

Preventive Mental Health: A Comprehensive Review of the Early Detection and Digital Interventions of Depression and Anxiety

KhushiManohar¹, Harika Thokola²

¹Research Scholar Department of CE Krishna School of Technology Drs. Kiran & Pallavi Patel

²Assistant Professor Department of CSE Krishna School of Technology Drs. Kiran & Pallavi Patel Global University, Varnama, Gujarat, India

Abstract-- One of the main causes of disability in the globe is mental health conditions including anxiety and depression. Advances in artificial intelligence, machine learning, and digital health technology are increasingly supporting early detection and preventive mental healthcare measures. This paper examines wearable sensors, social media analytics, and electronic health records in predictive mental health systems. Additionally investigated are digital therapeutic approaches like teletherapy platforms, AI chatbots, and mobile health apps. The study examines current research from 2019 to 2025 and emphasizes machine learning methods for early anxiety and depression identification.

I. INTRODUCTION

Millions of people worldwide suffer from mental health conditions like anxiety and depression. Improving treatment outcomes requires early detection and preventive intervention. Automated methods for predicting mental health using behavioral data, such as social media activity, wearable sensor data, and electronic health records, have been made possible by artificial intelligence and machine learning.

II. BACKGROUND OF DEPRESSION AND ANXIETY

Anxiety disorders include excessive worry and physical symptoms, whereas depression is characterized by a persistent sense of sadness and a loss of interest in everyday activities. These conditions frequently coexist and necessitate early detection techniques for successful therapy.

III. MACHINE LEARNING APPROACHES FOR MENTAL HEALTH DETECTION

Predicting mental health has been a common use for machine learning algorithms like Naïve Bayes, Random Forest, Support Vector Machines, and deep learning models. These models examine extensive datasets, such as behavioral patterns and text from social media.

Table 1:
Comparison of Major Research Studies

Study	Year	Dataset	Algorithm	Accuracy
Lattie et al.	2019	Online platforms	Statistical analysis	78%
Kumar et al.	2020	Survey dataset	Random Forest	82%
Chiu et al.	2021	Social media text	Naive Bayes	84%
Govindasamy et al.	2022	Twitter	SVM	85%
Deshpande et al.	2023	Instagram	Multimodal ML	89%
Taousi et al.	2025	Social media	RoBERTa + CNN-LSTM	94%

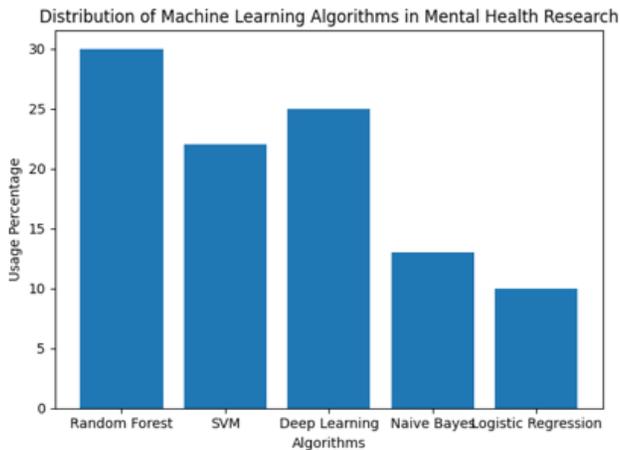


Fig. 1. Distribution of Machine Learning Algorithms used in mental health research.

IV. SOCIAL MEDIA ANALYTICS FOR MENTAL HEALTH DETECTION

An effective method for identifying psychological distress is social media analytics. To determine mental health risks, natural language processing techniques examine sentiment, linguistic patterns, and posting frequency.

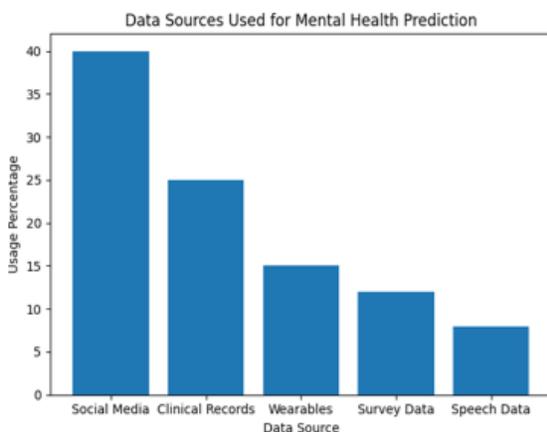


Fig. 2. Data sources used in predictive mental health systems.

V. ELECTRONIC HEALTH RECORDS AND PREDICTIVE MODELING

Electronic health records have important clinical information that can be used to predict mental health problems. Models of machine learning that are trained on HER data can find early signs of anxiety and depression.

Table 2: Technologies Used in Digital Mental Health Systems

S	Application	Examples
Mobile Health Apps	Mood tracking and CBT therapy	Woebot, Moodpath
AI Chatbots	Mental health counseling	Wysa, Tess
Wearable Devices	Physiological monitoring	Fitbit, Apple Watch
Social Media Analytics	Behavior analysis	Twitter sentiment analysis
Electronic Health Records	Predictive modeling	Clinical ML systems

VI. DIGITAL THERAPEUTIC INTERVENTIONS

More and more, digital therapeutic technologies are being used to provide mental health care services that help people stay healthy. Mood tracking, meditation exercises, and cognitive behavioral therapy modules are some of the features of mobile mental health apps.

AI-powered chatbots have also been made to give psychological support through conversations in natural language. These systems can evaluate mental health and suggest personalized ways to deal with problems.

Research indicates that digital mental health interventions can markedly enhance psychological well-being and alleviate symptoms of depression and anxiety [6], [14]. Wearable devices like smartwatches and fitness trackers can keep track of things like sleep patterns, heart rate variability, and physical activity levels, which could be signs of mental distress.

VII. RESEARCH GAPS

Despite promising progress, predictive mental health research still faces numerous challenges. Many machine learning models are trained on small datasets that may not accurately reflect the diversity of populations.

We also need to be very careful about privacy and ethical issues that come up when dealing with sensitive mental health data. Researchers must ascertain that predictive mental health systems adhere to data protection regulations and ethical standards [15], [26].

Also, many AI-based mental health systems don't have any clinical validation or studies that show how they work in the real world. To make reliable and trustworthy predictive mental health technologies, data scientists, psychologists, and healthcare professionals need to work together.

VIII. FUTURE RESEARCH DIRECTIONS

Future studies should concentrate on creating multimodal prediction models that incorporate data from wearable sensors, social media analytics, and electronic health records. Transparency and confidence in predictive mental health systems can be enhanced by developments in explainable AI. Another promising area of research is personalized digital therapeutic platforms that modify interventions according to individual behavioral patterns. Another promising area of research is personalized digital therapeutic platforms that modify interventions according to individual behavioral patterns.

IX. CONCLUSION

Preventive mental healthcare augmented by artificial intelligence and digital health technologies presents significant prospects for the early identification of depression and anxiety. Subsequent investigations ought to concentrate on multimodal predictive models and the ethical implementation of AI systems within healthcare.

REFERENCES

- [1] Muhammad Jazum Faisti, R. H. Kusumodestoni, Gentur Wahyu, and Nyipto Wibowo, "Mental Health Classification Using Naïve Bayes and Random Forest Algorithms," *JOURNAL OF APPLIED INFORMATICS AND COMPUTING*, 2025. E. G. Lattie, J. Adkins, A. Winquist, S. Stiles-Shields, and D. Mohr, "Digital mental health interventions for depression, anxiety, and psychological well-being among college students: A systematic review," *Journal of Medical Internet Research*, vol. 21, no. 7, 2019.
- [2] Ringeval et al., "AVEC 2019 workshop and challenge: Detecting depression with AI and cross-cultural affect recognition," *Proceedings of the Audio/Visual Emotion Challenge*, 2019.
- [3] I. Riadi et al., "Digital interventions for depression and anxiety in older adults: A systematic review protocol," *JMIR Research Protocols*, vol. 9, no. 12, 2020.
- [4] C. Y. Chiu et al., "A textual-based feature approach for depression detection using machine learning classifiers and social media texts," *Computers in Biology and Medicine*, vol. 135, 2021.
- [5] M. R. Islam et al., "Deep learning for depression recognition with audiovisual cues: A review," *Information Fusion*, vol. 67, pp. 1–12, 2021.
- [6] T. J. Philippe et al., "Digital health interventions for delivery of mental health care: A systematic meta-review," *Journal of Medical Internet Research*, vol. 24, no. 4, 2022.
- [7] K. Govindasamy and N. Palanichamy, "Depression detection using machine learning techniques on Twitter data," *Computational Intelligence and Neuroscience*, 2022.
- [8] Y. Kelley, C. Monaghan, T. Burke, and A. Gillan, "Machine learning of language use on social media reveals predictions of depression symptoms," *Nature Human Behaviour*, 2022.
- [9] M. Deshpande and S. Kulkarni, "Multimodal depression detection on Instagram using machine learning," *Journal of Intelligent Information Systems*, 2023.
- [10] H. Fu, B. Sun, and C. Zhang, "Deep learning models for robust depression detection from online behavior data," *Knowledge-Based Systems*, 2023.
- [11] W. A. Gadzama, D. Gabi, and M. Argungu, "Machine learning and deep learning models for depression detection on social media: A systematic literature review," *Psychiatry Research*, 2024.
- [12] Y. Cao et al., "Machine learning approaches for depression detection using social media text," *arXiv preprint arXiv:2410.16204*, 2024.
- [13] İ. Baydili et al., "Deep learning-based detection of depression and suicidal ideation from social media data," *Behavioral Sciences*, vol. 15, no. 3, 2025.
- [14] G. Cameron et al., "Effectiveness of digital mental health interventions in workplace settings: An umbrella review," *JMIR Mental Health*, 2025.
- [15] P. Cruz-Gonzalez et al., "Artificial intelligence in mental health care: A systematic review of diagnosis, monitoring, and intervention," *Healthcare*, 2025.
- [16] C. Taoussi et al., "Enhancing depression detection using SMOTE, RoBERTa, and CNN-LSTM models," *Informatica*, 2025.
- [17] G. Alsalloum et al., "Harnessing digital health interventions for personalized depression care: A systematic review," *Frontiers in Digital Health*, 2025.
- [18] W. A. Gadzama et al., "Depression detection using machine learning algorithms: A review," *FUDMA Journal of Sciences*, 2025.
- [19] Y. Liu et al., "Predictive analysis of mental health using machine learning algorithms," *International Journal of Data Science and Artificial Intelligence*, 2025.
- [20] K. Elnaggar et al., "EEG-based machine learning models for depression diagnosis: A systematic review," *Frontiers in Neuroscience*, 2025.
- [21] Arfan Ahmed et al., "Machine learning models to detect anxiety and depression through social media: A scoping review," *Computer methods and programs in biomedicine update*, vol. 2, 2022.
- [22] Lamia Bendebane, Zakaria Laboudi, Asma Saighi, Hassan Al-Tarawneh, Adel Ouannas, and Giuseppe Grassi, "A Multi-Class Deep Learning Approach for Early Detection of Depressive and Anxiety Disorders Using Twitter Data," *Algorithms*, vol. 16, 2023.
- [23] Prince Kumar, Shruti Garg, and Ashwani Garg, "Assessment of Anxiety, Depression and Stress using Machine Learning Models," *Procedia Computer Science*, vol. 171, 2020.



International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 03, March 2026)

- [24] Matthew D. Nemesure, Michael V. Heinz, Raphael Huang, and Nicholas 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. 1, 2021.
- [25] Anu Priya, Shruti Garg, and Neha Prerna Tigga, "Predicting Anxiety, Depression and Stress in Modern Life using Machine Learning Algorithms," *Procedia Computer Science*, vol. 167, 2020.
- [26] Fabeha Zafar et al., "The Role of Artificial Intelligence in Identifying Depression and Anxiety: A Comprehensive Literature Review," *Cureus*, vol. 16, 2024.