance, user behavior data, like movement patterns, dialogue content, communication styles, and other detailed information, are easier to collect and have great potential to be integrated into GenAI applications. These data enable the development of GenAI applications with diverse and high-quality functions to redefine digital experiences in Metaverse.

#### **3.2 Capitalizing the Dynamic Nature of Metaverse**

Ever-evolving environments, activities, functions, and digital characteristics differentiate Metaverse from the real world. The dynamic nature of Metaverse creates more diverse and constant content demands, aiming at satisfying user preferences and improving user experiences. Therefore, Metaverse is an environment for GenAI to realize its potential and deliver substantial value.

GenAI enables real-time adjustment and continuous optimization of various elements in Metaverse. By leveraging real-time data on user behaviors and interactions, GenAI gains insights into user preferences, enabling the creation and updating of content that aligns with user needs. Examples of GenAI's learning dimensions include users' conversational styles, clothing choices, work patterns, investment inclinations, risk attitudes, and consumption habits. Consequently, workspace aesthetics, conversational avatar dialogue, sales appearances, investment advice, product recommendations, and more can be continuously fine-tuned to elevate user experiences.

### 3.3 Enhancing Ubiquitous Human-AI Interactions in Metaverse

AI applications occupy a broad and universal scope in the diverse landscape of Metaverse. How to enhance ubiquitous human-AI interactions in Metaverse remains a central concern. The integration of GenAI presents a promising avenue.

First, AI-generated text supported by Natural Language Processing (NLP) has a broader application range in Metaverse. Given that most users may be unfamiliar with virtual environments, various chatbots, service assistants, and other interactive characters are essential to help users easily adapt to various settings and effectively conduct various activities. With GenAI, the interface mechanisms, such as Avatars or applications, can better understand user requirements and respond to users with natural and human-like language.

Second, GenAI creates new possibilities in avatar creation. As user interfaces play a considerable role in human-AI interactions, GenAI's image and audio generation potential can be fully capitalized in AI avatar generation. AI avatars with various appearances, demographic information, clothing styles, languages, accents, and other characteristics can be rapidly created to achieve optimal interaction effects in various contexts. The combination of AI-generated texts in AI avatars can shape AI avatars in Metaverse to be as realistic as real humans.

### 3.4 Enabling Collaborative Creation in Metaverse

Metaverse empowers users to create and build their own worlds. This power of creation extends to personalized environmental elements such as avatars, literary compositions, and artistic expressions. Integrating GenAI with Metaverse can provide multi-aspect assistance in user content generation.

For instance, GenAI can simplify the user creation process and extend the creation scope. By aiding users with GenAI-powered suggestions, templates, and prompts, creating personalized content is easier. Thus, users can be empowered to generate a broader range of content in Metaverse. The collaboration between users and GenAI in Metaverse will effectively reduce users' entry barriers to Metaverse and increase user confidence to explore the new domain, thus leading to a more inclusive and accessible creative environment.

Further, the collaboration of humans and GenAI can augment the creativity of both humans and GenAI. The interplay between human ingenuity and AI-augmented insights creates a virtuous circle to constantly foster innovation and fuel continuous development and evolution in Metaverse.

## 4 Research Directions and Research Questions

The swift evolution of technology is reshaping our world at an unprecedented pace. In particular, GenAI and Metaverse are immensely promising fields and offer great potential to promote profound transformations across diverse dimensions. They are changing individual lifestyles, altering work environments and modes, redefining social interactions, revolutionizing industries, and even propelling humanity into a future depicted in

science fiction. In this section, we discuss how GenAI and Metaverse may shape the future of work, the future of society, and the future of humanity. We summarize several research directions and list specific research questions for future research. We further propose research questions to support the integration of GenAI and Metaverse.

#### 4.1 Future of Work

**Table 1.** Research directions regarding future work.

Field	Research questions
<b>GenAI</b>	<p><b>Organizational adoption and use</b>            How do we design GenAI systems to enhance organizational adoption of GenAI in operations?            How do we integrate GenAI into the existing information systems of companies?</p>
	<p><b>Labor force substitution</b>            Will GenAI replace creative jobs?            How do we create more job opportunities utilizing GenAI?</p>
	<p><b>Human-AI collaboration</b>            How do we use GenAI to enhance employee creativity?            How do we avoid employees being over-dependent on GenAI at work?</p>
<b>Metaverse</b>	<p><b>Virtual workspace</b>            What kinds of environmental factors (e.g., layout, presence of objects, accessibility) influence employees' work efficiency in Metaverse?            What kinds of entertainment components (e.g., gamification) can enhance employees' productivity in Metaverse?</p>
	<p><b>Virtual avatar</b>            How do we design effective avatars?            How can AI avatars be used to enhance human-AI interactions in Metaverse?</p>
	<p><b>Virtual collaboration</b>            How do we effectively incorporate AI in a virtual work team?            How do we empower human-AI collaboration in Metaverse to improve collaboration efficiency?</p>

Embracing the future of work reshaped by GenAI and Metaverse can benefit both individuals and organizations. On the one hand, these cutting-edge technologies provide novel opportunities for personal career development and contribute to company growth.

Individuals who understand these advanced trends are more likely to be aware of promising job opportunities and be more competitive than others. Companies are increasingly seeking to utilize the power of GenAI and Metaverse to augment their workforce, reduce labor costs, and bolster performance. However, how to seize and leverage these opportunities is a critical and tough task, as a blind pursuit of advanced technologies and trends can yield unintended consequences.

On the other hand, potential risks come along with the advantages. Novel challenges arise that traditional approaches might not readily address due to the distinctive characteristics of these technologies. Therefore, constant effort is imperative to identify risks and mitigate any adverse impact proactively. In Table 1, we propose feasible research directions that need attention from researchers and practitioners to unlock the potential of GenAI and Metaverse better.

## 4.2 Future of Society

**Table 2.** Research directions regarding future society.

Field	Research questions
<b>GenAI</b>	<p><b>Education</b></p> <p>What are the most suitable GenAI adoption strategies for educational institutions of different disciplines, categories, and levels?</p> <p>How do we regulate students' use of GenAI to increase learning efficiency and encourage active thinking and creativity?</p>
	<p><b>Finance</b></p> <p>How can GenAI be integrated into other financial technologies to create more innovative financial tools?</p> <p>What are effective collaboration strategies for financial practitioners and GenAI to improve financial services?</p>
<b>Metaverse</b>	<p><b>Education</b></p> <p>How do we combine traditional physical teaching with virtual teaching in Metaverse to maximize student learning effect?</p> <p>How do we increase the creativity and critical thinking of students using Metaverse?</p>
	<p><b>Finance</b></p> <p>How do we support financial activities in Metaverse with traditional financial markets in the real world?</p> <p>How do we adapt legal structures in the real world to design a legal structure in Metaverse?</p>

Revolutionized technological advancement brings significant shifts across various industries and aspects of society. Education and economy serve as two important fields related to everyone in society. In this part, we discuss how GenAI and Metaverse shape the future of education and finance, identifying critical issues specific to the two domains that need to be solved in the future, as shown in Table 2.

## 4.3 Future of Humanity

**Table 3.** Research directions regarding future humanity.

Field	Research questions
<b>GenAI</b>	<p><b>Mental health</b></p> <p>What mental health problems may arise from the rapid technological changes that impact lifestyle?</p> <p>How do we focus on the central position of humans instead of AI applications?</p>
	<p><b>Discrimination and bias</b></p> <p>How can GenAI be used to provide targeted support and resources for vulnerable and marginalized groups to bridge existing societal gaps?</p> <p>How do we ensure that AI-generated content avoids reinforcing stereotypes and biases, especially in contexts like advertising, media, and content creation?</p>
<b>Metaverse</b>	<p><b>Mental health</b></p> <p>How do we encourage users to maintain offline social connections and nurture real-world relationships alongside virtual ones?</p> <p>How do we prevent users from overusing and becoming addicted to Metaverse?</p>
	<p><b>Discrimination and bias</b></p> <p>How do we ensure equal access to Metaverse and rich resources within Metaverse, particularly for individuals from marginalized populations, to prevent digital disparities?</p> <p>How do we regulate user-generated content and AI-generated content to avoid content containing social discrimination materials?</p>

Technological progress and societal transformation are intended to enhance human well-being. Thus, it is imperative to dedicate ample attention to the array of concerns associated with the future of humanity. These concerns serve as essential guidance for developing technologies to elevate human well-being while vigilantly averting any adverse impacts. We provide some noteworthy issues in Table 3.

#### 4.4 Integrating GenAI and Metaverse

We further list distinct research directions that deserve additional attention to successfully integrate GenAI and Metaverse, as shown in Table 4.

## 5 Conclusions

GenAI and Metaverse are rapidly changing our world. In this study, we investigate the potential of GenAI and Metaverse in shaping the future. We systematically review the current development of GenAI and Metaverse, including technology applications from the practical perspective and research topics from the academic dimension. Based on the comprehensive review of GenAI and Metaverse, we propose and discuss the potential of integrating GenAI and Metaverse. Finally, we describe how GenAI and Metaverse would reshape our work, society, and humanity. We also propose several research directions for each aspect. These research directions can provide insightful guidelines for the further development of technologies and societies.



This research makes both theoretical and practical contributions. Academic researchers can utilize the research directions identified to conduct significant future research and contribute to the development of GenAI and Metaverse. Policymakers, technical personnel, and practitioners from various industries can have a more comprehensive understanding of GenAI and Metaverse to better prepare for the future.

**Table 4.** Research directions regarding GenAI and Metaverse integration.

Field	Research questions
<b>GenAI-Metaverse</b>	<p><b>Data collection and use</b></p> <p>What components of Metaverse can be supported and improved by GenAI?</p> <p>What are effective methods to collect and aggregate minimal data from Metaverse so that only vetted information is used for GenAI training?</p>
	<p><b>Data privacy</b></p> <p>How do we integrate users' consent mechanism into Metaverse to ensure that the data usage in GenAI is transparent?</p> <p>How do we balance data privacy protection and high-quality user experience in the Metaverse?</p>
	<p><b>User experience</b></p> <p>How do we analyze user behavior in Metaverse to personalize where and how AI-generated content can best support user experiences?</p> <p>How do we ensure that AI-generated content is aligned with user-generated content and the overall context?</p>

## References

1. Siau, K., et al.: FinTech empowerment: data science, artificial intelligence, and machine learning. *Cutter Business Technology Journal* **31**(11/12), 12–18 (2018)
2. Wang, W., Siau, K.: Artificial intelligence, machine learning, automation, robotics, future of work, and future of humanity – a review and research agenda. *J. Datab. Manage.* **30**(1), 61–79 (2019)
3. Hyder, Z., Siau, K., Nah, F.: Artificial intelligence, machine learning, and autonomous technologies in mining industry. *J. Datab. Manage.* **30**(2), 67–79 (2019)
4. Nah, F., Zheng, R., Cai, J., Siau, K., Chen, L.: Generative AI and ChatGPT: applications, challenges, and ai-human collaboration. *J. Info. Technol. Case and Applicat. Res.* **25**(3), 277–304 (2023)
5. Sun, J., et al.: Investigating explainability of generative AI for code through scenario-based design. In: *27th International Conference on Intelligent User Interfaces*, pp. 212–228 (2022)
6. Siau, K., Wang, W.: Building trust in artificial intelligence, machine learning, and robotics. *Cutter Bus. Technol. J.* **31**(2), 47–53 (2018)
7. Siau, K., Wang, W.: Artificial Intelligence (AI) Ethics – Ethics of AI and Ethical AI. *J. Datab. Manage.* **31**(2), 74–87 (2020)
8. Greenbaum, D.: The virtual worlds of the metaverse. *Science* **377**(6604), 377 (2022)

9. Ma, Y., Siau, K.: Artificial intelligence impacts on higher education. In: Midwest United States Association for Information Systems (MWAIS 2018) **42**(5), (2018)
10. Yang, Y., Siau, K., Xie, W., Sun, Y.: Smart health: intelligent healthcare systems in the metaverse, artificial intelligence, and data science era. *J. Organizat. End User Comput.* **34**(1), 1–14 (2022)
11. Yousefpour, A., et al.: All one needs to know about fog computing and related edge computing paradigms: a complete survey. *J. Syst. Architect.* **98**, 289–330 (2019)
12. Eschenbrenner, B., Nah, F., Siau, K.: 3-D virtual worlds in education: applications, benefits, issues, and opportunities. *J. Datab. Manage.* **19**(4), 91–110 (2008)
13. Siau, K., Nah, F., Mennecke, B., Schiller, S.: Co-creation and collaboration in a virtual world: a 3D visualization design project in Second Life. *J. Datab. Manage.* **21**(4), 1–13 (2010)
14. CB Insights Research: GenAI 50: The most promising generative artificial intelligence startups of 2023, <https://www.cbinsights.com/research/generative-ai-top-startups-2023/>
15. Mckinsey & Company: The state of AI in 2023: Generative AI's breakout year | McKinsey, <https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-ais-breakout-year>
16. Uddin, M., Manickam, S., Ullah, H., Obaidat, M.A.: Abdulhalim dandoush: unveiling the metaverse: exploring emerging trends, multifaceted perspectives, and future challenges. *IEEE Access* **11**, 87087–87103 (2023)
17. Wang, Y., Siau, K., Wang, L.: Metaverse and human-computer interaction: a technology framework for 3D virtual worlds. In: International Conference on Human-Computer Interaction, pp. 213–221 (2022)
18. Schiller, S., Nah, F., Luse, A., Siau, K.: Men are from mars and women are from venus: dyadic collaboration in the metaverse. *Internet Research (to appear)*
19. Shneiderman, B.: Human-centered artificial intelligence: three fresh ideas. *AIS Trans. Human-Comp. Interac.* **12**, 109–124 (2020)
20. Davis, A., Murphy, J., Owens, D., Khazanchi, D., Ziguers, I.: Avatars, people, and virtual worlds: foundations for research in metaverses. *J. Assoc. Inf. Syst.* **10**, 90–117 (2009)
21. Hennig-Thurau, T., Aliman, D.N., Herting, A.M., Cziehso, G.P., Linder, M., Kübler, R.V.: Social interactions in the metaverse: framework, initial evidence, and research roadmap. *J. Acad. Mark. Sci.* **51**(4), 889–913 (2022)
22. Siau, K.: Education in the age of artificial intelligence: how will technology shape learning? *The Global Analyst* **7**(3), 22–24 (2018)