The Role of Artificial Intelligence (AI) in The Ever-Growing Aesthetic Clinic Industry

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ABSTRACT

The ever-growing aesthetic clinic industry has witnessed unprecedented growth over the last few years, with the driving forces of innovation, technology and changing consumer perceptions. At the center of this change is Artificial Intelligence (AI) which holds great promise to enhance operational efficiencies as well as drive individualized patient care and treatment outcomes. In line with this, the current study aims to present a critical analysis of the AI's transformative influence on aesthetic clinics, particularly in diagnostics, clinical procedures, and marketing strategies that contribute to innovation as well as marketing methods that contribute to the enhancement of clinic performance and patient satisfaction; thus ensuring a sustainable competitive edge. Employing a literature review approach, the present study focuses on the revolutionary potential of AI in reshaping patient experiences and service effectiveness in aesthetic clinics. By utilizing AI, the research accentuates the necessity of focusing on accurate custom treatment and enhancing patient interaction, engagement, along marketing insight, which further stimulates organizational operational effectiveness and market differentiation. In conclusion, the strategic adoption of AI is crucial for aesthetic clinics to meet the evolving demands of the market and deliver superior patient care. While AI cannot replace the role of humans and development in the industry, it can prove to be an invaluable support in developing the growing aesthetic clinic industry.

Keywords: *aesthetic clinic, artificial intelligence, ever growing aesthetic*

1. INTRODUCTION

The aesthetic clinic industry is a vibrant and rapidly changing field characterized by ongoing developments and changing consumer attitudes. The sector itself has been witnessing a huge growth in industrialisation over the past decades, which can be attributed to various factors including a growing aging population, increase in disposable income, and rising interest in their personal looks, statistics show that the beauty global market is projected to reach hundreds of billions of dollars, underlining the importance to encourage businesses to innovate and maintain their competitiveness. From the changing landscape, practitioners are deriving technological innovations to harness their practises and optimize projected patient outcomes (Pambudi & Dwinata, 2023).

Artificial Intelligence (AI) has become one of the most important factors, cultivating revolutionary changes in aesthetic medicine. Artificial intelligence (AI), which includes machine learning, deep learning, and natural language procession, refers to a computational paradigm in which machines conduct tasks that have thus far necessitated human intelligence encompassing data interpretation and decision-making alongside providing recommendations (Alyami et al., 2024).

The integration of artificial intelligence technologies in the healthcare industry has proved the potential to enhance operating efficiencies, improve diagnostic procedures, and enhance personalized treatment methods. For example, AI techniques employed in medical imaging have the potential to assist in the identification and diagnosis of skin diseases, tailoring treatment methods to the unique needs and features of patients, as highlighted in recent studies (Frank et al., 2024).

The ever-growing aesthetic clinic industry is undergoing great changes, mostly driven by rapid technological developments in Artificial Intelligence (AI). The application of AI to aesthetic procedures carries great potential to enhance both the care of patients and efficiency of operations (Pambudi & Dwinata, 2023). While AI technology advances and deeply infects the settings of healthcare institutions, aesthetic clinics are applying this technology to perfect their practices and

maximize the level of strategies toward patient engagement. As to the patient perception, these clinics utilize AI not only to aid clinical decisions but also to boost patient satisfaction and improve marketing campaigns. AI-facilitated predictive analysis enables clinics to take a more scientific approach to assess treatment effects, personalize the customer experience and maximize operations, doing so more effectively addressing specific patient concerns as well as being attuned to marketplace demands (Haykal et al., 2024).

Given that there are many implementations of artificial intelligence in the context of aesthetic clinic, the current study will explore the three major phases of AI in diagnostics, clinical management, and marketing. These dimensions were chosen because of their particular relevance to efficiency and effectiveness in aesthetic procedures. Through an evidence-based analysis of diagnostics, clinical management, and marketing, this paper hopes to provide an extensive insight into the revolutionary role of AI in aesthetic clinic operations. By stressing these key dimensions, the discussion hopes to draw attention to the imperative for aesthetic clinics to integrate AI technologies as a means to enhance care provision, enhance patient satisfaction, and maintain a competitive edge in a continuously changing environment.

2. RESEARCH METHOD

This research employs a qualitative approach using a comprehensive literature review method. A systematic search was conducted on databases like PubMed and Google Scholar, focusing on articles discussing the application of Artificial Intelligence (AI) in the Aesthetic Clinic Industry. Search terms included “artificial intelligence,” “aesthetic clinic,” “AI dermatology,” and “machine learning aesthetics”. Relevant articles for the interpretation were selected such as those containing information related to AI applications in diagnostic, clinical management and marketing. Data were collected and analysed via reading, notating, and extracting data from literature. The data upon which this research is based has been retrieved without observation from the field, rather through academic journals, industry reports and credible sites. ata analysis involved summarizing and identifying key themes related to the trends of AI in the ever-growing aesthetic clinic industry. Conclusions were drawn from the synthesis of literature to provide a comprehensive overview of AI's role in this industry, and research results are presented descriptively to clarify AI's impact on various aspects of aesthetic clinics.

3. RESULTS AND DISCUSSIONS

3.1. The Role of AI in Diagnostics

Diagnosis is defined as a method of identifying diseases based on symptoms and signs to determine underlying pathology. To achieve an accurate diagnosis, a doctor undergoes a complex process that involves gathering as much relevant information as possible. This process is challenging yet critical for medical professionals (Kaur et al., 2020). Each patient presents with different concerns, skin types, and predispositions that demand an attentiveness from their dermatologist to provide the appropriate treatments with the highest likelihood of reaching their aesthetic outcomes (Kania et al., 2024). Several instruments have been developed for assessing skin features, such as skin elasticity, discoloration, and pigmentation (Cengizler, 2023). One of the most advanced high-resolution digital camera systems for facial imaging and analysis is VISIA® by Canfield Scientific, Inc. (Henseler, 2022). The VISIA Skin Analysis System enhances aesthetic consultations by streamlining the imaging process and improving accuracy. It employs advanced software that enables quick image capture, precise facial feature detection, and automated skin analysis (Goldsberry et al., 2014). Helga Henseler's study confirmed the VISIA® camera's high precision in capturing skin features, showing minimal variations (<2%) in texture, UV spots, brown spots, and porphyrins, with slightly higher differences (2–6%) for pores, red areas, spots, and wrinkles. Subjective assessments found no clinically significant differences, proving its reliability and reproducibility (Henseler, 2022). Another skin analysis system, the Antera 3D from Miravex, is a recently developed handheld camera for in vivo skin topography and color-related (e.g., Lab, skin chromophores) measurements. The instrument uses shape-from-shading and photometric stereo technology to create 3D skin reconstructions from multiple images taken under different light sources. It overcomes specular reflection issues in the Lambertian model by using cross-polarized filters and analyzing pixel data from various illumination sources to discard high-intensity reflections (Messaraa et al., 2018).

Besides aesthetic purposes, machine learning algorithms achieve expert-level accuracy in skin lesion classification based on clinical images. AI-assisted clinicians achieve higher sensitivity (81.1%) and specificity (86.1%) in comparison to unassisted clinicians (74.8% and 81.5%, respectively) in diagnosing skin cancer (Krakowski et al., 2024). SkinVision B.V., Amsterdam, is a smartphone app that allows laypersons to self-assess a skin lesion for the risk of skin cancer. SkinVision lets users photograph lesions for AI analysis, providing a risk rating and doctor recommendations for high-risk cases. It

maintains a database of validated cases, with histopathological reports voluntarily shared and images clinically validated by dermatologists to recalibrate the algorithm. SkinVision has a high sensitivity (95%) to detect skin cancer, and it may therefore be a valuable tool for early detection of premalignant and malignant skin lesions (Udrea et al., 2020). Besides SkinVision, there are FDA-authorized AI-enabled devices for skin cancer detection, including MelaFind, NeviSense, and DermaSensor. MelaFind (multispectral spectroscopy) achieved 98.3% sensitivity but low specificity (9.9%). NeviSense (electrical impedance spectroscopy) showed 97.0% sensitivity and 31.3% specificity. DermaSensor (elastic scattering spectroscopy), used by primary care physicians for multiple skin cancers, had 96.6% sensitivity and 21.0% specificity (Venkatesh et al., 2024).

3.2. The Role of AI in Clinical Management

Patient-Generated Health Data (PGHD), as defined, includes health symptoms, medical history, biometric information, treatment history, lifestyle data, and other relevant details. AI has the capability to collect and process data while providing well-defined outputs. NLP plays a crucial role in analyzing unstructured data and extracting meaningful information from it. The role and function of a PGHD system integrated with electronic health records (HER), supported by AI, is to facilitate scheduled reviews, the acquisition and implementation of new clinical knowledge, and the simplification of data entry and documentation workflows (Ye et al., 2024). One application of AI in healthcare is the Epic System AI Module, which leverages AI and ambient listening technology to enhance interactions between patients and healthcare providers. This technology enables doctors to generate progress notes from patient-doctor conversations in examination rooms, draft responses to patient questions in real time, and highlight new patient-related information since the last visit. Additionally, Epic develops AI tools to assist medical coding staff by suggesting procedure and diagnosis codes based on clinical documentation, allowing coders to streamline their workflow without starting from scratch (Chishtie et al., 2023). This is particularly suitable for aesthetic clinic management, where a high volume of patients at any given time makes it challenging to efficiently summarize and document patient information. Another AI-driven innovation is Care.AI, whose Smart Care platform enhances routine monitoring and resource allocation to improve patient experiences and operational efficiency. The platform optimizes patient flow by sending reminders about room availability, reducing waiting times, and facilitating remote consultations, ultimately increasing efficiency and enhancing patient care. Care.AI offers two primary services: the Ambiently Aware Smart Clinic, which coordinates real-time data to expedite patient visits, support telemedicine, and enable clinics to serve more patients without additional physical space or staff; and the Smart Clinic AI Command Center, a fully integrated system that predicts busy periods and identifies resource utilization patterns, allowing clinic managers to allocate staff and equipment more effectively (Smart Clinic, 2025).

3.3 The Role of AI in Marketing

AI has been widely integrated into marketing in various forms and has significantly transformed the way companies define their marketing strategies thereafter. AI is commonly used to help generate highly targeted and personalized marketing content due to its excellent machine learning algorithms which is able to analyze consumer preferences, behaviours and buying patterns (Tadimarri et al., 2024).

Chatbots or virtual assistants powered by AI are also substantial and powerful marketing tools (Tadimarri et al., 2024). The use of chatbots, such as ChatGPT, in plastic surgery as education resources and to help answer frequently asked questions (FAQs) about the procedures has been broadly studied (Garg et al., 2024; Seth et al., 2023), but the lack of references found regarding the use of these features in aesthetic clinics, especially in Indonesia, suggests that chatbots or even AI, most likely are not generally used yet in the relevant field. In aesthetic clinic, chatbots or virtual assistants have the potential to be utilized to support 24/7 customer service, provide informational or educational information, suggest personalized product or treatment recommendations, schedule appointments and to follow up patients after treatment (Buzzaccarini et al., 2023; Goldust & Grant-Kels, 2024; Tadimarri et al., 2024). Incorporation of these features in the system is useful in reducing employees' tasks and burden (Goldust & Grant-Kels, 2024), in reducing consumers' wait times and also in improving quality of interaction (Murár & Piatrov, 2024), thus improving overall patient experience (Goldust & Grant-Kels, 2024). Currently, chatbots still rely on texts and images to function, but in the future, chatbots might even be voice-enabled, can engage with consumers through interactive conversations and will further improve consumers experience and satisfaction (Tadimarri et al., 2024).

Furthermore, the use of AI in diagnosis and treatment planning itself actually has its own appeal which can be used to increase marketing value. Unfortunately, the current AI technology studied is still in its infancy and have yet to meet the

standards for clinical applications (Shiraishi et al., 2024). Further advancements are needed before AI as a diagnostic tool can be promoted as a marketing point.

3.4 Drawbacks & Challenges

AI has the potential to revolutionize aesthetic clinics by offering more consistent and objective evaluations. In this study, we examine the applications of AI in diagnostics, clinical management, and marketing. The integration of AI into aesthetic clinics has transformed the field by improving diagnostic accuracy, enhancing efficiency, and providing innovative tools for both medical professionals and patients. As technology continues to evolve, AI-driven diagnostics will likely become an indispensable part of modern healthcare, enabling faster and more precise medical interventions. AI enhances clinical management by streamlining data collection, analysis, and documentation. Integrated with electronic health records, AI facilitates scheduled reviews, knowledge acquisition, and workflow automation. AI systems improve doctor-patient interactions, enhance patient flow, reduce waiting times, automate medical coding, and optimize documentation, benefiting high-volume clinics such as dermatology and aesthetics. The use of AI technology in marketing is notable for their ability to increase sales, business outcomes and consumer satisfaction. In addition, it can also optimize content generation and overall business process.

With the benefits that AI can bring, there are also limitations. Even though AI is outstanding to complement services, AI is only artificial, human-made technology. AI cannot completely replace human creativity, judgment ability, and their role to resolve complex problems (Tadimarri et al., 2024). Ethical issues, such as those related to data privacy and the potential for bias in AI algorithms, also pose challenges that must be addressed in the future (Buzzaccarini et al., 2023; Tadimarri et al., 2024). Since aesthetic dermatology data often involves sensitive personal information, it is crucial that AI models follow strict ethical guidelines to protect patient confidentiality and prevent data misuse. Another limitation is the lack of comprehensive datasets that reflect diversity in the patient population. Most AI models are trained on datasets that may not adequately represent different ages, skin types, and ethnicities, leading to potential biases and less accurate diagnoses for certain groups. A 2023 study emphasized the complexity of creating representative datasets for various skin types and ethnic groups, highlighting the underrepresentation of minorities in clinical studies and significant differences in skin barrier function, such as a higher number of corneocyte layers in Black individuals (Thunga et al., 2025).

4. CONCLUSION

AI has a very important role in supporting the development of the ever-growing aesthetic clinic industry, despite the fact that AI can not completely replace the role of humans in the industry. AI serves to assist clinicians in establishing a more accurate diagnosis. Skin analysis systems such as VISIA and Antera 3D are useful in skin imaging and analysis for aesthetic purposes, while SkinVision, MelaFind, NeviSense and DermaSensor are useful in detecting skin cancer through lesion analysis. In clinical management, AI is mainly used to help manage schedules, to monitor patients, and to simplify workflow processes. Meanwhile, in the marketing field, AI is beneficial to help create more targeted marketing content and also to support customer services. However, continuous system improvement and refinement are still needed to fully integrate AI into clinical systems to achieve clinical standards.

REFERENCES

Alyami, M. S. M., Alyami, M. M. M., Al Khuraim, H. A. M., Alsalem, A. M. S., Alrayshan, H. A. M., Albakri, K. A. M., ALsaqran, Q. N., Alyami, H. S., Alzamanan, A. S., & Alharbi, F. M. (2024). Integrating Artificial Intelligence Across Medical Clinics: Strengthening Collaborative Efforts for Improved Patient Outcomes. *Journal of Ecohumanism*, *3*(7), 2691–2698. https://doi.org/10.62754/joe.v3i7.4668

Buzzaccarini, G., Degliuomini, R. S., & Borin, M. (2023). The Artificial Intelligence application in Aesthetic Medicine: How ChatGPT can Revolutionize the Aesthetic World. *Aesthetic Plastic Surgery*, *47*(5), 2211–2212. https://doi.org/10.1007/s00266-023-03416-w

Cengizler, C. (2023). Diagnostic Methods and Instrumentation for Aesthetic Skin Conditions. *International Journal of Advances in Biomedical Engineering*, *2*(1), 1–8. https://www.researchgate.net/profile/Caglar-Cengizler/publication/373044445_Diagnostic_Methods_and_Instrumentation_for_Aesthetic_Skin_Conditions/links/64d54abcd3e680065aaca4fb/Diagnostic-Methods-and-Instrumentation-for-Aesthetic-Skin-Conditions.pdf

Chishtie, J., Sapiro, N., Wiebe, N., Rabatach, L., Lorenzetti, D., Leung, A. A., Rabi, D., Quan, H., & Eastwood, C. A. (2023). Use of Epic Electronic Health Record System for Health Care Research: Scoping Review. *Journal of*

Medical Internet Research, *25*(1), 1–29. https://doi.org/10.2196/51003

Frank, A. G., Thurer, M., Godinho Filho, M., & Marodin, G. A. (2024). Beyond Industry 4.0 – Integrating Lean, Digital Technologies and People. *International Journal of Operations & Production Management*, *44*(6), 1109–1126. https://doi.org/10.1108/ijopm-01-2024-0069

Garg, N., Campbell, D. J., Yang, A., McCann, A., Moroco, A. E., Estephan, L. E., Palmer, W. J., Krein, H., & Heffelfinger, R. (2024). Chatbots as Patient Education resources for aesthetic facial plastic surgery: evaluation of ChatGPT and Google Bard responses. *Facial Plastic Surgery & Aesthetic Medicine*, *26*(6), 665–673. https://doi.org/10.1089/fpsam.2023.0368

Goldsberry, A., Hanke, C. W., & Hanke, K. E. (2014). VISIA System: A Possible Tool in The Cosmetic Practice. *Journal of Drugs in Dermatology: JDD*, *13*(11), 1312–1314. https://pubmed.ncbi.nlm.nih.gov/25607694/

Goldust, M., & Grant-Kels, J. M. (2024). Regulatory Considerations for Safe and Ethical Use of Augmented Reality and Virtual Reality in Dermatology. *Clinics in Dermatology*, *1*(1), 1–10. https://doi.org/10. 1016/j.clindermatol.2024.09.023

Haykal, D., Garibyan, L., Flament, F., & Cartier, H. (2024). Hybrid Cosmetic Dermatology: AI Generated Horizon. *Skin Research and Technology*, *30*(5), 1–3. https://doi.org/10.1111/srt.13721

Henseler, H. (2022). Investigation of The Precision of the Visia® Complexion Analysis Camera System in The Assessment of Skin Surface Features. *GMS Interdisciplinary Plastic and Reconstructive Surgery DGPW*, *11*(1), 1–9. https://doi.org/10.3205/iprs000169

Kania, B., Montecinos, K., & Goldberg, D. J. (2024). Artificial Intelligence in Cosmetic Dermatology. *Journal of Cosmetic Dermatology*, *23*(10), 3305–3311. https://doi.org/10.1111/jocd.16538

Kaur, S., Singla, J., Nkenyereye, L., Jha, S., Prashar, D., Joshi, G. P., El-Sappagh, S., Islam, M. S., & Islam, S. M. R. (2020). Medical Diagnostic Systems Using Artificial Intelligence (AI) Algorithms: Principles and Perspectives. *Ieee Access*, *8*(1), 228049–228069. https://doi.org/10.1109/ACCESS.2020.3042273

Krakowski, I., Kim, J., Cai, Z. R., Daneshjou, R., Lapins, J., Eriksson, H., Lykou, A., & Linos, E. (2024). Human-AI Interaction in Skin Cancer Diagnosis: A Systematic Review and Meta-Analysis. *NPJ Digital Medicine*, *7*(1), 1–10. https://doi.org/10.1038/s41746-024-01031-w

Messaraa, C., Metois, A., Walsh, M., Hurley, S., Doyle, L., Mansfield, A., O'Connor, C., & Mavon, A. (2018). Wrinkle and Roughness Measurement by the Antera 3D and Its Application for Evaluation of Cosmetic Products. *Skin Research and Technology*, *24*(3), 359–366. https://doi.org/10.1111/srt.12436

Murár, P., & Piatrov, I. (2024). Chatbots and Customer Service: AI as a Key Tool for Customer Interaction. *MARKETING IDENTITY*, *1*(1), 498–505. https://doi.org/10.34135/mmidentity-2024-51

Pambudi, Y. J., & Dwinata, J. S. I. P. W. (2023). Customer Intention to Use AI Technology on Beauty Industry. *The Asian Journal of Technology Management*, *16*(2), 136–151. https://doi.org/10.12695/ajtm.2023.16.2.5

Seth, I., Cox, A., Xie, Y., Bulloch, G., Hunter-Smith, D. J., Rozen, W. M., & Ross, R. J. (2023). Evaluating Chatbot Efficacy for Answering Frequently Asked Questions in Plastic Surgery: A ChatGPT Case Study Focused on Breast Augmentation. *Aesthetic Surgery Journal*, *43*(10), 1126–1135. https://doi.org/10.1093/asj/sjad140

Shiraishi, M., Miyamoto, S., Takeishi, H., Kurita, D., Furuse, K., Ohba, J., Moriwaki, Y., Fujisawa, K., & Okazaki, M. (2024). The Potential of Chat-Based Artificial Intelligence Models in Differentiating Between Keloid and Hypertrophic Scars: A Pilot Study. *Aesthetic Plastic Surgery*, *48*(24), 5367–5372. https://doi.org/ 10.1007/s00266-024-04380-9

Smart Clinic. (2025). *Smart Clinic - Care.Ai 's® Smart Care Facility Platform*. Smart Clinic. https://www.care .ai/smart-clinic.html

Tadimarri, A., Jangoan, S., Sharma, K. K., & Gurusamy, A. (2024). AI-Powered Marketing: Transforming Consumer Engagement and Brand Growth. *International Journal for Multidisciplinary Research*, *6*(1), 1–11. https://www.researchgate.net/profile/Anish-Tadimarri/publication/379775820_AI-Powered_Marketing_Transforming_Consumer_Engagement_and_Brand_Growth/links/6619484ef7d3fc28744fda04/AI-Powered-Marketing-Transforming-Consumer-Engagement-and-Brand-Growth.pdf

Thunga, S., Khan, M., Cho, S. I., Na, J. I., & Yoo, J. (2025). AI in Aesthetic/Cosmetic Dermatology: Current and Future. *Journal of Cosmetic Dermatology*, *24*(1), 1–7. https://doi.org/10.1111/jocd.16640

Udrea, A., Mitra, G. D., Costea, D., Noels, E. C., Wakkee, M., Siegel, D. M., de Carvalho, T. M., & Nijsten, T. E. C. (2020). Accuracy of A Smartphone Application for Triage of Skin Lesions Based on Machine Learning Algorithms. *Journal of the European Academy of Dermatology and Venereology*, *34*(3), 648–655. https://doi.org/10.1111/jdv.15935

Venkatesh, K. P., Kadakia, K. T., & Gilbert, S. (2024). Learnings from The First AI-Enabled Skin Cancer Device for Primary Care Authorized by FDA. *NPJ Digital Medicine*, *7*(1), 1–4. https://doi.org/10.1038/s41746-024-01161-1

Ye, J., Woods, D., Jordan, N., & Starren, J. (2024). The Role of Artificial Intelligence for the Application of Integrating

Electronic Health Records and Patient-Generated Data in Clinical Decision Support. *AMIA Summits on Translational Science Proceedings*, *2024*(1), 459–467. https://pmc.ncbi.nlm.nih.gov/articles/PMC11141850/