



# KONFERENCIAKÖTET

## Conference Proceedings

**Nemzetközi tudományos konferencia  
a Magyar Tudomány Ünnepe alkalmából**  
International Scientific Conference  
on the Occasion of the Hungarian Science Festival

**Sopron, 2023. november 23.**  
23 November 2023, Sopron

**FENNTARTHATÓSÁGI ÁTMENET:  
KIHÍVÁSOK ÉS INNOVATÍV MEGOLDÁSOK**  
SUSTAINABILITY TRANSITIONS: CHALLENGES AND INNOVATIVE SOLUTIONS

Szerkesztők / Editors:

OBÁDOVICS Csilla, RESPERGER Richárd, SZÉLES Zsuzsanna, TÓTH Balázs István

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## **A Generative AI and Neural Network Approach to Sustainable Digital Transformation: A Focus on Medical and Marketing Sectors**

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### **Abstract:**

Artificial intelligence (AI), in particular generative AI (GAI) and neural networks (NN), is emerging as a transformative force in the evolving landscape of digital transformation in industries such as medicine and marketing. The paper describes the actual and potential impact of AI on the advancement of sustainable practices in these areas through a theoretical study of existing research. Through case studies, from NN in medicine, e.g., skin cancer diagnosis to GAI in marketing strategy, we highlight current applications and challenges. Despite the undeniable capabilities of AI in these domains, there remains a dearth of research that links AI to tangible sustainability outcomes. Our findings on AI in marketing highlight its importance in enhancing branding, optimizing pricing, refining channels and personalizing promotions. Furthermore, the application possibilities of NN in medical are presented. Due to the high model quality in the field of cancer detection, diagnostic processes can be designed more efficiently by NN and thus staff shortages can be compensated cost-efficiently and patient-centered. However, while AI offers promising opportunities, it also requires an ethical, socially responsible approach, as underscored by recent studies. This research underscores the imperative of AI integration for holistic, sustainable outcomes in the medical and marketing sector.

**Keywords:** Artificial Intelligence, Generative Artificial Intelligence, Neural Networks, Sustainable Practices, Ethics and Social Responsibility

JEL Codes: Q55, L10, M31, I11, C45

### **1. Introduction**

Artificial Intelligence (AI) has emerged as a pivotal force in medicine and marketing, heralding transformative changes across these sectors. In medicine, AI's potential to improve medical diagnostics, treatment plans, and decision-making processes is increasingly recognized, as it adeptly identifies patterns in patient data, facilitates natural language processing, and supports sophisticated image analysis, automation, and predictive analytics (Davenport & Kalakota, 2019; Deng, 2014; Jiang et al., 2017; Wiens & Shenoy, 2018). At the same time, in marketing, AI-driven digital transformation is revolutionizing business operations, enhancing customer engagement, optimizing e-commerce platforms, and refining overarching strategies (Gołąb-An-drzejak, 2023). AI-powered tools, including chatbots and virtual assistants, are streamlining

service delivery and increasing personalization in customer interactions (Tinashe et al., 2022). In particular, Generative Artificial Intelligence (GAI) is increasingly being used in marketing for content personalization, market insight generation, and innovative content marketing strategies (Kshetri et al., 2023). The integration of AI technologies, particularly GAI and Neural Networks (NN), in these areas not only improves operational efficiency, cost savings, and brand image, but also drives long-term success and competitiveness (Nishant et al., 2020).

This paper aims to explore the intersection of AI and digital transformation, specifically focusing on the role of GAI in marketing and NN in medicine. We intend to address the following guiding research question: How can marketing and medicine achieve sustainable digital transformation using artificial intelligence? To answer this question, we will conduct a methodological meta-analysis of existing research to highlight the impact of AI in promoting sustainable practices in these sectors. Our research will include specific case studies – examining NN in skin cancer diagnosis and GAI in marketing – to illustrate their current applications and anticipate future implications and challenges.

To further refine our investigation, we pose complementary research questions. Regarding GAI in marketing, we ask: (1) How is GAI currently being used in marketing? And (2) How can GAI contribute to a sustainable digital transformation of the marketing process? In the context of NN in medicine, our focus shifts to: (3) How are NNs currently being used in medicine? And (4) How can NNs contribute to sustainable digital transformation in diagnostics? These inquiries are critical in today's context, where the concept of sustainability goes beyond environmental and ethical considerations. The integration of AI in creating sustainable practices and operations in both medicine and marketing is increasingly becoming a critical issue. Despite considerable progress in AI integration, significant research gaps remain, particularly regarding the implications of GAI and NN through the lens of sustainability and linking AI capabilities to sustainable outcomes in these sectors.

## **2. Methodology**

This study employs a methodological meta-analysis of existing research on GAI and NN in marketing and medicine. Given the diverse and evolving nature of studies in this area, a non-statistical meta-analysis is considered most appropriate. This approach allows for a comprehensive synthesis of the literature where statistical meta-analysis may not be applicable (Döring, 2023; Medjedović, 2014).

First, a literature search is conducted focusing on criteria specifically relevant to the application of AI in medicine and marketing, with an emphasis on GAI and NN and their role in sustainable practices. This process guides a comprehensive search across multiple databases, including Scopus, Semantic Scholar, typeset.io, Web of Science, emerald insight, and Google Scholar, resulting in a robust data set of literature relevant to the intersection of these technologies with sustainable practices. Each retrieved reference undergoes a rigorous quality assessment to ensure alignment with the study's themes and methodological soundness. The criteria for this evaluation include relevance, methodological rigor, credibility of data sources, and the study's contribution to the field (Flick, 2020). High-quality references are then annotated succinctly to summarize their key findings, methods, conclusions, and any limitations or gaps. This process ensures a clear understanding of each study's contribution to the research questions at hand.

The synthesis phase is a critical component of the methodology. It involves a thorough analysis and integration of high-quality, relevant literature. This process not only compares and contrasts different approaches and findings, but also discusses common themes, divergences and innovative applications of AI in the context of sustainability. The aim is to fill existing

research gaps and provide new insights into the sustainable use of AI technologies in medicine and marketing.

By adopting this methodological approach, the study aims to provide a replicable, reliable, and trustworthy synthesis of existing research that addresses the critical question of how AI, specifically GAI and NN, can facilitate sustainable digital transformation in medicine and marketing.

### **3. Theory and state of research**

#### ***3.1. Definition of digital transformation***

Digital transformation, a term widely discussed in the academic literature, refers to the comprehensive integration of digital technologies into various aspects of an organization, leading to fundamental changes in business operations and value delivery (Kretschmer & Khashabi, 2020; Westerman et al., 2014). However, there is no generally accepted definition of the term (Teichert, 2019). In the academic literature, digital transformation is not only a technological change, but also a strategic and organizational overhaul that affects business processes, customer experience, and organizational culture (Kretschmer & Khashabi, 2020; Matt et al., 2015). It is characterized as a continuous process that includes digitization, digitalization, and digital transformation, with the latter being the most pervasive phase (Matt et al., 2015). Digital transformation strategies are cross-functional and have far-reaching implications, requiring dedicated leadership roles to drive and oversee the transformation process (Weber et al., 2022). The impact of leadership on digital transformation is profound, requiring strategic and prioritized changes to business activities, processes, competencies, and models to fully leverage the opportunities presented by digital technologies (Sow & Aborbie, 2018).

According to the research topic, digital transformation in medicine is transforming patient care and services, providing opportunities to improve pandemic strategies, increase access to services, and improve the quality of care (Gopal et al., 2019; Jabarulla & Lee, 2021; Pilares et al., 2022). The COVID-19 pandemic has highlighted the need for innovative solutions and technologies (Agostino et al., 2021). Digital transformation has led to new roles and technologies, such as information platforms and remote services (Hermes et al., 2020). It has also improved the performance of key medicine business processes and simplified information technology (Laurenza et al., 2018). AI has transformed medicine, enabling breakthroughs in healthcare delivery and paving the way for effective, reliable, and safe AI systems (Bajwa et al., 2021).

Looking more specifically at the marketing sector, the academic community has yet to extensively explore the relationship between marketing and sales in the digital age (Hauer et al., 2021). Nevertheless, the ever-changing technological landscape demands that all business units undergo digital transformation. Digital transformation involves the use of digital technologies to redesign traditional and non-digital business processes and services in response to changing market and consumer demands (Cheromukhina, 2022). In the context of digital transformation in marketing, there has been a significant amount of research in the field of marketing, and this research has primarily focused on specific digital tools. Among these tools, marketing through social media platforms is the most studied. Close behind are other technologies such as data analytics, mobile marketing, the Internet of Things, artificial intelligence, and Industry 4.0. These technologies have all been the subject of extensive research in the marketing field (Cioppi et al., 2023). However, there are other technologies that have not received as much attention in the literature. These technologies apply machine learning (ML), virtual/augmented reality, and security protection systems (Cioppi et al., 2023). A thorough analysis is required to understand the correlation between marketing and sales in the digital age (Hauer et al., 2021). Overall, the marketing domain is vast and diverse, encompassing a wide range of digital tools

and concepts. While certain technologies have received more attention than others, it is crucial to recognize the importance of exploring both specific technologies and the broader concept of digitization to gain a comprehensive understanding of the field.

### ***3.2. Definition of sustainability and sustainable Artificial Intelligence***

The Brundtland Commission defined sustainability in 1987 as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, S. W. S., 1987). Since then, sustainability has developed far beyond its original scope. The definition emphasizes the need to consider environmental, economic and social dimensions as interdependent (Davidson, 2010; McKenzie, 2004; Morelli, 2011; Olawumi & Chan, 2018), which together enable achieving sustainability. In particular, environmental sustainability emphasizes the interaction with the environment for the management of natural resources so that future generations are not harmed by excessive resource consumption (Zarte et al., 2019). This comprehensive approach to sustainability is crucial for the development and application of AI, which must consider ecological integrity, social equity, and economic efficiency.

Environmental sustainability means that current and future generations' needs for resources and services can be met without compromising ecological integrity (Morelli, 2011). Concepts and topics include low-impact transportation, sustainable agriculture, and the combined conservation of environmental assets and management of waste and pollution (Callicott & Mumford, 1997). Research on AI for sustainability has explored many of these issues, and the focus has been on specific AI applications for biodiversity enhancement. Other trends are also emerging. First, a largely overlooked component of AI is cognition and robotics. Some pattern recognition and classification methods were based on ML models, such as Artificial NNs (ANN) and clustering (Voyant et al., 2017). Second, renewable energy received much more attention compared to saving energy. Third, most articles on renewable energy focused on only one type of renewable energy rather than hybrid energy sources. Solar is the most commonly studied renewable energy source. Only one article discusses public opinion on energy production (Nuortimo & Härkönen, 2018), and none examines the financial feasibility of market deployment. There appears to be an overemphasis on technical difficulties in studies of AI.

The definition of social sustainability focuses on the development and promotion of practices and structures that support long-term well-being and equity within a society (Van Wynsberghe, 2021). Social sustainability includes the protection and promotion of human rights, equity, access to resources and education, and the promotion of social inclusion and community spirit (Dovers & Handmer, 1992). Creating conditions that ensure ecological integrity and social justice in all areas of human activity is part of social sustainability (Mensah, 2019). This includes the preservation of environmental resources for present and future generations, and the development of economic models and social values in ways that take into account the needs of all members of society (Dovers & Handmer, 1992). Transparency and the exchange of information between stakeholders are crucial to the promotion and safeguarding of social sustainability in various initiatives and legislation (Van Wynsberghe, 2021). This approach aims to balance progress with the preservation of human and environmental values, prioritizing societal well-being and promoting social inclusion (Dovers & Handmer, 1992). Recognizing the interdependence of environment, economy and society, social sustainability is a holistic approach that seeks to create and maintain a just, inclusive and safe environment for all (Mensah, 2019; Van Wynsberghe, 2021).

Economic sustainability refers to the efficient use of resources to maximize operational profit and increase market value. This form of sustainability encompasses substituting natural

resources with man-made ones, as well as reusing and recycling (Khakurel et al., 2018; Kindylidi & Cabral, 2021). At its core, it is about balancing economic growth with the protection of the environment and social welfare. Economic sustainability is not just focused on maximizing short-term profits but also includes a long-term perspective, emphasizing the conservation of resources for future generations and the fair distribution of these resources. According to Van Wynsberghe (2021), sustainable development oscillates not only between innovation and equitable resource distribution but also between the needs of the environment, economy, and society. In the realm of AI, this tension between innovation and sustainability, as well as the sustainability of AI training and usage, must be considered. Kindylidi and Cabral (2021) highlight that the European Commission in its White Paper on AI emphasizes the value of AI in achieving sustainable economic growth and societal well-being and promotes the circular economy in the single market. This underscores the importance of considering the environmental impacts of AI throughout its lifecycle and supply chain. Overall, economic sustainability is a multidimensional concept that goes beyond mere profit maximization, placing ecological and social aspects at the forefront. It is a crucial component of a comprehensive approach to sustainability and plays a vital role in creating a just, resilient, and equitable society. This approach ensures that economic activities are not only profitable but also sustainable in the long run, contributing to the well-being of current and future generations.

Sustainable AI is a comprehensive concept that encompasses the entire life cycle of AI systems and aims to promote ecological integrity, social equity, and economic efficiency (Van Wynsberghe, 2021). It encompasses both the use of AI for sustainable purposes and the sustainability of AI itself, which includes assessing and reducing its environmental impact (Kindylidi & Cabral, 2021). Economic sustainability in this context means developing and deploying AI systems in a way that not only improves operational efficiency and optimizes resource management (Kar et al., 2022), but also creates long-term economic value by reducing costs and increasing market opportunities. This requires a balanced approach that integrates innovative solutions, ethical and social responsibility, and economic considerations to meet the needs of current and future generations while protecting the environment (Nishant et al., 2020). Therefore, environmental, and social sustainability, as well as economic profitability and value creation, must be considered for sustainable AI in marketing and medicine.

### ***3.3. Generative Artificial Intelligence and Neural Networks: Definition and delimitation***

In recent years, there has been a significant increase in interest in the disciplines of GAI and NN due to their close relationship. GAI is a type of AI algorithm that generates new data instances that mimic an existing collection of data. One of the most prominent techniques in GAI are generative adversarial networks (GANs), which consist of two NNs, a generator and a discriminator, that work together to produce realistic outputs (Creswell et al., 2018). GANs have been widely used in various applications such as image generation, data augmentation, and video synthesis (Kakkar & Singh, 2021). ANNs, on the other hand, which are modeled after the structure of the human brain, are an essential component of artificial intelligence. They evaluate complex data and identify patterns. Nodes in NNs are interconnected and work together to process information. These methods are useful for tasks such as speech and image identification, natural language processing, and decision making (Hansen & Salamon, 1990).

Understanding the differences between GAI and NNs is critical to recognizing their individual strengths and weaknesses. NNs are the foundational technology that allows GAI to focus on generating novel data. ANNs, or GANs, are essential to the operation of GAI systems. By analyzing patterns and characteristics in the training data, they provide the basis for learning new information and generating new data (Yao & Liu, 1997). The development of GAI and NNs has raised concerns about the potential misuse of AI-generated content, such as deepfakes



and false information (Hwang et al., 2021). Therefore, it is crucial to establish ethical standards and boundaries for the use of NNs and GAI.

## **4. Generative Artificial Intelligence and Neural Networks in Digital Transformation**

### **4.1. Neural Networks in medicine**

NNs are a powerful tool in medicine, especially for diagnosing and classifying diseases. NNs have shown promising results in dermatology, oncology, and pathology. In fact, deep learning has outperformed many dermatologists in classifying dermoscopic melanoma images (Brinker et al., 2019). In this study, enhanced deep learning methods were used to train a Convolutional Neural Network (CNN) with a large dataset of dermoscopic images. Therefore, out of 100 tissue scans, 20 were tumors and 80 were benign moles, 157 dermatologists were asked to classify them as malignant or non-malignant. Based on this study, only 7 dermatologists were better than the classification algorithm, 14 were equal and 136 performed worse within this classification task (Brinker et al., 2019). This study demonstrated the potential of the NN to accurately diagnose skin neoplasms. The NN outperformed over 86% of the dermatologists. Therefore, the use of AI, especially NN, in the context of skin cancer diagnosis can be highly recommended.

Additionally, another study highlighted the effectiveness of CNN in accurately classifying genetic mutations in gliomas, a type of brain neoplasm (Chang et al., 2018). It highlighted the potential of CNN approaches to model the animal visual cortex. By simulating multiple layers of neurons, these approaches transform raw input images into complex representations. This, in turn, demonstrates the potential of NN in aiding the diagnosis and classification of complex diseases, such as gliomas (Chang et al., 2018).

NN has shown promise in the field of oral medicine. A pilot study was conducted on the classification of clinical autofluorescence spectra of oral leukoplakia using an ANN (Van Staveren et al., 2000). The study demonstrated the potential of NN to aid in the diagnosis of oral leukoplakia and showed its versatility in different medical domains. This study can be described as one of the oldest studies of NN in medicine, where an NN achieves a sensitivity of 86% by analyzing spectral data instead of the image classification used today (Van Staveren et al., 2000).

An additional study demonstrated the ability of deep learning to predict microsatellite instability directly from histology in gastrointestinal cancer. This expands the application of NNs in oncology and pathology (Kather et al., 2019). The potential of NNs in providing valuable insights and predictions from histological data can significantly impact the diagnosis and treatment of gastrointestinal neoplasms.

NN are not only useful for diagnosis, but also for detecting diseases. A study presented an efficient method for detecting skin cancer using CNN, highlighting the potential of NNs in aiding early detection and diagnosis of skin cancer (Sreelakshmi et al., 2023). NNs have a significant impact on preventive medicine and public health.

Another study compared the performance of a conventional image analyzer with a CNN in diagnosing skin lesions (Sies et al., 2020). The study further highlighted the superiority of the NN in accurately diagnosing skin neoplasms. This comparative study provides valuable insights into the potential of NNs in revolutionizing the field of dermatology and skin cancer diagnosis.

In a separate research study, a CNN was used to detect brain tumors. The study used a CNN that was improved through the use of a policy optimizer, which resulted in a remarkable accuracy rate of 95.98% in identifying brain tumors (Wu & Shen, 2023). To improve the performance of the CNN, certain techniques were implemented, including skull removal and noise

reduction. As a result, the optimized CNN model outperformed previous methods, demonstrating the great potential of NNs in medical image processing (Wu & Shen, 2023). This approach can be compared to the successful use of NNs in various other fields, such as dermatology, where they have proven to be highly effective in accurately identifying diseases. In summary, NN has shown great promise in various medical fields, including dermatology, oncology, pathology, and preventive medicine. NN can accurately diagnose, classify, and detect disease, demonstrating its potential to revolutionize medical practice and improve patient outcomes.

#### ***4.2. Generative Artificial Intelligence in marketing***

The application of AI in B2B marketing has received considerable attention, with companies using AI to identify strategic options and reduce operating costs (Huang & Rust, 2021; Paschen et al., 2020). AI research in B2B marketing remains underrepresented in comparison with B2C marketing. Especially when focusing on the application of GAI in B2B marketing (Dwivedi et al., 2021; Keegan et al., 2022), there is a noticeable lack of in-depth studies focusing on AI applications in B2B marketing. GAI, an advanced segment of AI capable of independently generating new content, has already played a transformative role in the B2C domain (Giri et al., 2019). However, the potential and challenges of B2B GAI remain largely unexplored due to the complexity of customer relationships and longer sales cycles in the B2B market (Keegan et al., 2022). There is an urgent need for research, especially in the application of GAI in B2B marketing, given the lower intensity of AI research in B2B compared to B2C and the relative newness of GAI (Kshetri et al., 2023). Studying GAI in this context offers promising opportunities for developing and understanding innovative B2B marketing strategies.

GAI has revolutionized marketing by introducing innovative capabilities and changing traditional approaches (Butler, 2023). It has an impact on content creation, campaign optimization, and audience engagement strategies (Kshetri, 2023a). A substantial portion of marketers are using GAI tools in their creative process, with 66 percent using them to brainstorm and nearly half creating final content from scratch (Butler, 2023). This shift in marketing content creation and management is significant. GAI also provides a more efficient and cost-effective approach to the creation of custom visual content (Fui-Hoon Nah et al., 2023). More than 100 billion pieces of content, including articles, blog posts, and social media posts, have been created using GAI, revolutionizing traditional campaign processes with real-time content creation, adaptive optimization, and faster results (Cromwell et al., 2023).

Tools such as OpenAI's ChatGPT, GPT-4, and DALL-E2, as well as marketing-specific variants such as Neuroflash, HeyGen, and Canva are increasingly being used in marketing activities. ChatGPT in particular has become very popular. Approximately 86% of marketing managers in Germany believe that the importance of AI in marketing will increase in the coming years (Bünthe, 2023). GPT-4 offers a significant advantage in creating more engaging and relevant content through its advanced speech generation capabilities, including the ability to process both text and image input. This is critical to creating personalized customer experiences. DALL-E2's text-to-image prompting capabilities further enhance the potential for generating realistic images and artwork. This adds a valuable dimension to visual marketing. In addition, Microsoft's introduction of a Copilot for Office 365 or Adobe's Firefly integration within the Creative Suite highlights the growing role of GAI in digital advertising (Kshetri, 2023b). This innovation allows advertisers to create different iterations of ad copy, generate background images via text prompts, and adjust image cropping for different media formats. It demonstrates the growing integration of GAI tools within the marketing ecosystem. GAI's multifaceted impact on marketing ranges from content generation to campaign customization to visual content creation (Kshetri et al., 2023). Marketers can now engage more effectively with their audiences, create personalized content, and execute innovative campaigns with tools like

ChatGPT, neuroflash, HeyGen, and Canva. The future of marketing with GAI is poised to offer even more personalized and effective strategies, driving the industry toward more innovative and customer-centric approaches.

The integration and effectiveness of GAI in marketing is influenced by several key factors. The ease of use and accessibility of GAI tools, such as ChatGPT, are critical, as they do not require specialized skills, broadening their appeal to marketers (Kshetri, 2023a). The trialability of these tools, often offered through free access periods, encourages experimentation and understanding without an initial financial commitment (J. Chen et al., 2023). In addition, the cost-effectiveness of GAI tools, illustrated by affordable pricing models and subscriptions, makes them accessible to a wide range of organizations, including SMEs (T.-P. Chen, 2023; Kshetri et al., 2023). The availability of various GAI tools tailored to specific marketing needs also plays a critical role. This diversity allows marketers to select tools that best meet their specific needs, whether for accuracy, content security, or graphical sophistication (Kshetri et al., 2023; O'Brien, 2023). In addition, the ability to customize these tools for specific content domains and marketing strategies is critical. Techniques such as prompt training and similarity algorithms allow for the fine-tuning of GAI models to align with unique brand messages, products, and services (Davenport & Alavi, 2023). Together, these factors are driving the marketing industry toward more innovative, efficient, and personalized approaches.

In the context of marketing, GAI presents both transformative opportunities and significant limitations. False results are a primary concern, as GAI models such as LLMs can produce plausible but incorrect or nonsensical content, a phenomenon termed “hallucination” (Ji et al., 2022; Spitale et al., 2023). Bias and fairness issues arise from societal biases embedded in training data, leading to unfair or stereotypical representations (Caliskan et al., 2017; Hartmann et al., 2023; OpenAI, 2023). Copyright infringement also poses legal challenges, as GAI may replicate copyrighted works. In addition, the environmental impact of developing and using GAI systems is a growing concern due to their significant energy consumption (Van Wynsberghe, 2021).

## **5. Discussion**

### ***5.1. Impact of Neural Networks in medicine***

NN have had a profound impact on medicine. They have revolutionized various aspects of medical practice and contributed to social and economic sustainability. NNs have made treatment approaches more efficient and patient-centered, ultimately improving medicine outcomes and reducing the burden on healthcare systems.

The use of NNs in medicine and its transition to impact is evident in the field of dermatology, where deep learning has demonstrated superiority over dermatologists in the classification of dermoscopic melanoma images, highlighting the potential of NNs to provide accurate and efficient diagnosis, thereby enabling patient-centered treatment (Brinker et al., 2019; Wu & Shen, 2023). NNs play a critical role in ensuring timely and accurate diagnosis, which is essential for effective patient care.

In addition, CNN has demonstrated its impact in oncology by accurately classifying genetic mutations in gliomas (Chang et al., 2018). Accurate classification of genetic mutations can have significant implications for personalized treatment approaches. This can lead to targeted therapies, improving patient outcomes and reducing the economic burden of ineffective treatments. The study indicated that NN can predict microsatellite instability in gastrointestinal cancer directly from histology. This highlights the potential of NN to provide valuable insights for personalized treatment strategies (Kather et al., 2019). This approach not only improves

patient outcomes but also contributes to the economic sustainability of medicine by reducing unnecessary treatments and associated costs.

Moreover, the impact of NN in preventive medicine is evident from the work in skin cancer diagnosis, which presented an efficient method for skin cancer detection using CNN (Sreelakshmi et al., 2023). NN-based approaches for early detection of skin cancer can improve patient outcomes and reduce the economic burden of advanced-stage treatments, contributing to the overall sustainability of medicine systems.

The study by Sies et al. (2020) compared the performance of a conventional image analyzer with a CNN in diagnosing skin lesions. The results emphasize the potential of NN to revolutionize dermatological diagnosis, leading to more efficient and accurate diagnosis, and enabling timely and patient-centered treatment.

In conclusion, NNs have a far-reaching impact on medicine. They contribute to social and economic sustainability by enabling efficient, patient-centered treatment approaches. The application of NN has the potential to revolutionize medical practice and improve healthcare outcomes.

## ***5.2. Impact of generative artificial intelligence for the marketing***

GAI has shown promise in marketing by improving content creation, campaign optimization, and audience engagement. Tools such as ChatGPT and Neuroflash have shown the potential to improve the customer experience through personalized content and efficient campaign management. However, GAI applications have limitations. For example, there is a risk of generating incorrect or nonsensical results, known as “hallucination”. This requires careful monitoring and validation of GAI-generated content to ensure accuracy and relevance. In addition, societal biases in training data raise concerns about fairness and representation, requiring critical examination of data sources. Legal challenges related to copyright infringement are also a significant risk, as GAI's ability to replicate copyrighted works requires careful navigation.

GAI systems require a balanced approach to contribute to long-term economic growth and market value without depleting natural resources. They should optimize operating costs, foster innovation, and promote social welfare. This is consistent with the principles of sustainable AI and promotes ecological integrity. AI systems can be catalysts for sustainable economic practices that benefit current and future generations. However, their energy-intensive nature raises concerns about their sustainability. The integration of GAI in marketing is growing due to its ease of use, accessibility, cost-effectiveness, and adaptability. This enables companies, including SMEs, to use GAI for innovative marketing strategies. The variety of available GAI tools, each tailored to specific marketing needs, further enhances this integration, allowing marketers to choose tools that meet their unique needs.

The study explores the use of GAI in marketing, highlighting its potential to revolutionize marketing strategies from content creation to customer engagement. Despite challenges such as accuracy, bias, and legal issues, GAI's potential for economic sustainability and innovation remains undiminished. Its ability to personalize marketing efforts and its cost-effectiveness make it a valuable tool for future marketing efforts. The research provides a balanced view of GAI's impact on marketing and offers insights for integrating it into sustainable, effective, and ethically responsible marketing strategies. The findings provide a valuable framework for the evolving marketing landscape.

## 6. Conclusion

This paper critically examines the transformative role of GAI in marketing and NN in medicine, specifically addressing their potential to facilitate sustainable digital transformation in these sectors.

In medicine, NNs have proven to be disruptive, particularly in dermatology and oncology. Studies such as Brinker et al. (2019) demonstrate the superiority of NNs in diagnosing diseases such as melanoma, where they outperformed the majority of dermatologists. In a similar vein, Chang et al. (2018) and Kather et al. (2019) show how NNs can effectively classify genetic mutations in complex diseases such as gliomas and gastrointestinal cancers, paving the way for more personalized treatment approaches. These advances in medical diagnostics and treatment underscore NNs' critical role in improving patient care and contributing to health systems' economic sustainability.

Conversely, in marketing, GAI has emerged as a powerful tool. It is reshaping content creation, customer engagement, and campaign optimization. As highlighted by Butler (2023) and Cromwell et al. (2023), the adoption of tools such as ChatGPT and Neuroflash demonstrates the effectiveness of GAI in creating personalized marketing strategies. Nevertheless, the challenges of content accuracy, embedded bias, and legal complexity discussed by Ji et al. (2022) and Hartmann et al. (2023) require careful and ethical application of this technology.

Reflecting a broader trend toward leveraging AI for sustainable digital transformation, the integration of GAI and NN in marketing and medicine, respectively, is on the rise. While GAI in marketing faces hurdles such as content verification and bias mitigation, its ability to generate innovative and tailored marketing solutions is undeniable. Similarly, a significant leap towards efficient, accurate and patient-centric medical care is being made through the application of NN in medicine, particularly in disease diagnosis and prediction. In conclusion, the burgeoning role of GAI in marketing and NN in medicine represents not only technological advancement, but also a commitment to sustainable practices. These AI technologies, with their unique strengths and limitations, are critical to driving the digital transformation of these sectors. As AI continues to evolve, its integration across sectors must be guided by ethical considerations, sustainability goals, and a commitment to improving human well-being.

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