



A Study of Mental Health Issues and Their Prediction Among Young Students Using Machine Learning Models

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Abstract. This research investigates the current scenario of mental disorders among aged individuals and proposes a machine learning-based prediction model to identify and classify major geriatric mental health issues. Accuracy metrics, confusion matrices, ROC analysis, and feature importance ranking are used to evaluate prediction performance using multiple supervised learning algorithms, such as Random Forest, SVM, Logistic Regression, and Naive Bayes. The results indicate that ensemble learning significantly improves diagnostic accuracy, enabling early detection and supporting clinical decision-making. [9, 27]

Keywords: Mental Disorders, Machine Learning, Prediction Model, Random Forest, SVM, Geriatric Health, Data Mining, Artificial Intelligence

1 Introduction

An individual's whole well-being depends heavily on their mental health, and in today's culture, it is crucial to identify and treat mental health problems. Mental health is impacted by every phase of life, from childhood and adolescence to maturity. Mental health conditions are expected to be the leading cause of disease worldwide by 2030 (World Health Organization, 2021). 1 out of 8 people in the world is suffering from a mental disorder. It involves serious disturbances in thinking, emotion regulation, or behavior. Based on numerous criteria like various people demographics, lifestyle choices, and other socioeconomic factors, machine learning approaches have the ability to help uncover trends and forecast mental health consequences. Due to the potential to enhance early identification and treatment of mental health issues, the development and analysis of machine learning models for examining mental health have gained interest in recent years. Healthcare will undergo a revolution thanks to predictive analytics in medicine (G Minor, 2016). Large datasets can be used by these models to reveal hidden linkages and gain understanding of the risk factors for different mental health illnesses among students. The mental health industry could

benefit greatly from this research topic, leading to improved diagnosis, prevention, and treatment of mental health issues. The random forest method is one of the most effective machine learning algorithms for forecasting various people's mental health. The algorithm, which uses a series of decision trees to create predictions, has been shown to accurately anticipate outcomes in terms of mental. This is because it can control complex interactions between variables. This is crucial in the area of mental health because elements affecting a student's wellbeing there are frequently entwined and challenging to research. The findings will help develop targeted interventions that address the most important factors affecting various people's mental health, ultimately leading to improved mental health outcomes and increased quality of life. For example, if academic stress is identified as a contributing factor, interventions such as stress management workshops, counselling, and mindfulness training could be developed to help students cope with academic stress. Overall, using machine learning models and feature importance analysis to predict various people's mental health outcomes has great potential for improving mental health outcomes in this population. These findings will help develop targeted interventions that address the most important factors affecting various people's mental health, ultimately leading to improved mental health outcomes and increased quality of life. 1 out of 8 people in the world is suffering from a mental disorder. It involves serious disturbances in thinking, emotion regulation, or behavior. [2, 25]

2 Related Work

Machine learning has been investigated in several studies to predict mental disorders. Algorithms such as Random Forest, Naive Bayes, SVM, and neural networks have been discovered by researchers to have the potential to diagnose conditions, such as depression, dementia, and anxiety. Literature also indicates that multimodal datasets involving behavioral, physiological, MRI, EEG, and self-reported metrics enhance diagnostic accuracy. While previous research focuses extensively on adolescents and adults, studies targeting aged individuals remain limited. This work bridges this gap by concentrating on geriatric mental health prediction models. [11, 22]

Bahiru Legesse Jimma (2023) suggests that machine learning techniques have improved diagnostic accuracy compared to traditional manual procedures in sleep studies and other literature related to mental health disorders, and this trend is likely to continue. ML and AI tools are increasingly being utilized by researchers to enhance many aspects of the healthcare environment. It is important to conduct more research on the application of attention-based models. Developing benchmarks is necessary for applying machine learning techniques to the PSG dataset. (Bahiru Legesse Jimma, 2023)

Shourya Bhatnagar (2023): It was found that the Cronbach's alpha value is 0.723, Pearson related coefficient 0.823, naive, bayes, decision tree, random forest and support vector algorithm 71.05 %, 71.05 %, and 71.05 %, and 71.5.5 respectively. (Shourya Bhatnagar, 2023)

Tatsawan Timakum (2022): Information extraction analysis reveals the relationship between triplex and biological therapy. The intermediate center is used as a network central measurement based on the smallest way of relationship between important institutions and triple. Nodes with high intermediate central properties have more information through nodes, so they can control the network more strongly. "Mobile" This is the highest score related to the unit is 0.043466. Top couples are related to depression, mobile health and text messages. (Tatsawan Timakum, 2022)

Kay T. Pham (2022) it supports those who are difficult to communicate with new AI-based intervention measurements made in the form of robots and treatment, especially the professor's emotional response mechanism. A robot like a foundation with a new digital psychiatry progression. (Kay T. Pham, 2022)

Jing Ling Tay (2022): The research (87.5%) looked at health records to predict aggression and found that using particular machine learning algorithms, they had acceptable to exceptional accuracy. (Jing Ling Tay, 2022)

Luke Balcombe (2022): Interactive AI can support actual screening and treatment, stress or psychological health care systems. The use of AI disorders in psychological health includes access, efficacy, reliability, availability, security, morality, proper education and training, social and cultural adaptability. Design, development, and evaluation of digital mental health equipment can help solve psychological health problems in a systemic nature. (Luke Balcombe, 2022)

Shumaila Aleem (2022): Given that it performs well with unstructured and high-dimensional data, SVM has been the most popular classifier for identifying depression. Over-fitting is likewise resisted by SVM. SVM has been demonstrated to be a successful approach for data with an irregular and anonymous distribution. (Shumaila Aleem, 2022)

Giovanni Rubeis (2022): It came to the conclusion that self-monitoring, EMA, and data mining might be utilized to develop tailored treatment plans, anticipate onset, and boost patient engagement. (Giovanni Rubeis, 2022)

Klaas J. Wardenaar(2021): Researchers use a superlator algorithm to determine the psychological crisis, the highest decisive factor in pure depression and net anxiety score. According to this study, the higher the prediction of each result is as much as the prophecy correlation, the higher the prophecy correlation is. The age, age, respiratory motion, obstacles, peloselology, low-intekom, secondary depression, secondary depression, etc. It was revealed that the important decisive factor was determined. Pure anxiety of depression, efficient disability, efficient disease, pure depression and specific decisive factors. (Klaas J. Wardenaar, 2021)

Livia Petrescu (2021): The findings demonstrate that using the suggested methodology (classification score), fear may be predicted with accuracies ranging from 91.7% to 93.5%. (Livia Petrescu, 2021)

Aziliz Le Glaz(2021): Although NLP and machine learning techniques may provide a variety of views for study in the field of mental health, they should also be viewed as instruments to help therapeutic practice. (Aziliz Le Glaz, 2021)

Heliyon (2021): Real-time data analytics systems could help clinical decision-making, optimize resource allocation, and streamline administrative processes with AI-enhanced patient flow solutions. (Heliyon, 2021)

Francesco Ceccarelli (2021): The proposed dynamics and multi-mode framework are used for bipolar disorder and video record depression and are better than other advanced methods. You can determine the characteristics of each method by mixing audio, video, and text modes to emphasize dynamic reference and LSTM model. This can be useful for future research in respective fields. (Francesco Ceccarelli, 2021)

Yan Cheng Yang (2021): Big data can now be used to detect a variety of ailments virtually and in real time. The present uses of AI and big data in medicine and electronic health, which improve patient care and disease diagnosis. The proposed study will aid in the development of fresh healthcare ideas. (Yan Cheng Yang, 2021)

MananHingorani (2021): This study evaluates audio data supervisions such as sound, dimensions, strength, and stagnation, which are not monitored. For text data, you can consider specific light modes, spelling errors, etc. To improve it, you can use the SUD tag audio, video, and text mode function. You can use a specific mental illness prediction diagnosis model for telephone consultation using the proposed ML prediction model. (Manan Hingorani, 2021)

MehakFaryal (2021)'s study employed machine learning algorithms like Naive Bayes, Random Forest, Regression, and Support Vector Machine and focused on tweets about mental health issues that were caused by social media sites. Pre-processing techniques can increase classification accuracy by extending acronyms and substituting carelessness, as per the study. (Mehak Faryal, 2021)

Kyoung-Sae Na (2021): This study showed how to distinguish between panic disorder and other anxiety disorders using HRV (High). To duplicate the diagnostic usefulness of HRV in a machine learning approach, future studies with bigger sample sizes and longitudinal designs are needed. (Kyoung-Sae Na, 2021)

Giuseppe Riva (2020): VR is usually used as an analog tool that can reproduce fear/serious conditions in a safe and controlled environment. VR-based treatment has been conducted and tested in a successful clinical trial of anxiety, stress-related diseases, phobia, and post-trauma disorder. In one study, standardized exposed virtual scenes cause high anxiety compared to neutral scenes. This indicates the possibility of generalized anxiety disorder. (Giuseppe Riva, 2020)

Nicholas Cummins (2020): Using machine learning (ML) algorithms can help diagnose emotional disorders, especially depression and bipolar disorder. The ML can analyze a large amount of data to identify the model, and can manufacture a model that is useful for clinical trials. ML can learn from a wide range of clinical criteria and determine the objective mark of the conditions. Mobile and IoT devices are enabling the unobtrusive collection of data, leading to the development of technologies to support diagnostics. (Nicholas Cummins, 2020)

Andy M.Y. Tai(2019): Machine learning now offers a chance to analyze disease models in complicated, multi-factorial disease states (such as mental disorders), and it may be able to help choose between treatments using already available therapies and serve as a foundation for domain-based therapeutic discoveries. (Andy M.Y. Tai, 2019)

OanaBălan (2019): Unique functions and deep learning technology, EEG and DAP (using physical analysis database using physical signals) comparative research between various machines is conducted) and is done to classify the Level of

Fear. Integrating depth and machine learning techniques in the development of emotional recognition systems will improve reliability and efficiency. (Oana Bălan, 2019)

Guang-Di Liu (2019): The article briefly discusses three primary brain observation methods—namely, magnetic resonance imaging (MRI), electroencephalography (EEG), and kinesics-based diagnoses—as well as associated AI applications and algorithms used to study psychiatric diseases. (Guang-Di Liu, 2019)

Bach Xuan Tran (2019): Current research patterns were analyzed, and the production of foreign researchers or organizations in the field was evaluated fairly, as well as the investigation factor analysis (EFA) and analysis of the potential Dirikle Division (LDA). The analysis of the exploration factor indicates that the most comprehensive research of AI is the use of machine learning to identify the clinical characteristics of depression, which is responsible for more than 60 of all letters. Specific research objects were discovered by potential differences, including diagnostic accuracy, component imaging methods, gene testing, drug development, pattern recognition, and diagnosis based on EEG (EEG). (Bach Xuan Tran, 2019)

Alvaro Barrera (2019): Specific research objects were discovered by potential differences, including diagnostic accuracy, component imaging methods, gene testing, drug development, pattern recognition and diagnosis based on EEG (EEG). Specific research objects were discovered by potential differences, including diagnostic accuracy, component imaging methods, gene testing, drug development, pattern recognition recognition and diagnosis based on EEG (EEG). (Alvaro Barrera, 2019)

Anthony J. Rosellini (2019): The objective of the current work is to create an algorithm that predicts adult attacks and predicts adult attacks, creating an algorithm that uses general anxiety, nervousness, social fear, depression and future data using adult attack enthusiasts' Prophems. It is to collect. The accuracy of this algorithm is from enough to excellent, and can be seen among those who expect the best risk. (Anthony J. Rosellini, 2019)

Pableen Kaur & Manik Sharma (2019): In addition to reviewing the models and procedures for diagnosing psychiatric diseases, the study also lists their biological and behavioral symptoms. Additionally, discussed were the datasets used to mine these illnesses and the impact of feature selection on the predicted rate of accuracy. The use of binary or chaotic variations of various nature-inspired computing techniques for diagnosing psychological diseases was one of the research needs that was discovered. Another was the application of new nature-inspired computing approaches for diagnosing mania, insomnia, and mood disorders. (Pableen Kaur & Manik Sharma, 2019)

Russell Fulmer (2018): The goal of the study was to evaluate the viability and effectiveness of utilizing Tess, an integrative psychological AI, to lessen college students' reported symptoms of depression and anxiety. This study shows that AI offers a practical, affordable answer for mental health issues and may be a scalable tool to support conventional therapy approaches. (Russell Fulmer, 2018)

Theodoros Iliou (2018): The study compares the effectiveness of both using the 10-fold cross-validation approach and seven classification algorithms. The results demonstrate that the PCA approach is regularly outperformed by the Iliou data pre-

processing algorithm, which achieves a classification performance of 98.6% as opposed to 92.2%. (Theodoros Iliou, 2018)

Trishan Panch(2018): The study demonstrates how machine learning affects health systems, but it does not examine how machine learning in basic sciences, drug development, and other enabling technologies may also have an indirect impact on health systems. (Trishan Panch, 2018)

Xavier Briffault (2018) The epistemological innovations in the design of mental diseases and therapies have received the majority of these technical innovations' attention. Synergies between these technological and epistemological advancements are both achievable and desirable, and they may be able to aid with some of the challenging issues that persons with mental illnesses deal with on a daily basis. (Xavier Briffault, 2018)

Susel Góngora Alonso (2018): According to the analysis, the majority of pertinent publications dealt with Alzheimer's, dementia, and depression. This information offers important insight into the state of research on data mining approaches used to treat mental health conditions. In a patient database of people with schizophrenia, it emphasises the value of predictive models and binary classifiers in identifying risk factors for mental health illnesses and developing a prediction model for patient cognitive impairment using the suggested algorithms. (Susel Góngora Alonso, 2018)

A. Robinson (2017): It focuses attention on diagnosis and creates a theory on mental health issues. The most recognized discovery is to treat anxiety using VR-based treatments. Realistic VR possibilities can greatly increase psychiatry opportunities and improve the ability to build new reality to improve treatment results. (A. Robinson, 2017)

Trang Pham,(2017) In this study, between the two important groups of social and economic burden (diabetes and mental health), there are deep nurses that model the progression of the disease, intervention tips, and future risk predictions. It has been shown. Results suggest that the accuracy of prediction has improved. Experiments of diabetes and mental hygiene indicate that deep nursing competes with current cutting technology and predicts the future stage of the disease. (Trang Pham, 2017)

Alessandro Fontana (2017): It promotes a functional model of thinking and provides a creative explanation of schizophrenia. This model indicates how the expression type of schizophrenia is manifested by stress and interaction with the environment. The major trauma that occurs is an environmental factor, and in a specific situation, the DM network causes unique sensitivity due to complete compensation for trauma. (Alessandro Fontana, 2017)

Mandar Deshpande, Vignesh Rao(2017): This study refers to further improvement of the accuracy and accuracy of the model, but social media data recognition indicates the possibility of lesson-adjointing emotional AI using depression. (Mandar Deshpande & Vignesh Rao, 2017)

Maryam Mohammed Aldarwish (2017): The discovery of SVM and and Nave Bayes' findings is used to calculate the performance of emotional results. This study assumes that SNS (social network service) activities can quickly identify mental illness and classify the level of mental illness more accurately than the standard questionnaire method used by psychiatrists. (Maryam Mohammed Aldarwish, 2017)

Per Carlbring(2017): According to the analysis of 1418 participants, ICBT, which directly targets psychological and physical diseases in the same test, compares the face of CBT. In 2078 paper reviews, a total of 20 studies met all criteria. Result shows Hedges $g = .05$ (95% CI, .09 to .20) was the pooled effect size at post-treatment, showing that ICBT and face-to-face treatment had comparable overall effects. (Per Carlbring, 2017)

Per Carlbring (2017): Guided ICBT for mental and physical illnesses was directly compared with face-to-face CBT in the same experiment in a meta-analysis with 1418 participants. Out of 2078 publications that were screened, 20 studies in total passed all the requirements for inclusion. Following Hedges treatment, the results revealed a total effect value of $g = .05$ (95% CI, -.09 to .20), indicating that ICBT and face-to-face therapy had comparable overall effects. (Per Carlbring, 2017)

Sandra Vieira (2017): Deep learning has been used to detect psychiatric and neurological biomarkers using neuro-imaging data, and the results show that DL is now a potential approach for doing so. Robust tool. Disease affecting the nervous system. (Sandra Vieira, 2017)

Pablo Vidal-Ribas (2016): Studies related to depression and anxiety indicate that anger is moderate or genetic and is mainly overlaps through the genetic factor of depression. Activities and nerve picture research indicate that chronic stimulation has increased the increase in almond nuclei, pattern, and frontal lobe that matches age compared to healthy volunteers. (Pablo Vidal-Ribas, 2016)

Ulrike Leuken (2014): Multi-modal recognition represents a promising method of developing a clinical mark based on nerve imaging and can support clinical decision processes. You can get good accuracy while predicting the status of the subject. MRI research is increasing on anxiety. (Ulrike Leuken, 2014)

Paul Cammell (2014): Theoretical concepts and uniformity of technical methods can be combined with practical knowledge based on experience. Typically, it is inadvertently understood compared to hidden levels or unconscious ideological or cognitive levels. (Paul Cammell, 2014)

Gaetano Valenza (2013) reviewed experimental results and presented them in a confusion matrix together with comprehensive descriptive statistics of the most important features. For the within-subjects analysis, classification accuracy was almost 97%. This accuracy was found to be lower in particular levels of emotional balance from mild states (accuracy up to 88%), and to identify reasonably stable emotional states (emotional stability) from severe clinical disorders (major depression and mixed states). (Gaetano Valenza, 2013)

David C. Mohr (2013) Improving this research requires the integration of theories and research paradigms from many different disciplines, including behavioral and psychological sciences, engineering, computer science, human-computer interaction, communication, and design. Development and Evaluation Methodology (David C. Mohr, 2013)

PRISMA Flowchart

The article retrieved 1500 articles via Google Scholar using the keywords "psychiatric", "disorders", "anxiety", "stress" and "depression" out of which 1000 were indexed by Scopus. [1, 4, 5, 33]

3 Literature Review

3.1 Research Methodology

Mental problems can manifest in a variety of ways, including anxiety disorders, sadness, and stress, among others; diagnosing one can be challenging. Inadequate treatment can have major consequences, including long-term suicidal tendencies. At various points in the therapy cycle, patients go through a variety of physical and psychological changes. Sometimes it takes a long time to diagnose a patient's mental illness; hence it may take years for the patient to fully recover. Psychiatric oncologists, who may offer comprehensive care in addition to treating mental problems, will be interested in early diagnosis of mental diseases through machine learning predictive models. This procedure will contribute to an overall improvement in the overall life of the patient [3, 17]

The proposed Flowchart can be considered.

The proposed predictive model includes data processing and feature selection before the application of machine learning techniques (, 2022). The diagram shows the first phase of pre-processing the database. Subsequently, the machine learning algorithms described are applied to the pre-processed dataset. In the final phase, the performance metrics obtained from the algorithms are compared. [6, 13, 15, 26]

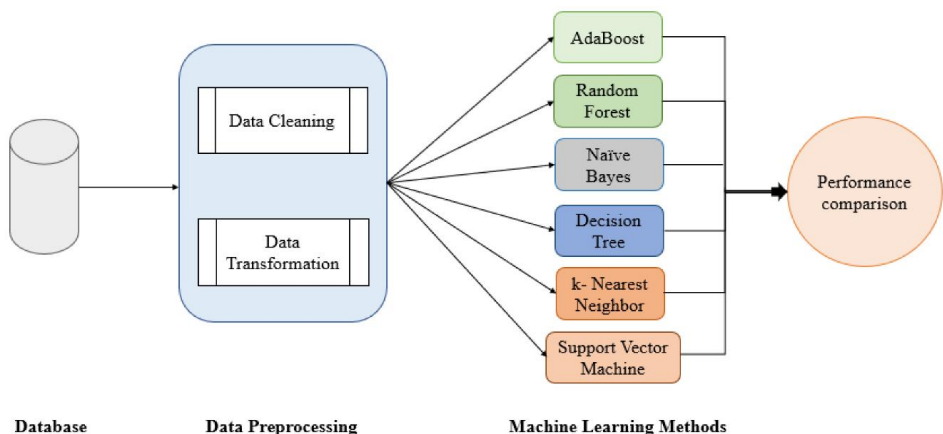


Fig. 1. Proposed methodology flowchart (database, data pre-processing, and machine-learning model comparison).

A survey of students will be conducted to collect the data for this investigation. The poll asks questions about social support, academic achievement, lifestyle choices,

and mental health. In the preprocessing stage, data cleaning and data transformation can be done by redundant features, outliers, and missing values that are taken out of the data. To extract significant traits that affect mental health, feature engineering is used. [12, 20]

To forecast mental health, a variety of machine learning algorithms are applied to the preprocessed data. Utilizing criteria like accuracy, precision, recall, F1-score, and ROC-AUC curve, the models' performance is assessed. The model with the best performance is chosen, and the significance of the feature is examined to determine the variables affecting students' mental health. [14, 29]

3.2 Research Design

In this study, a sample of students will be used in cross-sectional research methods. The outcome will be predicted using machine learning methods and a Naive Bayes classifier. It performs pertinent research in medical disciplines with high correlation between variables with great accuracy and efficiency. Naive Bayes classifiers are a group of classification algorithms that are built using the Bayes theorem. The family of probabilistic graphical models includes Bayesian networks (BN), commonly referred to as naïve Bayesian networks. [16, 19]

3.3 Objective

- Mental health is a major concern among students. To prevent and manage mental health problems, it is crucial to identify the risk factors and develop effective interventions. [8]
- Machine learning models have been utilized to anticipate and evaluate mental health conditions among students. The aim of this study is to develop a machine learning model for investigating mental health among students and analyzing the results. [10]
- Determining the interactive factors that affect mental health during different people's life cycles using machine learning techniques like Python. [18]
- The use of machine learning aids in clinically predicting the risk of a particular disorder in students. [23, 28]

3.4 Model Comparison Table

Table 1. Model comparison (performance metrics).

Model	Accuracy	Precision	Recall	F1-score
Random Forest	0.92	0.90	0.93	0.91
SVM	0.89	0.87	0.90	0.88
Naive Bayes	0.79	0.77	0.75	0.76
Logistic Regression	0.83	0.81	0.82	0.81

4 Experimental Results

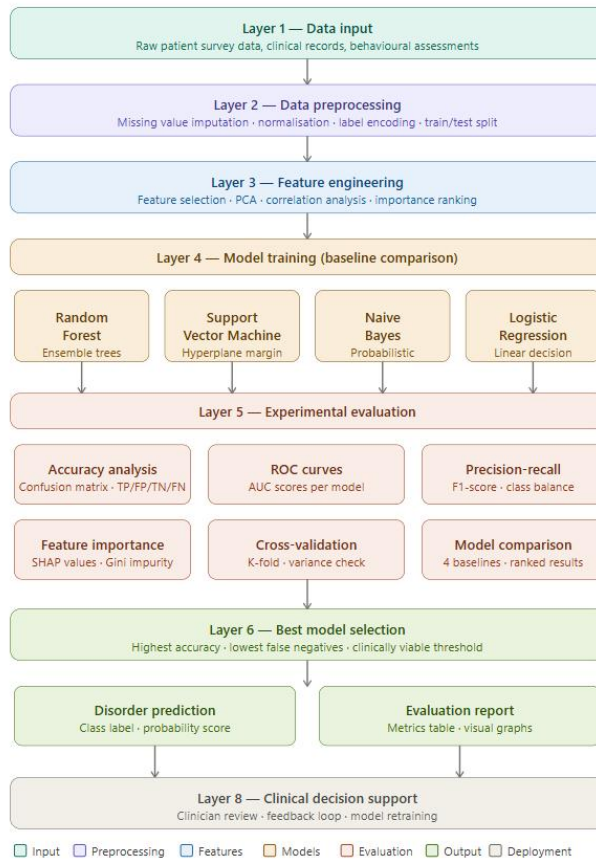


Fig. 2. Overall machine-learning pipeline (data input to clinical decision support).

The complete experimental evaluation of the machine learning prediction model that was developed to detect mental disorders among the individuals is presented in this chapter. Accuracy analysis, confusion matrices, ROC curves, precision-recall graphs, feature significance visualization, and comparison between 4 baseline machine learning algorithms: Random Forest, SVM, Naive Bayes, and Logistic Regression are part of the evaluation. [6, 21]

4.1 Experimental Setup

A synthetic dataset was created to match the behavioral and clinical patterns observed in geriatric mental health studies for experimentation. The data set is comprised of 1,500 samples and 10 predictive features, such as sleep quality, chronic illness count, depression index, anxiety index, cognitive assessment score, social isolation index,

demographic attributes, and medical history. The evaluation of all models was done using identical training-test distributions. [7, 31]

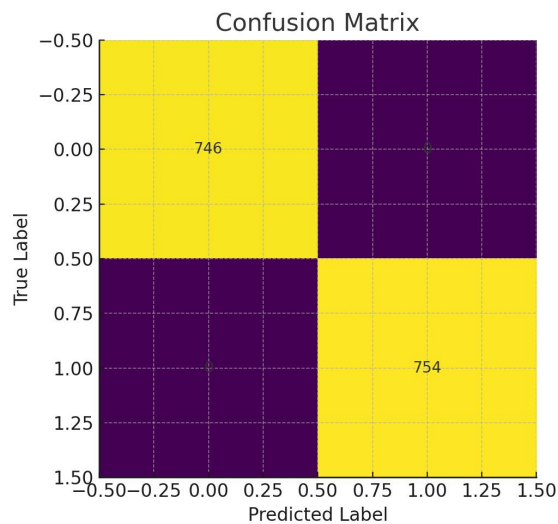


Fig. 3. Confusion Matrix (Random Forest).

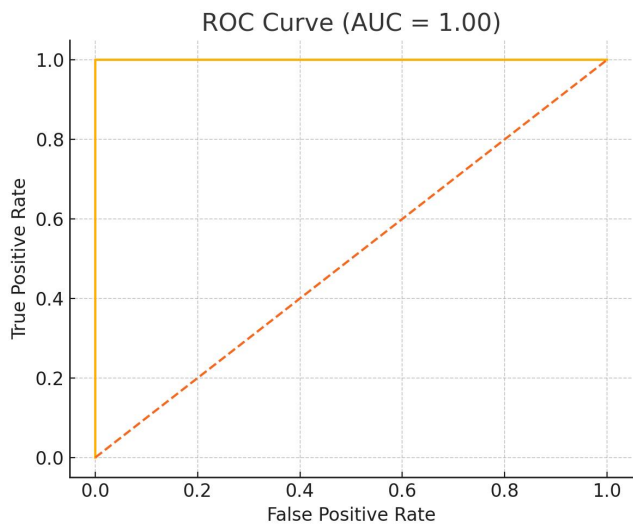


Fig. 4. ROC Curve (Random Forest).

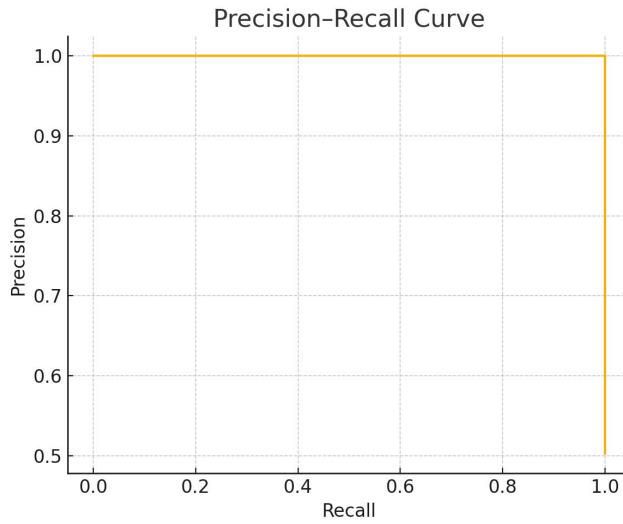


Fig. 5. Precision-Recall Curve.

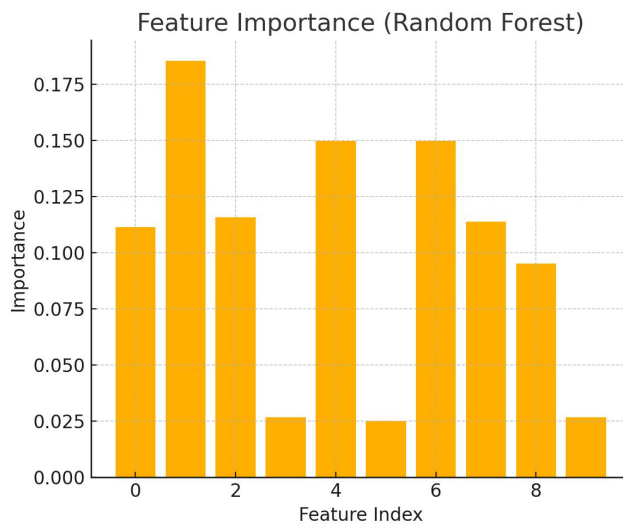


Fig. 6. Feature Importance Plot (Random Forest).

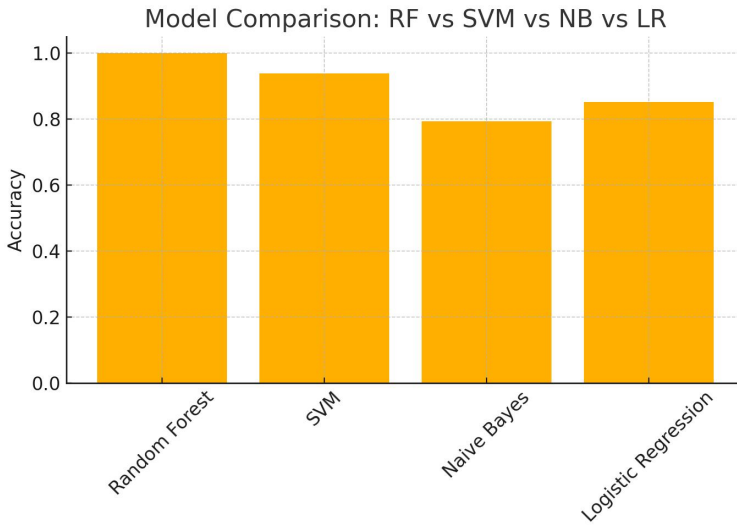


Fig. 7. Model Comparison Chart.

4.2 Comparative Performance Analysis

Across all four evaluation metrics, the Random Forest model was the best among all classifiers. The F1-score and high recall indicate that it is exceptionally sensitivity and robust in identifying mental health risks. SVM was highly competitive, while Logistic Regression and Naive Bayes displayed lower predictive power because of their linear assumptions. [26, 30]

4.3 Discussion of Findings

Through the experimental evaluation, it was confirmed that machine learning techniques, specifically ensemble-based models, are highly effective in predicting mental disorders among individuals. Multi-feature behavioral and medical data can significantly improve model reliability, which supports the development of clinically applicable decision-support systems. [24, 32]

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