

Artificial Intelligence for Mental Health: A Review Based Analysis of Early Detection and Management of Depression in Elderly Citizens

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ABSTRACT

Depression among the elderly in India is increasingly concerning due to socio-economic, health, and cultural factors. The elderly population is projected to rise significantly, highlighting the need to address mental health issues like depression. Social isolation is a major factor, exacerbated by the shift from traditional joint families to nuclear families, leaving many elderly individuals lonely and with reduced familial support. Additionally, the erosion of social networks and community ties further isolates them.

Health issues also significantly contribute to depression among the elderly. Chronic illnesses, physical disabilities, and general health decline with aging impact mental well-being. The lack of adequate healthcare infrastructure, especially in rural areas, leaves many elderly without necessary medical and psychological care. Financial insecurity, due to inadequate pension systems and rising living costs, adds stress and anxiety.

Cultural stigmas around mental health prevent many from seeking help. Depression is often misunderstood or dismissed, leading to underreporting and insufficient care. Societal expectations for stoicism and resilience in the elderly further discourage them from expressing their struggles.

A multi-faceted approach is needed to address this issue, including expanding accessible mental health services, community-based support systems, awareness campaigns to destigmatize mental health issues, and integrating mental health care into primary health services. Utilizing AI for prevention and mental well-being among senior citizens can be a potential solution. This paper is an attempt to understand how effectively AI can be used to address the issue.

Key words - Artificial Intelligence, Depression, Mental health, Senior Citizens

Introduction

Depression among the elderly in India is a growing concern, driven by a range of socio-economic, health, and cultural factors. With the country experiencing rapid demographic changes, the elderly population is projected to rise significantly, bringing mental health issues like depression into sharper focus.

Several factors contribute to the increasing rates of depression among the elderly in India. Social isolation is a primary concern, often exacerbated by the traditional joint family system giving way to nuclear families. Many elderly individuals find themselves living alone or with reduced familial support, leading to feelings of loneliness and abandonment. Additionally, the erosion of social networks and community ties, once strong pillars of support, further isolates them.

Health-related issues also play a significant role. Chronic illnesses, physical disabilities, and the general decline in health associated with aging can severely impact mental well-being. The lack of adequate healthcare infrastructure, especially in rural areas, means that many elderly individuals do not receive the medical and psychological care they need. Financial insecurity, often resulting from inadequate pension systems and the increasing cost of living, adds another layer of stress and anxiety.

Cultural stigmas around mental health prevent many from seeking help. Depression and other mental health issues are often misunderstood or dismissed, leading to underreporting and a lack of appropriate care. The societal

expectation for the elderly to remain stoic and resilient in the face of adversity can also discourage them from expressing their struggles.

To address this growing problem, a multi-faceted approach is required. Expanding mental health services and making them accessible to the elderly, particularly in rural areas, is crucial. Community-based support systems can help mitigate social isolation. Awareness campaigns to destigmatize mental health issues and encourage seeking help are essential. Furthermore, integrating mental health care into primary health services can ensure that elderly individuals receive comprehensive care.

The rising incidence of depression among the elderly in India calls for urgent attention and action. By addressing the socio-economic, health, and cultural factors contributing to this issue, India can improve the quality of life for its aging population. Artificial Intelligence can be used to deal with the problem. This paper is an endeavour to find out how effective AI can be in prevention of depression and mental wellbeing of the senior citizens.

Artificial Intelligence for Mental Health

D'Alfonso's (2020) article provides a comprehensive overview of the intersection between artificial intelligence (AI) and mental health care. The paper highlights the transformative potential of AI technologies in diagnosing, treating, and managing mental health conditions. D'Alfonso underscores the capabilities of AI-driven tools, such as machine learning algorithms, in analyzing vast datasets to identify patterns and predict mental health issues, potentially leading to earlier interventions and more personalized treatments.

The article also addresses the ethical and practical challenges associated with the integration of AI in mental health. These include concerns about data privacy, the risk of algorithmic bias, and the need for transparency in AI decision-making processes. D'Alfonso emphasizes the importance of developing robust ethical guidelines and regulatory frameworks to ensure the responsible use of AI in this sensitive field.

Moreover, the paper discusses the potential benefits of AI in enhancing access to mental health services, especially in underserved populations. AI-powered chatbots and virtual therapists, for example, could provide support to individuals who might otherwise lack access to traditional mental health care. Overall, D'Alfonso's article is a valuable contribution to the ongoing discourse on AI's role in mental health, offering insights into both its promises and perils.

Carr's (2020) work offers a critical perspective on the ethical implications and engagement strategies surrounding AI in mental health care. The paper underscores the transformative potential of AI while also cautioning against its uncritical adoption.

Carr explores how data-driven technologies can enhance mental health services through improved diagnostic tools, personalized treatment plans, and more efficient resource allocation. However, the article raises significant ethical concerns, such as data privacy, consent, and the potential for exacerbating existing inequalities. Carr emphasizes the need for robust ethical frameworks to guide the development and deployment of AI technologies in mental health.

The paper also discusses the importance of meaningful engagement with stakeholders, including patients, healthcare providers, and policymakers, to ensure that AI tools are designed and implemented in ways that are beneficial and acceptable to all parties involved. Carr advocates for transparent communication, participatory design processes, and continuous ethical oversight to mitigate the risks associated with AI in mental health care. To sum up, Carr's article provides a nuanced view of the promises and pitfalls of AI in mental health, urging a balanced approach that prioritizes ethical considerations and stakeholder engagement.

Koutsouleris et al.'s (2022) study provides a comprehensive roadmap for integrating AI into mental health care. The authors highlight the substantial potential of AI to revolutionize the field by improving diagnostic accuracy, personalizing treatments, and optimizing resource allocation.

The paper emphasizes the need for rigorous clinical validation and real-world implementation of AI tools to bridge the gap between theoretical promise and practical application. Koutsouleris and colleagues discuss various AI technologies, such as machine learning and natural language processing, and their applications in detecting mental health disorders and predicting treatment outcomes.

However, the article also addresses significant challenges, including data privacy concerns, algorithmic bias, and the need for ethical standards. The authors call for a collaborative approach involving clinicians, researchers, and policymakers to ensure the ethical and effective deployment of AI in mental health care.

On the whole, the article presents a balanced perspective, advocating for cautious optimism and highlighting the critical steps necessary to realize the benefits of AI in mental health practice.

Chen, Szolovits, and Ghassemi's (2019) article explores the potential of AI to address inequities in healthcare. The authors discuss how AI technologies, such as machine learning and predictive analytics, can improve access to and the quality of care for underserved populations.

The paper highlights AI's capacity to analyze large datasets to identify patterns that might be overlooked by traditional methods, leading to more accurate diagnoses and personalized treatment plans. By optimizing resource allocation and enabling early intervention, AI could mitigate disparities in healthcare outcomes.

However, the authors also acknowledge significant challenges. These include the risk of perpetuating existing biases if the AI systems are trained on biased data, as well as concerns about data privacy and the ethical use of AI in sensitive contexts. They advocate for careful design and implementation of AI systems, emphasizing the importance of transparency, inclusivity, and continuous ethical oversight.

By and large, the article presents a balanced view, recognizing AI's potential to reduce healthcare disparities while urging caution to ensure these technologies are used ethically and effectively.

Shah's (2022) Study delves into the transformative role of AI in mental health care. The paper primarily focuses on predictive analytics and its potential to revolutionize mental health interventions. Shah highlights how machine learning algorithms can analyze vast datasets to predict the onset of mental health disorders, enabling early intervention and personalized treatment plans.

The article outlines various AI-driven strategies for mental health interventions, including the use of chatbots for providing immediate support and virtual reality for therapeutic purposes. Shah emphasizes the potential of these technologies to enhance accessibility and efficiency in mental health care, particularly for underserved populations.

However, the article also addresses the challenges and ethical considerations of implementing AI in mental health. Shah discusses concerns related to data privacy, the potential for algorithmic bias, and the importance of maintaining human oversight in AI-driven interventions.

To a great extent, Shah's article provides a comprehensive overview of the current and potential future applications of AI in mental health, advocating for a balanced approach that leverages AI's benefits while addressing its ethical and practical challenges.

Minerva and Giubilini's work (2023) examines the potential and challenges of integrating AI into mental health care. The authors provide a balanced analysis, weighing AI's capabilities against its ethical and practical implications.

The article begins by highlighting the transformative potential of AI technologies, such as machine learning and natural language processing, in enhancing the accuracy of mental health diagnoses, personalizing treatment plans, and predicting patient outcomes. Minerva and Giubilini emphasize how AI can analyze complex data sets, including patient histories and real-time behavioral data, to identify patterns that might elude human practitioners. However, the authors also delve into significant ethical concerns. They discuss the risks of algorithmic bias, data privacy issues, and the potential loss of the human touch in mental health care. The article argues for the importance of maintaining human oversight and empathy in AI-driven interventions to ensure that care remains patient-centered and ethical.

Moreover, Minerva and Giubilini advocate for a collaborative approach involving technologists, ethicists, and mental health professionals to develop AI tools that are both effective and ethically sound. They call for robust regulatory frameworks and ethical guidelines to govern the deployment of AI in mental health care.

All inclusively, the article offers a nuanced perspective on the role of AI in mental health, recognizing its potential while urging caution and ethical vigilance.

Lee et al.'s (2021) paper presents a thorough exploration of AI's potential in mental health care. The authors examine various AI applications, including predictive analytics, diagnostic tools, and personalized treatment strategies. They highlight how AI can improve the accuracy of diagnoses and the effectiveness of interventions by analyzing large-scale data from diverse sources.

The paper also identifies significant barriers to AI implementation, such as data privacy concerns, algorithmic bias, and the need for transparency in AI decision-making processes. The authors emphasize the importance of addressing these challenges to ensure the ethical and effective use of AI in mental health care.

Additionally, the paper discusses facilitators that can enhance AI integration, including interdisciplinary collaboration, robust ethical guidelines, and continuous feedback from stakeholders.

The concept of "artificial wisdom" is introduced, advocating for the combination of human judgment and AI capabilities to optimize mental health outcomes. Overall, the article provides a balanced view, recognizing AI's transformative potential while underscoring the importance of ethical considerations and collaborative efforts in its application to mental health care.

Tutun et al.'s (2023) article explores the development and application of an AI-driven system designed to predict mental health disorders. The authors detail how their system utilizes machine learning algorithms to analyze diverse datasets, including clinical records, genetic information, and social determinants of health, to identify individuals at risk of developing mental health conditions.

The paper highlights the system's potential to enhance early detection and intervention, leading to improved patient outcomes. By providing healthcare professionals with actionable insights and predictive analytics, the AI-based decision support system aims to personalize treatment plans and allocate resources more efficiently.

Despite its promising potential, the article also addresses several challenges, such as ensuring data privacy, mitigating algorithmic bias, and achieving high accuracy and reliability in diverse populations. The authors emphasize the importance of continuous validation and refinement of the AI models to maintain their effectiveness and ethical integrity.

On the whole, Tutun et al.'s article provides a comprehensive overview of the capabilities and limitations of AI-based decision support systems in mental health care. It underscores the need for interdisciplinary collaboration and ethical considerations to maximize the benefits of AI in predicting and managing mental health disorders.

Sharma et al.'s (2023) paper investigates the synergistic potential of human-AI collaboration in enhancing empathy in mental health support conversations. The study focuses on text-based peer-to-peer mental health platforms, where AI tools are used to assist human supporters in delivering more empathetic responses.

The authors describe how AI algorithms analyze conversation data to provide real-time suggestions and feedback to human supporters, improving the quality and emotional resonance of their responses. This collaboration aims to bridge the empathy gap that can sometimes occur in digital interactions, ensuring that individuals seeking help feel understood and supported.

The authors describe how AI algorithms analyze conversation data to provide real-time suggestions and feedback to human supporters, improving the quality and emotional resonance of their responses. This collaboration aims to bridge the empathy gap that can sometimes occur in digital interactions, ensuring that individuals seeking help feel understood and supported.

Overall, Sharma et al.'s article presents a compelling case for the integration of AI in peer-to-peer mental health support, highlighting its ability to enhance empathy and improve user experience while emphasizing the importance of ethical considerations and human oversight.

Cheng and Jiang's (2020) study investigates the role of AI-driven chatbots in providing mental health support following traumatic events. The study explores user motivations for engaging with these chatbots, their communicative actions, and the level of user engagement.

The authors found that individuals turn to AI chatbots for immediate, accessible mental health support during crises. These chatbots offer anonymity, round-the-clock availability, and non-judgmental interactions, which are particularly valuable in the aftermath of mass-shooting disasters. The study highlights that users actively communicate with chatbots, seeking emotional relief and coping strategies.

Cheng and Jiang also discuss the effectiveness of chatbots in maintaining user engagement, emphasizing the importance of personalized and empathetic responses. However, they note challenges such as ensuring data privacy and the need for continuous improvement of chatbot algorithms to better mimic human empathy.

To sum up, the article provides valuable insights into the benefits and challenges of using AI-powered chatbots for mental health support in crisis situations, advocating for their potential while calling for ethical considerations and technological advancements.

Hamdoun, Monteleone, Bookman, and Michael's (2023) study provides a comprehensive analysis of the growing reliance on AI-driven mental health applications. The authors examine the dual aspects of these technologies: their potential to meet mental health care needs and the associated risks.

The article highlights the significant benefits of AI-based mental health apps, such as increased accessibility to care, personalized treatment plans, and continuous monitoring of mental health conditions. These apps can bridge gaps in traditional mental health services, especially in underserved areas, by offering timely and cost-effective support.

However, the authors also emphasize the inherent risks, including concerns about data privacy, the reliability of AI-generated diagnoses, and the potential for algorithmic bias. They call for robust regulatory frameworks to ensure these technologies are used responsibly and ethically. Moreover, they advocate for greater transparency in AI algorithms and continuous evaluation to maintain trust and effectiveness.

All inclusively, the article provides a balanced perspective on AI-based mental health apps, acknowledging their transformative potential while underscoring the importance of addressing ethical and practical challenges to safeguard users' well-being.

De Freitas, Uğuralp, Oğuz-Uğuralp, and Puntoni's (2023) paper delves into the safety and efficacy of generative AI in mental health chatbots. The authors explore how these AI systems interact with users seeking mental health support, examining both the potential benefits and risks.

The paper underscores the advantages of AI chatbots, such as their accessibility, scalability, and ability to provide immediate, round-the-clock support. These features make AI chatbots particularly valuable for individuals who may lack access to traditional mental health services. The study also highlights the potential of these chatbots to deliver consistent and non-judgmental interactions, fostering user engagement and support.

However, the authors raise significant concerns about the safety of generative AI in this context. They discuss issues related to the accuracy and reliability of the AI-generated responses, the potential for harmful advice, and the challenges of ensuring user data privacy. The need for stringent regulatory measures and continuous monitoring of AI systems is emphasized to mitigate these risks.

To a large extent, the article provides a thorough analysis of the role of generative AI in mental health chatbots, advocating for a cautious approach that balances benefits with safety and ethical considerations.

Singh's (2023) article offers a concise yet insightful examination of the implications of AI technologies like ChatGPT in mental health care. The author highlights the significant opportunities presented by AI, such as enhanced accessibility to mental health services, personalized care, and the ability to provide immediate support.

Singh emphasizes the potential for AI to transform mental health diagnostics and treatment through advanced data analysis and interactive tools that can engage users effectively. However, the article also addresses several challenges, including concerns about data privacy, the risk of AI-generated misinformation, and the ethical considerations of relying on AI for sensitive mental health issues.

The author calls for a balanced approach, advocating for the integration of AI into mental health care while emphasizing the importance of robust ethical guidelines, continuous oversight, and the need for AI to complement rather than replace human professionals. Overall, Singh's article provides a thoughtful perspective on the evolving role of AI in mental health, recognizing its potential benefits and inherent risks.

Higgins, Short, Chalup, and Wilson's (2023) provides a comprehensive overview of AI and ML applications in mental health decision support systems. The authors discuss how these technologies can enhance clinical decision-making by analyzing large datasets to identify patterns, predict outcomes, and recommend personalized treatments.

The review highlights significant benefits, including improved diagnostic accuracy, early detection of mental health conditions, and optimized treatment plans. However, the authors also address challenges such as data privacy concerns, potential biases in AI algorithms, and the need for rigorous validation of these systems in clinical settings.

The article emphasizes the importance of integrating AI and ML tools with human expertise to ensure ethical and effective mental health care. Overall, Higgins et al. present a balanced view, recognizing the transformative potential of AI and ML while underscoring the necessity for ethical considerations and continuous improvement. Boucher et al.'s (2021) offers a thorough analysis of AI chatbots in mental health care. The authors review the effectiveness, accessibility, and user engagement of these digital interventions. They highlight how AI chatbots can provide immediate, scalable, and cost-effective mental health support, making care more accessible to diverse populations.

The review also addresses the limitations of AI chatbots, such as their inability to fully replicate human empathy and the potential risks associated with data privacy and security. The authors call for rigorous validation, ethical considerations, and continuous improvement to enhance the reliability and effectiveness of AI chatbots in mental health interventions.

In a nutshell, the article presents a balanced view, acknowledging the significant potential of AI chatbots while emphasizing the need for careful implementation and ethical oversight.

Tornero-Costa et al.'s (2023) article, "Methodological and Quality Flaws in the Use of Artificial Intelligence in Mental Health Research: Systematic Review," published in *JMIR Mental Health*, critically examines the current state of AI applications in mental health research. The authors systematically review existing studies and identify significant methodological weaknesses and quality issues.

The review highlights common flaws, including inadequate sample sizes, lack of diverse datasets, and insufficient validation of AI models. The authors stress that these shortcomings can lead to unreliable results and hinder the translation of AI advancements into clinical practice. They also point out the frequent absence of ethical considerations and transparency in the studies reviewed.

Tornero-Costa et al. advocate for more rigorous research methodologies, better standardization, and adherence to ethical guidelines to improve the reliability and applicability of AI in mental health care. Overall, the article underscores the need for higher standards in AI research to fully realize its potential in the mental health domain.

Artificial Intelligence for Depression

Liu et al. (2022) conducted a study to evaluate the effectiveness of AI chatbots in providing self-help interventions for depression among university students. Published in *Internet Interventions*, this randomized trial involved participants who were randomly assigned to either an AI chatbot intervention group or a control group. The AI chatbot delivered cognitive-behavioral therapy (CBT)-based interventions tailored to the needs of university students. Results indicated significant reductions in depressive symptoms for those in the intervention group compared to the control group, suggesting that AI chatbots can be an effective tool for delivering mental health support in a university setting. The study highlights the potential of AI technology in expanding access to mental health resources and providing timely, scalable support. However, the authors also acknowledge the need for further research to optimize chatbot design and address limitations such as the lack of human empathy. Overall, this study contributes valuable insights into the application of AI in mental health interventions, particularly for young adults in educational environments.

Kaywan et al. (2023) explored the potential of a conversational AI bot for the early detection of depression in their study published in *PLOS ONE*. This non-clinical trial focused on assessing the bot's ability to identify depressive symptoms through natural language conversations with users. The AI bot employed advanced natural language processing (NLP) techniques to analyze users' responses and detect markers of depression. Results demonstrated that the bot was effective in identifying early signs of depression, with accuracy comparable to traditional screening methods. Participants reported positive experiences with the bot, highlighting its user-

friendly interface and the perceived confidentiality of interactions. However, the study also emphasized the importance of ethical considerations and the need for human oversight in AI-based mental health tools. The authors concluded that conversational AI bots hold promise for early depression detection, potentially increasing access to mental health resources and facilitating timely intervention. This research underscores the growing role of AI in mental health and the importance of ongoing development and evaluation to ensure effectiveness and safety.

Abd-Alrazaq et al. (2023) conducted a comprehensive scoping review on the application of wearable artificial intelligence (AI) devices for managing anxiety and depression, published in the *Journal of Medical Internet Research*. The review synthesized existing literature on wearable AI technologies, such as smartwatches and fitness trackers, that monitor physiological and behavioral indicators to detect and manage mental health conditions. The findings indicated that wearable AI devices show promise in providing continuous, real-time monitoring of symptoms, offering personalized feedback and interventions to users. The reviewed studies demonstrated the potential for these devices to improve mental health outcomes through early detection and timely intervention. However, the review also identified significant challenges, including data privacy concerns, the need for rigorous validation studies, and issues related to user adherence and device accuracy. The authors concluded that while wearable AI technology holds great potential for enhancing mental health care, further research and development are needed to address these challenges and optimize their effectiveness and safety. This review highlights the growing role of AI in personalized mental health management.

Deshpande and Rao (2017) presented a study on using emotion artificial intelligence (AI) for detecting depression, detailed in the proceedings of the 2017 International Conference on Intelligent Sustainable Systems (ICISS). Their research focused on developing an AI system capable of analyzing emotional cues from text and speech to identify signs of depression. The system employed advanced machine learning algorithms to process emotional data and classify user states as depressed or non-depressed. Results showed that the AI system achieved high accuracy in detecting depressive symptoms, demonstrating the potential of emotion AI in mental health diagnostics. The authors highlighted the importance of integrating such technologies into existing mental health frameworks to enhance early detection and intervention. However, they also noted challenges such as ensuring data privacy, improving algorithm robustness, and addressing ethical considerations related to AI in healthcare. This study underscores the promise of emotion AI in transforming depression detection and the need for further research to refine these technologies for practical use.

Fulmer et al. (2018) conducted a randomized controlled trial to evaluate the efficacy of Tess, a psychological artificial intelligence chatbot, in alleviating symptoms of depression and anxiety. The study involved participants who were randomly assigned to interact with Tess or placed on a waitlist. Tess utilizes a variety of therapeutic techniques such as cognitive behavioral therapy (CBT), psychoeducation, and motivational interviewing to provide real-time support. Results demonstrated a significant reduction in depression and anxiety symptoms in the group that engaged with Tess compared to the waitlist control group. The chatbot's ability to offer personalized, immediate, and consistent support contributed to its effectiveness. This study highlights the potential of AI-driven tools like Tess in supplementing traditional mental health interventions, providing accessible and scalable mental health support. The research supports the integration of AI into mental health care, emphasizing the importance of ongoing evaluation and improvement of these technologies to enhance their therapeutic efficacy and user engagement.

Wasil et al. (2022) conduct a comprehensive review of popular mobile applications designed to address depression, anxiety, and overall well-being. The study meticulously evaluates the functionality, evidence base, and user engagement of these apps, highlighting the significant variability in quality and effectiveness. Despite the growing popularity of mental health apps, the authors emphasize the need for greater empirical validation and user-centric design improvements. The review identifies a gap between the availability of apps and their actual therapeutic value, suggesting that many apps lack rigorous scientific support. Wasil et al. call for developers to collaborate with mental health professionals to enhance the credibility and impact of these digital interventions, ultimately aiming to bridge the gap between technology and effective mental health care.

Ahmed et al. (2023) present a scoping review of chatbot features for managing anxiety and depression. The study examines various chatbots, evaluating their design, functionality, and therapeutic effectiveness. The authors identify key features such as natural language processing, personalized responses, and integration with human support, which enhance user engagement and treatment outcomes. However, the review reveals significant inconsistencies in the quality and evidence supporting these chatbots. Ahmed et al. call for more rigorous research and standardized guidelines to ensure the development of effective and reliable mental health chatbots. The study underscores the potential of chatbots in mental health care while highlighting the need for continued innovation and validation.

Guțu et al. (2021) explore the impact of a fully automated conversational agent on anxiety and depression in a randomized controlled trial. The study assesses the agent's effectiveness in reducing symptoms through user interactions. Findings indicate significant improvements in both anxiety and depression scores among participants who used the chatbot compared to a control group. The research underscores the potential of automated

conversational agents as accessible, cost-effective tools for mental health support. However, the authors call for further studies to replicate these results and refine chatbot interventions. Overall, the study highlights the promising role of conversational agents in mental health care.

Martinengo, Lum, and Car (2022) conduct a content analysis to evaluate chatbot-delivered interventions for the self-management of depression, as reported in the *Journal of Affective Disorders*. The study meticulously analyzes various chatbot features, therapeutic approaches, and user interactions. It identifies the use of cognitive-behavioral techniques, psychoeducation, and motivational interviewing as common intervention methods. The findings reveal that while chatbots show promise in providing accessible mental health support, there is considerable variability in their content quality and therapeutic depth. The authors emphasize the need for more rigorous clinical trials and standardized content to ensure the effectiveness of these digital tools. This study underscores the potential of chatbots in mental health care while highlighting the necessity for evidence-based approaches and continuous improvement.

Artificial Intelligence for Depression among Elderly Community

Rajawat et al. (2021) explored the application of AI robotic systems for detecting depression in elderly individuals using the Nelder–Mead Method. Presented in the book "Artificial Intelligence for Future Generation Robotics," this study highlights the need for innovative solutions to address mental health issues in aging populations. The researchers designed an AI-driven robotic system that uses the Nelder–Mead optimization algorithm to assess behavioral and physiological indicators of depression. The system's efficacy was tested through a series of interactions with elderly participants, focusing on detecting subtle signs of depression that might be overlooked in traditional assessments. Results indicated that the AI robotic system could effectively identify depressive symptoms, offering a non-invasive and accessible tool for early detection. This approach underscores the potential of combining AI and robotics to enhance mental health diagnostics, particularly for populations with limited access to conventional mental health services. The study advocates for further development and refinement of such technologies to improve accuracy, user acceptance, and integration into existing healthcare frameworks.

Kim et al. (2022) investigate the impact of an AI Robot Integrated Management Program on elderly individuals' cognitive function, daily life activities, and depression levels at home. The study, published in the *Journal of Digital Convergence*, involved 150 participants aged 65 and older. Results indicate significant improvements in cognitive function and daily life activities, as well as a notable reduction in depression symptoms. The AI robot provided personalized assistance, promoting mental engagement and independence. The authors conclude that AI-integrated interventions can be effective in supporting the elderly, enhancing their quality of life and well-being. This research highlights the potential of AI in eldercare.

Lee and Lee (2022) explore design strategies for AI speakers aimed at reducing depression among the elderly. The study emphasizes the importance of user-centered design, proposing features tailored to the unique needs of older adults. Key recommendations include incorporating empathetic communication, intuitive interfaces, and personalized content. The authors stress the significance of emotional support, suggesting that AI speakers should facilitate social interaction and provide companionship. They highlight the role of voice technology in creating a more engaging and supportive environment for the elderly. The research underscores the potential of AI speakers as tools to mitigate loneliness and depression, advocating for thoughtful design to maximize their therapeutic benefits. This study contributes valuable insights into enhancing AI technology for eldercare.

Li (2023) presents a comprehensive evaluation of elderly mental health using artificial intelligence in the article published in *Occupational Therapy International*. The study leverages AI algorithms to assess cognitive function, emotional state, and behavioral patterns in older adults. Utilizing a sample of 200 participants, the research demonstrates AI's ability to accurately identify early signs of mental health issues such as depression and anxiety. Li emphasizes the potential of AI in providing continuous, non-invasive monitoring and personalized interventions, enhancing traditional mental health assessment methods. The findings highlight AI's role in early detection and proactive management of mental health conditions, promoting better outcomes for the elderly. The study concludes that integrating AI into mental health care can significantly improve the quality of life for older adults by facilitating timely and effective support. This work underscores the transformative potential of AI in eldercare and mental health evaluation.

Song (2023) explores emotion detection in elderly residents of nursing homes using AI robot vision, as detailed in *Soft Computing*. The study utilizes advanced image processing and machine learning techniques to analyze facial expressions and body language, providing real-time emotional assessments. Results indicate high accuracy in detecting emotions such as happiness, sadness, and anxiety. The AI system enables timely intervention by caregivers, enhancing the emotional well-being of residents. Song highlights the potential of AI robots to improve mental health monitoring and personalized care in nursing homes. This research underscores the transformative impact of AI in eldercare, offering promising solutions for emotion detection and management.

Kumar, Sharma, and Karnwal (2024) present an AI-Based Health Management System for elderly individuals in their paper for the 2024 2nd International Conference on Disruptive Technologies. The system integrates AI to

monitor vital signs, predict health issues, and provide personalized care recommendations. Utilizing machine learning algorithms, the system analyzes data from wearable devices, enabling continuous health tracking and early detection of potential problems. The authors highlight the system's ability to enhance the quality of care, reduce hospital visits, and improve the overall well-being of elderly users. This innovative approach demonstrates the potential of AI in revolutionizing health management and eldercare, offering a proactive solution to address the healthcare needs of the aging population.

Discussion

Artificial Intelligence has brought a revolutionary change in the field of mental health care. It has opened many new avenues before the mental health practitioners as well as the treatment seekers or the common people. First of all, with the intelligence of this new technologies, it has become quite easy to identify patterns and predict mental health related issues. Secondly, immediate attention can be given also achieving real-time feedback has become much easier. Data gathering, analysis and record keeping is a matter of just a few clicks these days. Also, with the invention of AI, personalized treatment has become comparatively easier. Earlier it took lots of time and effort. An enhancement is seen in the case of accuracy as well. Apart from these, mental health care has become accessible for the underserved communities too as AI tools are world widely available using that is also not a big deal.

If we see from the point of view of the common people, it is serving as a boon for them too. Mental health is still a social taboo in a country like India. Because of the user-friendly nature of AT technology, now anyone can monitor their mental health status and take care whenever needed secretly without informing anybody. Prevention is always better than cure. They can even interact with the mental health experts online and take counselling session.

Depression is perhaps the biggest challenge in the contemporary period as far as mental health is concerned. It can take a very dreadful form if not treated on time. AI technologies chatbot or AI bot has enough potential to deal with the issue. Their user-friendly interface and high level of confidentiality make the patients feel comfortable and they open up easily. These technologies can be used for early detection as well as prevention and cure to minimise the rate of growth. Apart from that, smart watches and fitness trackers can also be used to monitor mental health conditions. These are commonly recommended by mental health practitioners for self-care. Studies have shown that the rate of depression gradually decreases among the people who regularly use AI technologies for mental health care. Experts believe that AI has enough potential to detect depression from speech, tone or texts. People can be easily classified as depressed or non-depressed only after a few minutes of interaction. Besides that, AI has high level of accuracy. It is an added advantage. But, with the mechanical devices, there is no human empathy. And, that is the most important thing when it comes to deal with mental health patients. Depression can be detected and prevented with AI but whether it can be purely cured, that is still a big question. None of the studies suggested that and neither did any of them give any hint.

Not many papers were found in the area of user of AI technologies to address the issue of depression. Studies showed that AI can detect depression at an early at an early stage among the elderly and can give personalised care. It can promote mental engagement and independence which is of great importance for the aging communities as in most of the cases they live in isolation away from the families. AI can be a good companion in loneliness. It is a good step in prevention of depression. As, most of the seniors are not techno savvy, features like voice technology or analysis of facial expression and body language prove to be highly impactful. Researchers believe that integration of AI in mental health care can improve the quality of life for the elderly people to a great extent by providing on time support, timely treatment and emotional comfort. They suggested to focus on incorporating empathetic communication, designing intuitive interfaces, and providing personalized content to enhance user experience for promotion of AI tools in mental health sphere.

Despite thousands of merits, inclusion of AI tools in mental health care has some challenges as well. The most common risk in the use of AI is data privacy. There is high risk of data leak. Also, consent of the patient and his family is a major concern. It may sometimes create difficulties as when it comes to technology, a large number of people lack awareness and hence carry many kinds of apprehensions. Another important challenge is bias in algorithm. If not handled properly, it can generate many complications. Most importantly, Artificial Intelligence cannot replace human touch. Patients need care and sympathy. It is possible only when the treatment is given in person. With AI, things are mechanical and they have their limitations. It is useful in the initial stages but for crucial diseases, personal care and treatment is required. AI cannot take the place of a systematically trained and experienced psychologist.

Researchers care up with different solutions regarding how to deal with the shortcomings. Carn suggested that some ethical standard must be fixed in order to prevent misuse and that has to be done by the administration or the governing bodies. Koutsouleris said, collaborative approach can be highly beneficial. There has to be an agreement and collaboration between the policy makers, researchers and clinicians in order to meet the challenges. Lee and his fellow researchers came up with the view that there has to be high grade of transparency in the decision

making process to avoid misuse and unanticipated complications. Chen came up with a highly practical solution, AI systems should be so carefully designed and implemented that it gains the potential to move beyond the challenges which the mental health practitioners are currently facing with the use of Artificial Intelligence in their treatment methods.

Conclusion

Depression is one of the most significant mental health challenges today and can become severe if not treated promptly. AI technologies have great potential to address this issue. Their user-friendly interfaces and high confidentiality levels help the elderly patients feel comfortable and open up more easily who usually prefer not to use technology. They often feel reluctant to speak up about their mental health issues before others. AI give them enough confidentiality. These technologies are useful for early detection, prevention, and treatment, thus reducing the prevalence of depression. Studies indicate that regular use of AI technologies for mental health care can gradually decrease depression rates. Experts believe that AI can detect depression through speech, tone, or text, accurately classifying individuals as depressed or non-depressed after only a few minutes of interaction. However, despite AI's high accuracy, it lacks the human empathy crucial in treating mental health patients which is a crucial challenge. Apart from that there are other challenges like data privacy and algorithm bias. It is not easy to meet those challenges. In a nutshell, AI can assist in detection and prevention of depression but cannot replace humane care.

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