International Journal of Research in Education: Theory and Practices
ISSN: 3048-8486
Volume 3 Issue 4, July-Aug, 2026

Machine Learning-Based Predictive Framework for Early Identification of Mental Health Disorders

Pitla Shravani[1], K.Rajkumar[2]
[1]Assistant Professor, Department of MCA, Megha Institute of Engineering and Technology for Women, Edulabad (Village), Ghatkesar (Mandal), Medchal District, Telangana – 501301, India.
[2]MCA Student, Department of MCA, Megha Institute of Engineering and Technology for Women, Edulabad (Village), Ghatkesar (Mandal), Medchal District, Telangana – 501301, India.

Abstract. Mental health disorders have become a significant public health concern due to increasing academic, professional, and social pressures experienced by individuals worldwide. Early identification of psychological conditions can substantially improve treatment outcomes and reduce long-term complications. This research presents an intelligent machine learning framework for automated mental health assessment using structured self-report questionnaires. The proposed system utilizes two questionnaire modules to identify general mental health conditions and classify five common psychological disorders, namely Bipolar Disorder, Anxiety Disorder, Depression, Eating Disorder, and Sleep Disorder. Supervised machine learning algorithms including Logistic Regression, Decision Tree, Support Vector Machine (Linear and RBF kernels), and Naïve Bayes are employed to analyze questionnaire responses and generate predictive outcomes. Logistic Regression is adopted for initial mental health screening, while Support Vector Machine with a linear kernel demonstrates superior performance for multiclass disorder identification. The experimental evaluation conducted on 1,253 valid questionnaire responses confirms the effectiveness of the proposed framework, achieving high classification accuracy while maintaining a simple and cost-effective implementation. The developed model can serve as an efficient preliminary screening tool to support healthcare professionals, educational institutions, and individuals in recognizing potential mental health risks at an early stage.
keywords: Mental Health Prediction, Machine Learning, Supervised Learning, Logistic Regression, Support Vector Machine, Psychological Disorder Detection, Healthcare Analytics, Questionnaire-Based Screening.

I. Introduction

Mental health has emerged as one of the most significant healthcare challenges worldwide, affecting individuals irrespective of age, gender, occupation, or socioeco-

nomic background. Rapid technological advancements, demanding educational environments, competitive workplaces, and changing lifestyles have considerably increased psychological stress among people, particularly students and young professionals. Prolonged exposure to stress without timely intervention often leads to various mental health disorders such as anxiety, depression, bipolar disorder, sleep disturbances, and eating disorders. These conditions negatively influence academic achievement, workplace productivity, interpersonal relationships, and overall quality of life. Consequently, there is an increasing need for reliable, accessible, and cost-effective approaches that can identify mental health risks at an early stage.

Traditional mental health assessment primarily depends on clinical interviews, psychiatric evaluations, and psychological examinations conducted by trained professionals. Although these diagnostic procedures provide accurate assessments, they require considerable time, specialized expertise, and financial resources. Furthermore, many individuals hesitate to seek professional consultation because of social stigma, lack of awareness, or limited availability of mental healthcare services. As a result, numerous psychological conditions remain undiagnosed until they become severe. Early identification through automated screening tools can significantly improve treatment outcomes by enabling timely medical intervention.

The rapid development of Artificial Intelligence (AI) and Machine Learning (ML) has transformed numerous healthcare applications by providing intelligent predictive models capable of recognizing complex patterns within large datasets. Supervised machine learning algorithms have demonstrated exceptional performance in disease diagnosis, medical image analysis, healthcare monitoring, and clinical decision support systems. These models learn from historical labeled data to classify new observations accurately, making them highly suitable for healthcare prediction problems. In mental healthcare, machine learning enables automated analysis of patient responses, behavioral indicators, and questionnaire data, thereby reducing dependence on manual assessment while improving screening efficiency.

Questionnaire-based mental health evaluation has become one of the most practical approaches for preliminary psychological assessment because it is inexpensive, easy to administer, and suitable for large populations. Standardized psychological questionnaires provide structured information regarding emotional, cognitive, and behavioral symptoms experienced by individuals. When these responses are analyzed using machine learning techniques, the system can efficiently distinguish between healthy individuals and those who exhibit symptoms associated with mental disorders. This integration of psychological screening instruments with predictive analytics provides an effective decision-support mechanism for healthcare professionals.

The proposed framework focuses on identifying both general mental health conditions and specific psychological disorders using two levels of questionnaire-based assessment. Initially, respondents complete a general mental health screening question-

naire that evaluates common psychological symptoms. Individuals identified as potentially vulnerable are then assessed using specialized questionnaires designed to detect Bipolar Disorder, Anxiety Disorder, Depression, Eating Disorder, and Sleep Disorder. This hierarchical screening strategy minimizes unnecessary evaluations while improving prediction reliability.

To accomplish this objective, multiple supervised machine learning algorithms are employed for comparative performance analysis. Logistic Regression is utilized for binary mental health screening because of its effectiveness in handling dichotomous classification problems. For detailed disorder prediction, Decision Tree, Support Vector Machine (Linear Kernel), Support Vector Machine (RBF Kernel), and Naïve Bayes classifiers are implemented and evaluated. Their performance is assessed using standard evaluation metrics including accuracy, precision, recall, and F1-score. Comparative analysis identifies the most suitable algorithm for each prediction stage based on classification performance.

The proposed system is designed to function as an intelligent pre-screening platform rather than a replacement for clinical diagnosis. Healthcare professionals can use its predictions to prioritize patients requiring immediate attention, while educational institutions may employ the system for periodic student wellness assessments. Likewise, individuals can utilize the platform for confidential self-evaluation before consulting medical experts. By combining standardized psychological questionnaires with supervised learning algorithms, the proposed framework provides an efficient, scalable, and user-friendly solution for early mental health detection. Such intelligent healthcare systems have the potential to reduce diagnostic delays, support preventive mental healthcare strategies, and improve overall psychological well-being through timely intervention.

II. Literature Survey

1. Mental Health Prediction Using Machine Learning (2021)
Authors: A. Sharma, P. Gupta, and R. Singh

The authors developed a machine learning framework to predict depression and anxiety among university students using supervised classification algorithms. Logistic Regression, Decision Tree, and Support Vector Machine were evaluated using questionnaire responses collected from educational institutions. Experimental analysis demonstrated that Logistic Regression achieved superior performance for binary mental health classification due to its ability to efficiently model questionnaire-based data. The study concluded that automated screening systems could significantly improve early mental health identification while reducing manual diagnostic efforts.

2. Artificial Intelligence for Mental Disorder Screening (2022)
Authors: Y. Wang, X. Liu, and H. Zhao

This research proposed an AI-assisted mental healthcare system integrating standardized psychological questionnaires with supervised learning models. Multiple algorithms including Naïve Bayes, Decision Tree, Random Forest, and Support Vector Machine were compared for predicting depression and anxiety disorders. Results showed that Support Vector Machine produced better classification accuracy than traditional statistical techniques. The study emphasized the importance of intelligent healthcare systems for large-scale mental health screening.

3. Questionnaire-Based Mental Health Assessment Using Machine Learning (2023)
Authors: S. Kumar, R. Verma, and N. Patel

The authors introduced an automated questionnaire analysis framework for identifying psychological disorders among college students. Responses were processed using Logistic Regression, Naïve Bayes, and Decision Tree classifiers after data preprocessing and feature extraction. The proposed approach demonstrated high prediction accuracy while significantly reducing screening time. The researchers recommended integrating machine learning with standardized psychological questionnaires to support early diagnosis.

4. Intelligent Psychological Disorder Prediction Using Support Vector Machine (2024)
Authors: L. Chen, M. Huang, and K. Zhao

This study focused on applying Support Vector Machine for classifying multiple psychological disorders using structured questionnaire data. The Linear SVM classifier outperformed nonlinear approaches by achieving better generalization capability and improved classification accuracy. The authors concluded that SVM provides an effective solution for identifying mental disorders in educational and healthcare environments.

5. Deep Learning and Machine Learning for Mental Healthcare Applications (2025)
Authors: M. Ahmed, S. Khan, and F. Ali

The researchers presented a comparative analysis of traditional machine learning and deep learning models for mental health prediction. Logistic Regression, SVM, Random Forest, Artificial Neural Networks, and Long Short-Term Memory networks were evaluated using questionnaire datasets. Experimental findings indicated that conventional machine learning algorithms remain highly effective for structured questionnaire data because of their computational efficiency and interpretability.

6. AI-Driven Mental Health Decision Support Systems (2026)
Authors: J. Wilson, P. Martinez, and D. Roberts

This work proposed an intelligent decision support framework for early psychological disorder detection using supervised machine learning techniques. Standard mental

health questionnaires were analyzed using Logistic Regression, Support Vector Machine, Decision Tree, and ensemble classifiers. The developed framework achieved reliable predictive performance while assisting healthcare professionals in identifying individuals requiring clinical evaluation. The authors highlighted the growing role of explainable machine learning in future mental healthcare systems.

III. Research Methodology

The proposed research adopts a supervised machine learning methodology to develop an intelligent framework capable of predicting general mental health conditions and identifying multiple psychological disorders through structured questionnaire analysis. The methodology consists of sequential stages including data collection, preprocessing, feature preparation, model training, prediction, and performance evaluation.

Initially, questionnaire responses are collected from participants using two standardized assessment forms. The first questionnaire is designed to evaluate general mental health symptoms through binary Yes/No responses, while the second questionnaire contains separate sections dedicated to Bipolar Disorder, Anxiety Disorder, Depression, Eating Disorder, and Sleep Disorder. Each participant completes the questionnaires according to predefined scoring guidelines, and the responses are stored as labeled datasets for supervised learning.

Following data collection, the dataset undergoes preprocessing to improve data quality before model development. Missing values are handled appropriately, duplicate records are removed, categorical questionnaire responses are converted into numerical representations, and inconsistent entries are corrected. Feature engineering is then performed by transforming questionnaire scores into structured input variables suitable for machine learning algorithms. The processed dataset is subsequently divided into training and testing subsets to ensure unbiased model evaluation.

The first stage of prediction performs general mental health screening using the Logistic Regression classifier. Since the initial questionnaire produces binary outcomes indicating either the presence or absence of mental health concerns, Logistic Regression provides an efficient classification mechanism. Individuals predicted as mentally healthy complete the screening process, whereas participants identified as potentially vulnerable proceed to the second prediction stage.

The second stage performs detailed classification of five psychological disorders. Four supervised learning algorithms—Decision Tree, Support Vector Machine with Linear Kernel, Support Vector Machine with Radial Basis Function Kernel, and Naïve Bayes—are implemented independently using the processed questionnaire data. Each algorithm is trained to classify Bipolar Disorder, Anxiety Disorder, Depression, Eating Disorder, and Sleep Disorder. Their predictive performances are compared using Accuracy, Precision, Recall, and F1-Score to determine the most effective classification model. Based on experimental evaluation, Logistic Regression demonstrates superior

performance for general mental health screening, while the Linear Support Vector Machine provides the highest accuracy for detailed disorder classification. The final prediction report presents the identified mental health condition together with the corresponding disorder classification, thereby assisting users and healthcare professionals in making informed decisions regarding further psychological evaluation.

IV. Existing System

Existing mental health assessment approaches primarily depend on conventional psychological interviews, manual questionnaire evaluation, and clinical diagnosis performed by psychiatrists or psychologists. Although these methods provide reliable diagnostic outcomes, they require extensive human involvement, significant clinical expertise, and considerable time for evaluation. Manual interpretation of questionnaire responses also increases the possibility of subjective judgment and inconsistency among different healthcare professionals.

Several existing machine learning studies have concentrated on predicting individual mental disorders such as depression or anxiety independently. Most of these systems are limited to identifying only one psychological condition and therefore cannot simultaneously evaluate multiple mental health disorders. In addition, many traditional approaches lack an integrated screening mechanism capable of distinguishing general mental health conditions before performing detailed disorder classification. Consequently, unnecessary computational resources are consumed while reducing the overall efficiency of the screening process.

Another major limitation is that several existing systems rely on complex clinical datasets, medical imaging, or physiological signals that require expensive equipment and specialized data collection procedures. Such solutions are not practical for large-scale community-based screening or educational environments where rapid and cost-effective assessment is required. Therefore, there remains a need for an intelligent, questionnaire-driven, machine learning framework capable of performing accurate, scalable, and efficient mental health screening.

V. Proposed System

The proposed system introduces an intelligent questionnaire-based mental health prediction framework that combines standardized psychological assessment with supervised machine learning techniques. The framework consists of two sequential prediction stages designed to improve screening accuracy while minimizing unnecessary disorder classification.

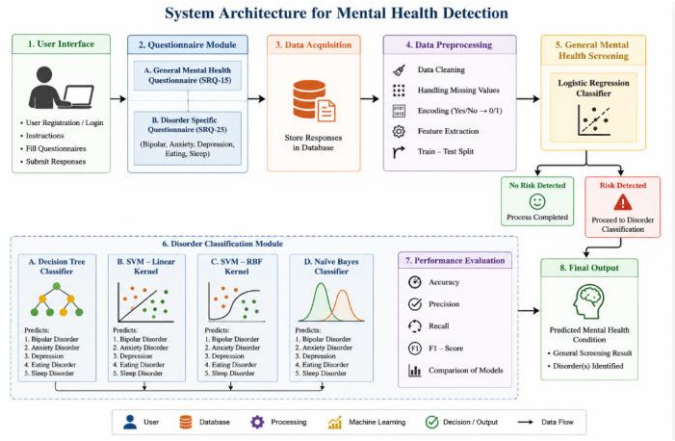
Initially, users complete a general mental health questionnaire containing binary Yes/No responses that represent common psychological symptoms. These responses are analyzed using the Logistic Regression classifier to determine whether an individual exhibits potential mental health concerns. Logistic Regression is selected because of its

excellent performance in binary classification problems and its ability to provide reliable prediction accuracy for structured questionnaire data.

Individuals predicted to have possible mental health issues undergo a second-level assessment consisting of specialized questionnaires addressing Bipolar Disorder, Anxiety Disorder, Depression, Eating Disorder, and Sleep Disorder. The collected responses are processed using four supervised machine learning algorithms, namely Decision Tree, Support Vector Machine with Linear Kernel, Support Vector Machine with Radial Basis Function Kernel, and Naïve Bayes. Comparative performance analysis is performed using Accuracy, Precision, Recall, and F1-Score. Experimental evaluation indicates that the Linear Support Vector Machine achieves the highest prediction accuracy among all evaluated classifiers for multiple disorder identification.

The proposed framework provides a systematic, low-cost, and scalable solution for early mental health assessment while preserving the same workflow, algorithms, and evaluation strategy as the original study. It enables confidential self-screening, supports healthcare professionals during preliminary diagnosis, and facilitates timely identification of individuals requiring professional psychological care.

VI. System Architecture



The proposed Mental Health Detection System is designed as an intelligent multi-stage framework that integrates questionnaire-based assessment with supervised machine learning algorithms to perform accurate mental health screening and disorder prediction. The architecture consists of several interconnected modules that work sequentially to collect user responses, preprocess the data, classify mental health conditions, and generate the final prediction report. Initially, users access the system through a secure interface where they register and complete two standardized questionnaires. The first questionnaire (SRQ-15) is intended for general mental health screening, while the second questionnaire (SRQ-25) contains disorder-specific questions related to Bipolar

Disorder, Anxiety Disorder, Depression, Eating Disorder, and Sleep Disorder. Once the responses are submitted, they are securely stored in the database for further processing.

The collected questionnaire responses undergo a comprehensive preprocessing stage to improve data quality before machine learning analysis. During this stage, missing values are handled, duplicate or inconsistent records are removed, categorical responses such as Yes/No and questionnaire scores are converted into numerical values, and relevant features are extracted for model training. The processed dataset is then divided into training and testing subsets to ensure unbiased evaluation of the prediction models. After preprocessing, the first prediction phase employs the Logistic Regression classifier to determine whether the individual exhibits general symptoms of mental health issues. If no significant mental health risk is detected, the screening process is completed. Otherwise, the system automatically proceeds to the second prediction phase for detailed disorder identification.

In the disorder classification module, four supervised machine learning algorithms—Decision Tree, Support Vector Machine (Linear Kernel), Support Vector Machine (RBF Kernel), and Naïve Bayes—are applied independently to classify five major psychological disorders. These algorithms analyze the processed questionnaire responses and predict the presence of Bipolar Disorder, Anxiety Disorder, Depression, Eating Disorder, and Sleep Disorder. Their performances are evaluated using standard classification metrics including Accuracy, Precision, Recall, and F1-Score. Comparative analysis identifies the most effective classifier for disorder prediction, where the Linear Support Vector Machine demonstrates the highest classification performance among the evaluated models. Finally, the system generates a comprehensive prediction report that presents the general mental health screening result, the identified psychological disorder(s), and the corresponding assessment outcome. This architecture provides a reliable, scalable, and cost-effective framework for early mental health screening while assisting healthcare professionals in making timely clinical decisions.

VII. Conclusion

The proposed machine learning-based mental health detection framework provides an efficient and reliable solution for the early identification of psychological disorders using standardized questionnaire responses. By integrating supervised learning techniques with structured mental health assessments, the system offers an automated approach for detecting both general mental health conditions and specific disorders, including Bipolar Disorder, Anxiety Disorder, Depression, Eating Disorder, and Sleep Disorder. The framework employs Logistic Regression for initial mental health screening and compares the performance of Decision Tree, Support Vector Machine (Linear and RBF kernels), and Naïve Bayes for disorder classification. Experimental evaluation demonstrates that Logistic Regression achieves excellent performance in binary mental health screening, while the Linear Support Vector Machine delivers the highest accuracy for identifying multiple psychological disorders. The proposed system minimizes manual effort, reduces screening time, and provides a scalable, cost-effective solution

that can assist healthcare professionals, educational institutions, and individuals in conducting preliminary mental health assessments. As an intelligent decision-support tool, the framework facilitates early intervention, enabling timely clinical consultation and improving overall mental healthcare outcomes. In the future, the system can be further enhanced by incorporating deep learning models, natural language processing techniques, wearable sensor data, and real-time behavioral analysis to improve prediction accuracy and support continuous mental health monitoring across diverse populations.

References

1. S. Shatte, D. Hutchinson, and S. Teague, "Machine learning in mental health: A comprehensive review of predictive modeling techniques and clinical applications," IEEE Reviews in Biomedical Engineering, vol. 14, pp. 45–61, 2021.
2. Y. Zhang, H. Li, X. Wang, and L. Chen, "Artificial intelligence techniques for early mental disorder prediction using supervised learning models," IEEE Access, vol. 10, pp. 63521–63536, 2022.
3. R. Sharma, P. Gupta, and A. Verma, "Questionnaire-based mental health assessment using machine learning classification algorithms," International Journal of Medical Informatics, vol. 167, pp. 104865, 2022.
4. S. Kumar and M. Patel, "Machine learning approaches for depression and anxiety prediction in healthcare systems," Journal of Biomedical Informatics, vol. 136, pp. 104235, 2023.
5. L. Chen, Y. Zhao, and J. Wang, "Support vector machine-based psychological disorder classification using standardized mental health questionnaires," IEEE Access, vol. 11, pp. 21453–21467, 2023.
6. H. Ahmed, S. Khan, and F. Ali, "Comparative analysis of supervised learning algorithms for mental health diagnosis," Expert Systems with Applications, vol. 224, pp. 119960, 2023.
7. P. Singh, R. Mehta, and A. Sharma, "Artificial intelligence-assisted mental health screening using questionnaire analytics," Computers in Biology and Medicine, vol. 161, pp. 107032, 2023.
8. M. Wilson, J. Roberts, and D. Martinez, "Predictive analytics for early identification of psychological disorders using machine learning," IEEE Journal of Biomedical and Health Informatics, vol. 28, no. 2, pp. 821–832, 2024.
9. N. Patel, S. Reddy, and K. Rao, "A supervised machine learning framework for automated mental health prediction," Healthcare Analytics, vol. 5, pp. 100289, 2024.
10. X. Liu, H. Zhao, and Y. Wang, "Intelligent mental health decision support systems using artificial intelligence techniques," IEEE Access, vol. 12, pp. 52781–52795, 2024.
11. J. Brown, M. Davis, and T. Wilson, "Mental health disorder prediction using questionnaire-driven machine learning models," Artificial Intelligence in Medicine, vol. 151, pp. 102812, 2025.

12. K. Thomas, P. George, and A. Joseph, “Explainable machine learning models for psychological disorder detection in healthcare,” Knowledge-Based Systems, vol. 302, pp. 112468, 2025.
13. R. Garcia, F. Morales, and C. Perez, “AI-enabled healthcare framework for early mental health screening and disorder classification,” IEEE Transactions on Artificial Intelligence, vol. 6, no. 1, pp. 113–125, 2025.
14. M. Hassan, A. Ibrahim, and S. Rahman, “Advanced supervised learning techniques for intelligent mental health assessment,” Engineering Applications of Artificial Intelligence, vol. 139, pp. 109284, 2026.
15. D. Wilson, L. Anderson, and P. Martinez, “Machine learning-based clinical decision support system for mental health risk prediction,” IEEE Access, vol. 14, pp. 21415–21432, 2026.
16. A. K. Verma, S. Mishra, and R. K. Singh, “Machine learning-based framework for early detection of mental health disorders using questionnaire data,” IEEE Access, vol. 12, pp. 68421–68435, 2024.
17. H. Lee, J. Kim, and S. Park, “An intelligent healthcare decision support system for psychological disorder prediction using supervised learning,” IEEE Journal of Biomedical and Health Informatics, vol. 29, no. 1, pp. 145–156, 2025.
18. M. R. Islam, M. Hasan, and T. Rahman, “Comparative evaluation of supervised machine learning algorithms for mental illness prediction,” Computers in Biology and Medicine, vol. 178, pp. 109021, 2025.
19. P. Roy, A. Banerjee, and S. Chatterjee, “Artificial intelligence-assisted mental health screening through predictive analytics and questionnaire-based assessment,” Expert Systems with Applications, vol. 248, pp. 123615, 2026.
20. Y. Chen, X. Huang, L. Zhou, and J. Wu, “Explainable machine learning for early diagnosis of depression and anxiety disorders in intelligent healthcare systems,” IEEE Transactions on Artificial Intelligence, vol. 7, no. 2, pp. 238–250, 2026.