



Research Article

Treating Psychological Depression Utilising Artificial Intelligence: AI for Precision Medicine- Focus on Procedures

Marwa M. Eid^{1,*}, Wang Yundong², George Benneh Mensah³, Pramila Pudasaini⁴

¹ Faculty of Artificial Intelligence, Delta University for Science and Technology, Mansoura, Egypt

² Institute of Media, Social Sciences and Humanities, South Ural State University, Chelyabinsk, Russia

³ EGRC Ghana Limited, Accra, Ghana

⁴ Associate Professor and Founder, Life Skills Education Institute Pvt. Ltd., Kathmandu, Nepal

ARTICLE INFO

Article History

Received 9 Jun 2023

Accepted 28 Sep 2023

Published 8 Dec. 2023

Keywords

Artificial Intelligence

Depression

Medical Records

Machine Learning

Psychological



ABSTRACT

Depression is a common and complex mental health condition that affects millions of people in the world. Medical advice, medications, and constant medical supervision by a specialist are common components of traditional treatment methods. Recently, there has been a growing interest in the potential of artificial intelligence to improve the diagnosis, monitoring, and treatment of depression. The potential of artificial intelligence algorithms has been demonstrated in the development of chatbots, or virtual agents, that can provide treatment, assistance, and support to individuals with depression. These artificial intelligence (AI) systems can simulate therapy sessions, offer strategies, monitor progress in treatment phases, and speak in natural language. Artificial intelligence has the potential to play an important role in the early diagnosis and prognosis of depression. By analysing multiple data sets and information such as genetic information, patient medical records, and social media posts using the Internet, artificial intelligence algorithms can identify individuals vulnerable to depression and distinguish them from normal humans. This facilitates the implementation of interventions and preventive measures at the right time and day. AI can also be used to improve depression treatment strategies. By analysing massive databases of patient data, AI systems can determine the ideal drug combinations, doses, amounts, and combinations for each patient. This personalized approach can lead to better treatment outcomes and reduces the trial-and-error process typically required to determine the best action. While AI has the potential to treat psychological depression, it is important to keep in mind that AI should never replace qualified and helpful medical professionals. Artificial intelligence in treating depression seeks to enhance and support the care provided by therapists, psychologists, and psychiatrists, rather than replace human communication and knowledge.

1. INTRODUCTION

Psychological depression is being studied as a possible cure for artificial intelligence [1][2]. Artificial Intelligence holds great potential to transform the diagnosis, monitoring, and treatment of depression through its capacity to analyse vast volumes of data and spot patterns [3-5]. Artificial Intelligence systems can potentially enhance treatment programs' efficacy by utilizing sophisticated algorithms and machine-learning approaches to deliver tailored interventions. The creation of virtual agents, or chatbots, is one application of AI. These AI-powered platforms can offer therapy, support, and assistance to people who are depressed [6-8]. They can mimic therapeutic encounters, providing emotional support and coping skills by conversing in natural language. AI chatbots can also evaluate user data to monitor symptoms, measure progress, and instantly modify treatment regimens. Early detection and prediction of depression is another area where AI can have a big influence [9]. Artificial intelligence systems can recognize people at risk of developing depression by examining a variety of datasets, including genetic data, internet behaviour, medical records, and sociodemographic information. This can make it possible to carry out preventative and early intervention strategies, which can lessen the intensity and length of depressive episodes (see Figure 1). Additionally, AI can help optimize depression treatment plans. Artificial intelligence algorithms can determine the best drug combinations, dosages, and levels based on the analysis of vast patient datasets [10-12]. This tailored strategy may improve therapy results and lessen the trial-and-error process that's frequently involved in determining the best course of action for depressed patients.

Using machine learning algorithms and data analysis from multiple sources, an artificial intelligence-based clinical depression diagnosis entail. Relevant information is gathered from a variety of sources, including genetic data, social media

*Corresponding author. Email: mmm@ieee.org

activity, online behaviour, patient interviews, and medical records [14]. With the use of this information, a thorough patient profile can be produced. From the gathered data, AI algorithms extract features that may include behavioural patterns, medical history, symptoms, and demographic data. The diagnostic algorithm then uses these features as inputs. Examples of patients with and without depression are included in a labelled dataset that is used to train a machine-learning model. The model picks up on trends and connections between the input characteristics and depression status [15]. Based on the input data, the model can be trained to predict a new patient's risk of developing depression. After assessing the given features, the model generates a score or probability that denotes the existence or severity of depression. To produce a diagnosis, the results of the predictive analysis are merged with clinical knowledge and recommendations. Developing an informed diagnosis entails taking into account the patient's history, symptomatology, and other pertinent data.

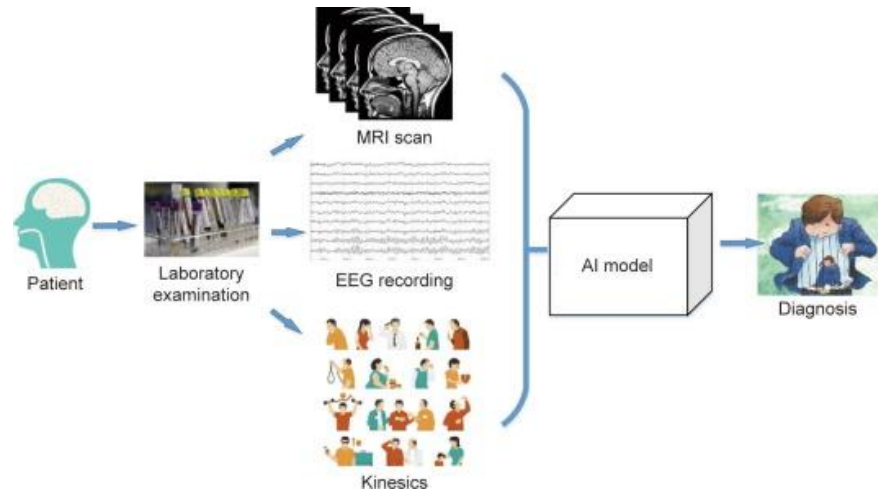


Fig. 1. Diagnosing psychological disorders using artificial intelligence techniques [13].

2. RECOMMENDATIONS FOR APPROPRIATE TREATMENT OF THE CONDITION

Although psychological depression can greatly benefit from AI, it is important to understand that AI must always support, support, and complement human healthcare and medical practitioners [16-18]. The following explains how artificial intelligence can be used appropriately to treat depression:

- *Collaboration*: AI should be used as a means to enhance existing collaboration between AI algorithms and human clinical psychologists, psychiatrists, therapists, and all their cadres [19]. Healthcare practitioners can gain greater insight, more personalized treatment regimens, and enhance patient progress monitoring by integrating AI into the detection and treatment process [20].
- *Help and treatment*: People suffering from depression can receive help and treatment via chatbots or virtual agents that work with artificial intelligence [21]. These programs can conduct therapeutic dialogues, teach coping mechanisms, and provide ongoing emotional support. However, it is essential to ensure that patients are aware of the limitations of AI-based treatment and can communicate with medical professionals when they need them.
- *Early detection and prevention of disease*: Artificial intelligence systems can examine a variety of data sets and information to identify people who may be at risk of developing depression. AI can identify early warning indicators and enable rapid interventions and preventive actions by tracking social media behaviour, genetic data, and medical records [22].
- *Personalized treatment via artificial intelligence*: By evaluating large sets of patient data, artificial intelligence can help improve treatment plans [23]. AI has the potential to enhance treatment outcomes and reduce the trial-and-error process involved in determining the most effective medications, doses, and combinations on a per-person basis.
- *Ethical considerations, privacy, and preservation of patient data* [24]: Adequate safeguards must be implemented to ensure patient confidentiality, informed consent, and ethical application of AI systems in the treatment of depression. It is necessary to put safeguards in place to protect patient's private information and ensure that privacy laws are followed.
- *Continuous monitoring and engagement* [25]: AI can provide continuous tracking of a patient's progress and provide feedback to medical staff as well as the patient. This encourages ongoing participation and support and modification of treatment programs as necessary.

3. EMOTIONAL SUPPORT AND POSITIVE MOTIVATION TECHNIQUES

Artificial intelligence can help people with psychological depression by using the following methods to help with emotional support and constructive motivating techniques:

- *Robots and Virtual Assistants*: Chatbots and virtual assistants that employ artificial intelligence can communicate with patients and provide a comforting and supportive environment. These platforms serve as a listening ear, an emotional support system, and a wellspring of practical knowledge and coping skills for patients [26].
- *Mood Monitoring and Evaluation*: AI systems can identify patterns in a patient's behaviour and emotional state by continuously observing various data inputs, such as voice recordings, text messages, and social media activity [26]. Because AI systems can identify mood swings and triggers, they can provide guidance and solutions for managing negative emotions.
- *Cognitive Behavioural Therapy (CBT) Tools* [27]: CBT interventions and approaches can be delivered using artificial intelligence. Interactive modules or apps that lead patients through mindfulness exercises, cognitive reframing exercises, relaxation techniques, and other research-backed therapy procedures can be a part of this.
- *Daily Reminders and Motivating factors*: AI systems can schedule specific reminders for self-care activities such as exercising, keeping a journal, or following medication schedules. They can also share motivational quotes, stories, or sayings to uplift the patient's spirits and encourage positive thinking [28].
- *Peer Support Groups and Online Communities* [29]: AI can facilitate connections for individuals experiencing depression by recommending peer support groups or online communities. Through the ability to share experiences, offer support to one another, and create supportive networks, these platforms can help patients feel like they belong to a community.
- *Entertainment and Diversion*: AI can recommend or provide engaging content, such as music playlists, movies, or video games that are carefully picked to boost mood and deflect negative thoughts. When choosing from these entertainment options, individual interests and preferences can be taken into consideration [30].

4. MONITORING SYMPTOMS OF THE DISEASE AND ANALYSING DATA REGARDING

Artificial intelligence can be used to monitor disease symptoms and analyse data associated with psychological depression in the healthcare industry [31-33]. AI is capable of analysing big datasets to find individualized treatment solutions for depressed patients. AI can assist medical personnel in customizing treatment regimens to meet the unique needs of each patient by taking into account variables such as genetic data, medical history, and reactions to various medications. AI is capable of analysing big datasets to find individualized treatment solutions for depressed patients [34]. AI can assist medical personnel in customizing treatment regimens to meet the unique needs of each patient by taking into account variables such as genetic data, medical history, and reactions to various medications. Chat bots and virtual assistants with AI capabilities can be used to remotely monitor depressive symptoms. These tools can converse with patients, elicit pertinent information about their symptoms from them, and, in response, offer resources or help [35]. This can guarantee patients receive continuing support and broaden the scope of mental health treatments. AI is capable of doing data analysis to estimate the chance of relapsing or predicting the risk of depression. Artificial Intelligence has the potential to facilitate preventative interventions and avert unfavourable outcomes by integrating variables such as lifestyle habits, environmental factors, and social determinants of health [36]. Large volumes of research data can be analysed by AI algorithms to find trends, connections, and possible causes of depression [37-40]. This can help scientists learn new things, create fresh remedies, and improve our comprehension of the illness.

5. CONCLUSIONS

The use of artificial intelligence in treating psychological depression holds great promise for facilitating the work of medical personnel in treating the patient. People with depression may be able to obtain personalized treatment and support that is easily accessible from artificial intelligence algorithms. It may help in early recognition, diagnosis, and prevention of depression, leading to faster and more effective treatment results. Furthermore, AI can optimize treatment plans by discovering the best drug, dosage, and combination for each condition. However, it is important to keep in mind that AI technology should never replace licensed medical professionals and their staff. AI systems should support psychologists, therapists, and psychiatrists in diagnosing, monitoring, and treating depression, not replace them. While more comprehensive research, analysis, and interpretation are needed to confirm the effectiveness of AI in treating depression, the field of mental health services could be profoundly transformed by this cutting-edge technology.

Funding

The authors had no institutional or sponsor backing.

Conflicts Of Interest

The author's disclosure statement confirms the absence of any conflicts of interest.

Acknowledgment

The authors extend appreciation to the institution for their unwavering support and encouragement during the course of this research.

References

- [1] S. Zhou, J. Zhao, and L. Zhang, "Application of Artificial Intelligence on Psychological Interventions and Diagnosis: An Overview," *Frontiers in Psychiatry*, vol.13, pp.1-7, March 2022. <https://doi.org/10.3389/fpsyt.2022.811665>
- [2] M. L. Joshi and N. Kanoongo, "Depression detection using emotional artificial intelligence and machine learning: A closer review," *Materials Today: Proceedings*, vol.58, no.1, pp.217-226, 2022. <https://doi.org/10.1016/j.matpr.2022.01.467>
- [3] J. Abdollahi and L. Mahmoudi, "An Artificial Intelligence System for Detecting the Types of the Epidemic from X-rays: Artificial Intelligence System for Detecting the Types of the Epidemic from X-rays," In Proceedings of International Computer Conference, Computer Society of Iran, pp.1-6, May 2022. <https://doi.org/10.1109/CSICC55295.2022.9780523>
- [4] A. T. Catherine, S. K. Towfek, and A. A. Abdelhamid, "An Overview of the Evolution and Impact of Chatbots in Modern Healthcare Services," *Mesopotamian Journal of Artificial Intelligence in Healthcare*, vol.2023, pp.71-75, December 2023. <https://doi.org/10.58496/MJAIH/2023/014>
- [5] M. M. Mijwil, AH. Al-Mistarehi, M. Abotaleb, E. M. El-kenawy, A. Ibrahim, A. A. Abdelhamid, M. E. Eid, "From Pixels to Diagnoses: Deep Learning's Impact on Medical Image Processing-A Survey," *Wasit Journal of Computer and Mathematics Science*, vol.2, no.2, pp:8-14, September 2023. <https://doi.org/10.31185/wjcms.178>
- [6] C. Popescu, G. Golden, D. Benrimoh, M. Tanguay-Sela, D. Slowey, et al., "Evaluating the Clinical Feasibility of an Artificial Intelligence–Powered, Web-Based Clinical Decision Support System for the Treatment of Depression in Adults: Longitudinal Feasibility Study," *JMIR Formative Research*, vol.5, no.10, pp. e31862, July 2021. <https://doi.org/10.2196/31862>
- [7] H. I. W. Al-Shahwani and A. K. Faieq, "The Benefit of Artificial Intelligence in the Analysis of Malignant Brain Diseases: A Mini Review," *Mesopotamian Journal of Artificial Intelligence in Healthcare*, vol.2023, pp.57-60, November 2023. <https://doi.org/10.58496/MJAIH/2023/011>
- [8] M. M. Mijwil, "Deep Convolutional Neural Network Architecture to Detection COVID-19 from Chest X-ray Images," *Iraqi Journal of Science*, vol.64, no.5, pp:2561-2574, May 2023. <https://doi.org/10.24996/ij.s.2023.64.5.38>
- [9] M. D. Nemesure, M. V. Heinz, R. Huang, and N. C. Jacobson, "Predictive modeling of depression and anxiety using electronic health records and a novel machine learning approach with artificial intelligence," *Scientific Reports*, vol.11, No.1980, pp.1-9, January 2021. <https://doi.org/10.1038/s41598-021-81368-4>
- [10] R. Gupta, D. Srivastava, M. Sahu, S. Tiwari, R. K. Ambasta, and P. Kumar, "Artificial intelligence to deep learning: machine intelligence approach for drug discovery," *Molecular Diversity*, vol.25, pp.1315–1360, April 2021. <https://doi.org/10.1007/s11030-021-10217-3>
- [11] L. K. Vora, A. D. Gholap, K. Jetha, R. R. S. Thakur, H. K. Solanki, and V. P. Chavda, "Artificial Intelligence in Pharmaceutical Technology and Drug Delivery Design," *Pharmaceutics*, vol.15, no.7, pp.1916, July 2023. <https://doi.org/10.3390/pharmaceutics15071916>
- [12] M. M. Mijwil and B. S. Shukur, "A Scoping Review of Machine Learning Techniques and Their Utilisation in Predicting Heart Diseases," *Ibn AL- Haitham Journal For Pure and Applied Sciences*, vol. 35, no.3, pp: 175-189, July 2022. <https://doi.org/10.30526/35.3.2813>
- [13] G. Liu, Y. Li, W. Zhang, and L. Zhang, "A Brief Review of Artificial Intelligence Applications and Algorithms for Psychiatric Disorders," *Engineering*, vol.6, no.4, pp.462-467, April 2020. <https://doi.org/10.1016/j.eng.2019.06.008>
- [14] J. Kamath, R. L. Barriera, N. Jain, E. Keisari, and B. Wang, "Digital phenotyping in depression diagnostics: Integrating psychiatric and engineering perspectives," *World Journal of Psychiatry*, vol.12, no.3, pp.393-409, March 2022. <https://doi.org/10.5498/wjp.v12.i3.393>
- [15] C. Y. Chiu, H. Y. Lane, J. L. Koh, and A. L. P. Chen, "Multimodal depression detection on instagram considering time interval of posts," *Journal of Intelligent Information Systems*, vol.56, pp.25–47, May 2020. <https://doi.org/10.1007/s10844-020-00599-5>
- [16] O. Asan, A. E. Bayrak, and A. Choudhury, "Artificial Intelligence and Human Trust in Healthcare: Focus on Clinicians," *Journal of Medical Internet Research*, vol.22, no.6, pp.e15154, 2020. <https://doi.org/10.2196/15154>

- [17] AH. Al-Mistarehi, M. M. Mijwil, Y. Filali, M. Bounabi, G. Ali, and M. Abotaleb, "Artificial Intelligence Solutions for Health 4.0: Overcoming Challenges and Surveying Applications," *Mesopotamian Journal of Artificial Intelligence in Healthcare*, vol.2023, pp.15-20, March 2023. <https://doi.org/10.58496/MJAIH/2023/003>
- [18] A. Čartolovni, A. Tomičić, and E. L. Mosler, "Ethical, legal, and social considerations of AI-based medical decision-support tools: A scoping review," *International Journal of Medical Informatics*, vol.161, pp.104738, May 2022. <https://doi.org/10.1016/j.ijmedinf.2022.104738>
- [19] G. Fu, Q. Zhao, J. Li, D. Luo, C. Song, et al., "Enhancing Psychological Counseling with Large Language Model: A Multifaceted Decision-Support System for Non-Professionals," *ArXiv*, pp.1-12, August 2023. <https://doi.org/10.48550/arXiv.2308.15192>
- [20] K. B. Johnson, W. Wei, D. Weeraratne, M. E. Frisse, K. Misulis, K. Rhee, J. Zhao, and J. L. Snowdon, "Precision Medicine, AI, and the Future of Personalized Health Care," *Clinical and Translational Science (CTS)*, vol.14, no.1, pp.86-93, January 2021. <https://doi.org/10.1111/cts.12884>
- [21] K. T. Pham, A. Nabizadeh, and S. Selek, "Artificial Intelligence and Chatbots in Psychiatry," *Psychiatric Quarterly*, vol.93, pp.249–253, February 2022. <https://doi.org/10.1007/s11126-022-09973-8>
- [22] D. Zeng, Z. Cao, and D. B. Neill, "Artificial intelligence-enabled public health surveillance—from local detection to global epidemic monitoring and control," In *Artificial Intelligence in Medicine*, pp.437-453, 2021. <https://doi.org/10.1016/B978-0-12-821259-2.00022-3>
- [23] S. Graham, C. Depp, E. E. Lee, C. Nebeker, X. Tu, et al., "Artificial Intelligence for Mental Health and Mental Illnesses: an Overview," *Current Psychiatry Reports*, vol.21, no.116, pp.1-18, November 2019. <https://doi.org/10.1007/s11920-019-1094-0>
- [24] K. Palomino and C. Berdugo, "Big Data Analytics and Mental Health: Would Ethics Be the Only Safeguard Against the Risks of Identifying "Potential Patients"?", *IEEE Intelligent Systems*, vol.38, no.5, pp.37 - 44, June 2023. <https://doi.org/10.1109/MIS.2023.3287409>
- [25] L. Xu, L. Sanders, K. Li, and J. C. L. Chow, "Chatbot for Health Care and Oncology Applications Using Artificial Intelligence and Machine Learning: Systematic Review," *JMIR Cancer*, vol.7, no.4, pp.e27850, 2021. <https://doi.org/10.2196/27850>
- [26] Y. Liang, X. Zheng, and D. D. Zeng, "A survey on big data-driven digital phenotyping of mental health," *Information Fusion*, vol.52, pp.290-307, December 2019. <https://doi.org/10.1016/j.inffus.2019.04.001>
- [27] S. W. Stirman, C. A. Gutner, J. Gamarra, M. K. Suvak, D. Vogt, et al., "A Novel Approach to the Assessment of Fidelity to a Cognitive Behavioral Therapy for PTSD Using Clinical Worksheets: A Proof of Concept With Cognitive Processing Therapy," *Behavior Therapy*, vol.52, no.3, pp.656-672, May 2021. <https://doi.org/10.1016/j.beth.2020.08.005>
- [28] I. Madujibeya, T. A. Lennie, J. Pelzel, and D. K. Moser, "Patients' Experiences Using a Mobile Health App for Self-Care of Heart Failure in a Real-World Setting: Qualitative Analysis," *JMIR Formative Research*, vol.7, pp.e39525, 2023. <https://doi.org/10.2196/39525>
- [29] D. Smit, J. N. Vrijnsen, B. Groeneweg, A. Vellinga-Dings, J. Peelen, and J. Spijker, "A Newly Developed Online Peer Support Community for Depression (Depression Connect): Qualitative Study," *Journal of Medical Internet Research*, vol.23, no.7, pp.e25917, 2021. <https://doi.org/10.2196/25917>
- [30] R. Doshi, K. K. Hiran, M. Gök, E. M. El-kenawy, A. Badr, and M. Abotaleb, "Artificial Intelligence's Significance in Diseases with Malignant Tumours," *Mesopotamian Journal of Artificial Intelligence in Healthcare*, vol.2023, pp.35-39, July 2023. <https://doi.org/10.58496/MJAIH/2023/007>
- [31] E. E. Lee, J. Torous, M. D. Choudhury, C. A. Depp, S. A. Graham, et al., "Artificial Intelligence for Mental Health Care: Clinical Applications, Barriers, Facilitators, and Artificial Wisdom," *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, vol.6, no.9, pp.856-864, September 2021. <https://doi.org/10.1016/j.bpsc.2021.02.001>
- [32] N. B. Oğur, C. Çeken, Y. S. Oğur, H. U. Yuvaci, A. B. Yazici, and E. Yazici, "Development of an Artificial Intelligence-Supported Hybrid Data Management Platform for Monitoring Depression and Anxiety Symptoms in the Perinatal Period: Pilot-Scale Study," *IEEE Access*, vol.11, pp.31456 - 31466, March 2023. <https://doi.org/10.1109/ACCESS.2023.3262467>
- [33] G. Rubeis, "iHealth: The ethics of artificial intelligence and big data in mental healthcare," *Internet Interventions*, vol.28, pp.100518, April 2022. <https://doi.org/10.1016/j.invent.2022.100518>

- [34] A. Rosenfeld, D. Benrimoh, C. Armstrong, N. Mirchi, T. Langlois-Therrien, et al., “Big Data analytics and artificial intelligence in mental healthcare,” *Applications of Big Data in Healthcare*, pp.137-171, 2021. <https://doi.org/10.1016/B978-0-12-820203-6.00001-1>
- [35] H. M. Derry, A. S. Epstein, W. G. Lichtenthal, and H. G. Prigerson, “Emotions in the room: common emotional reactions to discussions of poor prognosis and tools to address them,” *Expert Review of Anticancer Therapy*, vol.19, no.8, pp.689-696, August 2019. <https://doi.org/10.1080/14737140.2019.1651648>
- [36] P. J. Cho, K. Singh, and J. Dunn, “Roles of artificial intelligence in wellness, healthy living, and healthy status sensing,” In *Artificial Intelligence in Medicine*, pp.151-172, 2021. <https://doi.org/10.1016/B978-0-12-821259-2.00009-0>
- [37] B. X. Tran, R. S. McIntyre, C. A. Latkin, H. T. Phan, G. T. Vu, et al., “The Current Research Landscape on the Artificial Intelligence Application in the Management of Depressive Disorders: A Bibliometric Analysis,” *International Journal of Environmental Research and Public Health*, vol.16, no.12, pp.2150, June 2019. <https://doi.org/10.3390/ijerph16122150>
- [38] M. M. Mijwil, A. K. Faieq, and AH. Al-Mistarehi, “The Significance of Digitalisation and Artificial Intelligence in The Healthcare Sector: A Review,” *Asian Journal of Pharmacy, Nursing and Medical Sciences*, vol.10, no. 3, pp: 25-32, November 2022. <https://doi.org/10.24203/ajpnms.v10i3.7065>
- [39] S. Rasteau, D. Ernenwein, C. Savoldelli, and P. Bouletreau, “Artificial intelligence for oral and maxillo-facial surgery: A narrative review,” *Journal of Stomatology, Oral and Maxillofacial Surgery*, vol.123, no. 3, pp.276-282, July 2022. <https://doi.org/10.1016/j.jormas.2022.01.010>
- [40] L. Wilson and M. Marasoiu, “The Development and Use of Chatbots in Public Health: Scoping Review,” *JMIR Human Factors*, vol.9, no.4, pp.e35882, 2022. <https://doi.org/10.2196/35882>