## Relationship of Artificial Intelligence, Advertising, and Generative Models

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Although artificial intelligence technologies have provided valuable insights into the advertising industry, more comprehensive studies that properly examine the applications of AI in advertising using scientometric network analysis are needed.

Keywords: generative AI advertising ; artificial intelligence advertising ; machine learning advertising ; bibliometrics ; full counting ; co-occurrence network analysis ; co-authorship network analysis

### 1. Introduction

Artificial intelligence (AI) has emerged as a disruptive force, driven by rapid technological advancements that harness sophisticated computing capabilities, intricate algorithms, and vast datasets. This enables machines to replicate human cognitive and emotional functions, autonomously performing tasks like problem-solving and reasoning <sup>[1]</sup>. The progression of AI has been a transformative force across various industries, including finance, healthcare, manufacturing, marketing, and more <sup>[2]</sup>. Through the lens of advertising, its progression was accelerated by dynamic shifts in advertising strategies, fundamentally transforming how brands interact with their target audiences. Today, advertisers leverage AI to craft personalized experiences, target specific demographics, and make quicker decisions <sup>[3]</sup>. The integration of AI into advertising represents a paradigmatic shift in contemporary marketing strategies.

One prominent aspect of AI in Industry 4.0 are generative models. These models foster real-time communication across equipment, software, and human operators, offering manufacturers immediate insight into key production processes <sup>[4]</sup>. One example is Generative Artificial Intelligence, commonly known as "Generative AI". It was introduced decades ago, but it is only in recent years that it has evolved rapidly. Much of the current discourse revolves around large language models and image-generation models, where these tools allow users to create articulate-sounding texts and compelling images using an English-language prompt which helps users generate content. This, however, is just one facet of the broader scope of Generative AI <sup>[5]</sup>. Today, it holds the potential to revolutionize how brands connect with their audiences, ushering in new advertising avenues. Generative AI utilizes extensive datasets comprising images, text, or other forms of data to generate fresh iterations of text, visuals, or predicted data at the user's request. The field of computer science propelling CNBC <sup>[2]</sup>, Forbes <sup>[8]</sup>, LinkedIn <sup>[9]</sup>, and Google Blogs <sup>[10]</sup> attested to the monumental impact of Generative AI on the advertising industry. It was said that artificial intelligence advertising spending across the globe in 2022 was estimated at \$370 billion, together with predictions of \$1.3 trillion in the next decade <sup>[11]</sup>. This burgeoning technology has revolutionized advertising endeavors, from the precision of targeted ads to the potential for dynamic content creation and even the nuanced analysis of images and videos for marketing purposes.

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#### 2.1. AI Applications in Advertising

Al has transformed the advertising industry through various means. It harnesses the ability of data-driven decision-making and processing <sup>[12]</sup>, and more. One notable technique is machine learning, which is the technique behind enhanced targeting accuracy as it can predict the most relevant advertisements for audiences rooted in pre-existing or contextual user data <sup>[13]</sup>. For example, the media streaming service Netflix employs a machine learning algorithm to curate customized content recommendations from viewers' past viewing habits and preferences <sup>[14]</sup>. Natural language processing (NLP) is a technique that empowers computers to comprehend and process human language. It analyzes and comprehends human language <sup>[15]</sup>. Within advertising, NLP is used in applications for sentiment analysis; these provide brands with invaluable insights concerning perception and enhanced customer feedback. For example, KLM (airline) programmed a chatbot to deal with customer queries [16]. Image recognition expands the capabilities of artificial intelligence to data visualization; it enables the identification of scenes and objects in images. It can support out-of-home (OOH) advertising agencies in acquiring maximum reach for their businesses by optimizing the panel's geospatial positioning following the detected traffic in the pedestrian area and optimizing the advertising content flashed on panels, as well as the response of people when they view it [17]. Predictive analysis, another advertising technique, provides better recommendations to users that allow them to maximize the value of the services and products presented to them, which results in a high-value proposition and customer satisfaction [18]. Unilever uses this technique through their app, "Flower", which uses AI to generate a human-like profile that can interact with users on social media platforms [19]. Following this, recommender systems, a cornerstone of AI-powered advertising known by many today, analyzes audience behavior to offer customized suggestions to enhance user experience and drive engagement. This is most prominent in e-commerce as it greatly benefits from applying informatics through this technique <sup>[20]</sup>. The culmination of deep learning further elevates the capabilities of artificial intelligence, specifically in image and speech recognition tasks. This technique is utilized across many social network platforms. Today, deep learning covers almost all techniques, from image classification to object detection, which can inform targeted advertising strategies <sup>[21]</sup>. Examples of this are Deep Mind, Wolfram Alpha, and Aysadi [22].

The Content Generation that generative models facilitate enables advertisers to craft compelling ad copies, blog posts, and social media content. For example, ChatGPT can generate content production through the help of deep learning to create more diverse forms of content that are provided in real time <sup>[23]</sup>. All these techniques collectively represent the arsenal of artificial intelligence tools that advertisers of all walks leverage to engage with audiences in more efficient, impactful, and personalized ways.

#### 2.2. Opportunities of Innovation in Advertising: Generative Artificial Intelligence

Generative artificial intelligence (Generative AI) stands as a pivotal advancement in machine learning, with contributions from various techniques such as general adversarial networks (GANs) <sup>[24]</sup>, variational autoencoders (VAEs) <sup>[25]</sup>, and diffusion models <sup>[26]</sup>. The idea behind Generative Diffusion Models (GDMs) stands out as it takes inspiration from thermodynamic diffusion processes, forging distinctive connections with score-based models <sup>[27]</sup> and stochastic differential equations <sup>[28]</sup>. As a subset within the category of diffusion models, GDMs demonstrate a unique method of data generation and highlight the outstanding capability to model intricate data distributions <sup>[29]</sup>.

On another note, VAEs contribute significantly to the landscape of Generative AI. Utilizing an encoder–decoder architecture, VAEs comprehend the underlying distribution of the input data and create new samples <sup>[30]</sup>. This technique has paved the way for Generative AI in various fields, including art, entertainment, design, and scientific research, positioning VAEs as a cornerstone in artificial intelligence.

The versatility and potency of GDMs are evident in their widespread adoption and application across various domains, particularly in AI-generated content (AIGC) realms. An illustrative example is stable diffusion <sup>[31]</sup>. It is an image generation application based on diffusion models, with an impressive daily user base exceeding 10 million, highlighting the practicality and widespread popularity of GDMs. In computer vision (CV), GDMs like Denoising Diffusion Probabilistic Models (DDPM) and Denoising Diffusion Implicit Models (DDIM) contribute to generating high-quality images from noise <sup>[32]</sup>.

The unique advantages of GDMs over other Gen AI methods contribute to their widespread adoption. Notably, GDMs exhibit high-quality data generation ability, flexibility, and simplicity of implementation. These characteristics amplify the versatility of GDMs, positioning them as a significant player in the landscape of Generative AI. Including GDMs and acknowledging VAEs in the discussion enriches the narrative, providing advertisers with a comprehensive suite of tools for tailored and compelling content creation strategies. This diversity redefines the landscape of audience interaction and brand communication, marking a transformative chapter in the evolving field of Generative AI.

#### 2.3. Intersections of Artificial Intelligence and Advertising

Artificial intelligence (AI) has ushered in a new era of innovation within the advertising landscape, offering various applications and tools that redefine personalization, content creation, and campaign optimization. The transformative technology is exemplified by creations like OpenAI's GPT-3 which was introduced by U.S. Research Institute <sup>[33]</sup>, showcasing the potential of Generative AI in dynamically tailoring content to suit individual preferences, thereby augmenting user engagement, ad creative development, and driving conversion rates <sup>[34]</sup>. Another noteworthy example is DALL-E, a creation by OpenAI, and Midjourney by Mid Journey Inc., both of which are generative models capable of

creating novel images from textual descriptions. These developments underscore the remarkable intersection and power of artificial intelligence and generative models in generating new and unique content, enhancing personalization, and revolutionizing advertising practices by leveraging neural networks and other machine learning methods <sup>[35]</sup>. The intersection is apparent but further study is needed to understand the prominent relationship of the two entities with the generative model sitting at the center of it.

#### References

- 1. De Bruyn, A.; Viswanathan, V.; Beh, Y.S.; Brock, J.K.-U.; von Wangenheim, F. Artificial intelligence and marketing: Pitfalls and opportunities. J. Interact. Mark. 2020, 51, 91–105.
- Dwivedi, Y.K.; Hughes, L.; Ismagilova, E.; Aarts, G.; Coombs, C.; Crick, T.; Duan, Y.; Dwivedi, R.; Edwards, J.; Eirug, A.; et al. Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. Int. J. Inf. Manag. 2019, 57, 101994.
- 3. Boddu, R.S.K.; Santoki, A.A.; Khurana, S.; Koli, P.V.; Rai, R.; Agrawal, A. An analysis to understand the role of machine learning, robotics and artificial intelligence in digital marketing. Mater. Today Proc. 2022, 56, 2288–2292.
- 4. Javaid, M.; Haleem, A.; Singh, R.P.; Suman, R. Substantial capabilities of robotics in enhancing industry 4.0 implementation. Cogn. Robot. 2021, 1, 58–75.
- 5. Euchner, J. Generative AI. Res. Technol. Manag. 2023, 66, 71-74.
- 6. Stokel-Walker, C.; Van Noorden, R. What ChatGPT and generative AI mean for science. Nature 2023, 614, 214–216.
- Vanian, J. How the Generative A.I. Boom Could Forever Change Online Advertising. CNBC. 2023. Available online: https://www.cnbc.com/2023/07/08/how-the-generative-ai-boom-could-forever-change-online-advertising.html (accessed on 21 September 2023).
- Marr, B. The Amazing Ways Coca-Cola Uses Generative AI in Art and Advertising. Forbes. 2023. Available online: https://www.forbes.com/sites/bernardmarr/2023/09/08/the-amazing-ways-coca-cola-uses-generative-ai-in-art-andadvertising/?sh=1db364092874 (accessed on 21 September 2023).
- Technavio. Artificial Intelligence (AI) Market: Insights on US, Canada, China, Germany, and UK—Forecasts and Trends. Available online: https://www.linkedin.com/pulse/artificial-intelligence-ai-market-insights-us-canada-chinagermany (accessed on 21 September 2023).
- Dischler, J. Introducing a New Era of AI-Powered Ads with Google. Google. Available online: https://blog.google/products/ads-commerce/ai-powered-ads-google-marketing-live/ (accessed on 21 September 2023).
- 11. Huh, J.; Nelson, M.R.; Russell, C.A. ChatGPT, AI Advertising, and Advertising Research and Education. J. Advert. 2023, 52, 477–482.
- 12. Baltezarevic, R. The Role of Artificial Intelligence in Digital Marketing. ResearchGate: Berlin, Germany, 2023.
- 13. Choi, J.; Lim, K. Identifying machine learning techniques for classification of target advertising. ICT Express 2020, 6, 175–180.
- 14. Gorgoglione, M.; Panniello, U.; Tuzhilin, A. Recommendation strategies in personalization applications. Inf. Manag. 2019, 56, 103143.
- 15. Kang, Y.; Cai, Z.; Tan, C.; Huang, Q.; Liu, H. Natural language processing (NLP) in management research: A literature review. J. Manag. Anal. 2020, 7, 139–172.
- 16. West, A.; Clifford, J.; Atkinson, D. "Alexa, build me a brand" An Investigation into the Impact of Artificial Intelligence on Branding. Bus. Manag. Rev. 2018, 9, 321–330.
- Costache, A.; Popescu, D.; Mocanu, S.; Ichim, L. Target audience response analysis in out-of-home advertising using computer vision. In Proceedings of the 2020 12th International Conference on Electronics, Computers and Artificial Intelligence (ECAI), Bucharest, Romania, 25–27 June 2020; 2020; pp. 1–6.
- 18. Enache, M. Al for Advertising. Ann. Dunarea Jos Univ. Fascicle I Econ. Appl. Inform. 2020, 26, 28–32.
- Vellasamy, T.S. 15 Companies Using Data Analytics in Marketing. 2021. Available online: https://www.linkedin.com/pulse/15-companies-using-data-analytics-marketing-sivabalan-vellasamy- (accessed on 21 September 2023).
- 20. Necula, S.; Păvăloaia, V. Al-Driven Recommendations: A Systematic review of the state of the art in E-Commerce. Appl. Sci. 2023, 13, 5531.

- 21. Park, C.W.; Seo, D.R. Sentiment analysis of Twitter corpus related to artificial intelligence assistants. In Proceedings of the 2018 5th International Conference on Industrial Engineering and Applications (ICIEA), Singapore, 26–28 April 2018.
- Dodgson, M.; Gann, D. Artificial Intelligence Will Transform Universities. Here's How. World Economic Forum. 2017. Available online: https://www.weforum.org/agenda/2017/08/artificial-intelligence-will-transform-universities-here-s-how/ (accessed on 2 February 2024).
- 23. Lv, Z. Generative artificial intelligence in the metaverse era. Cogn. Robot. 2023, 3, 208–217.
- 24. Goodfellow, I.J.; Pouget-Abadie, J.; Mirza, M.; Xu, B.; Warde-Farley, D.; Ozair, S.; Courville, A.; Bengio, Y. Generative adversarial networks. arXiv 2014, arXiv:1406.2661.
- 25. Kingma, D.P.; Welling, M. An introduction to variational autoencoders. Found. Trends Mach. Learn. 2019, 12, 307–392.
- Sohl-Dickstein, J.; Weiss, E.; Maheswaranathan, N.; Ganguli, S. Deep unsupervised learning using nonequilibrium thermodynamics. In Proceedings of the 32nd International Conference on International Conference on Machine Learning, Lille, France, 6–11 July 2015; pp. 2256–2265.
- 27. Song, Y.; Sohl-Dickstein, J.; Kingma, D.P.; Kumar, A.; Ermon, S.; Poole, B. Score-based generative modeling through stochastic differential equations. arXiv 2020, arXiv:2011.13456.
- 28. Peng, S. Stochastic Differential Equations; Springer: Berlin/Heidelberg, Germany, 2019.
- 29. Cao, H.; Tan, C.; Gao, Z.; Chen, G.; Heng, P.-A.; Li, S.Z. A survey on generative diffusion model. arXiv 2022, arXiv:2209.02646.
- Pranckutė, R. Web of Science (WOS) and Scopus: The titans of bibliographic information in today's academic world. Publications 2021, 9, 12.
- 31. Stability AI. Available online: https://stability.ai/ (accessed on 16 November 2023).
- 32. Song, J.; Meng, C.; Ermon, S. Denoising diffusion implicit models. arXiv 2020, arXiv:2010.02502.
- 33. Kim, S.Y.; Kim, B.Y. Big Data Analysis of AI News and Robot Journalism Trends. Int. J. Adv. Res. Eng. Technol. 2020, 11, 1395–1402. Available online: http://www.iaeme.com/IJARET/issues.asp?JType=IJARET&VType=11&IType=10 (accessed on 4 December 2023).
- 34. Sinha, M.; Healey, J.; Sengupta, T. Designing with AI for Digital Marketing. In Proceedings of the 28th ACM Conference on User Modeling, Adaptation and Personalization, Genoa, Italy, 14–17 July 2020.
- 35. Fezari, M.; Al-Dahoud, A.; Al-Dahoud, A. Augmanting Reality: The Power of Generative AI; University Badji Mokhtar Annaba: Annaba, Algeria; Al-Zaytoonah University: Amman, Jordan, 2023.

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