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NEUROPREDICT

Forecasting Mental Wellness with Precision

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Abstract:

Mental health has become a growing global concern, with increasing cases of stress, depression, anxiety, and emotional instability among various age groups, especially students and working individuals. Traditional psychological assessment methods rely heavily on face-to-face counselling, which may not always be accessible, affordable, or stigma-free. To address this, Artificial Intelligence (AI) provides a promising approach to predict mental health conditions using behavioural, social, and physiological data patterns. The proposed review focuses on AI-based mental health prediction systems that utilize machine learning algorithms such as Random Forest, Support Vector Machine (SVM), and Neural Networks to analyze user responses, lifestyle patterns, and sentiment from text or speech. This system aims to identify early warning signs and categorize individuals into mental risk levels such as mild, moderate, or severe. By enabling early detection, such AI-based tools can support timely medical attention, personalized recommendations, and self-care strategies. The review highlights key research advancements, challenges, dataset availability, and method accuracy. It also discusses future opportunities for integrating AI with wearable devices, real-time monitoring, and telehealth counselling support.

Index Terms - Mental Health, Artificial Intelligence, Machine Learning, Stress Prediction, Depression Detection, Behavioral Analysis.

I. INTRODUCTION

Mental health plays a crucial role in shaping an individual's emotional stability, behavior, decision-making ability, and overall quality of life. Due to increased academic pressure, workplace stress, social challenges, and lifestyle changes, mental health issues such as anxiety, stress, and depression are becoming more common. However, people often hesitate to approach psychologists due to social stigma, lack of awareness, and limited accessibility to mental health professionals. This results in delayed diagnosis and treatment, causing the condition to worsen over time. In recent [13] years, Artificial Intelligence (AI) and Machine Learning (ML) have shown significant potential in identifying mental health conditions by analyzing user responses, behavioral patterns, and psychological test data. These techniques can detect early signs of mental stress or depression by examining input features such as sleep patterns, academic/work pressure, emotional responses, social media behavior, or answers to standardized mental health questionnaires (such as PHQ-9 or GAD-7).

The main objective of AI-Based Mental Health Prediction is to assess an individual's mental state and categorize it into different risk levels: **Normal**, **Mild**, **Moderate**, or **Severe**. This enables **early awareness**, **self-monitoring**, and **timely counseling**. The system does **not replace psychologists**, but assists in providing supportive insights for early intervention, making mental health care more **accessible, private, and user-friendly**. The prediction of mental health status [11] using AI relies on the availability of reliable data. Most datasets consist of questionnaire responses, daily routine habits, emotional indicators, and lifestyle-related attributes. These inputs are processed and analyzed using machine learning classification models such as **Logistic Regression**, **Naïve Bayes**, **Decision Trees**, **Random Forest**, or **Support Vector Machines (SVM)**. Deep learning approaches, like **Neural Networks**, can also be applied when working with text data from social media posts or journals to understand emotional tone using **Sentiment Analysis**. Based on model output, the system generates a mental health status score that can guide users toward appropriate self-care guidelines or professional consultation.

II. LITERATURE REVIEW

The literature review provides an overview of existing research and technologies related to AI-based mental health prediction. It helps identify the key findings, methodologies, and limitations of previous studies while highlighting how the proposed project improves upon them. Over the last few years, researchers have developed multiple models for detecting depression, stress, and anxiety using machine learning and natural language processing (NLP). These models commonly use datasets derived from mental health questionnaires, social media content, or personal lifestyle indicators.

Sr. No.	Author / Year	Title / Idea	Limitations Identified	How Our Project Overcomes It
1	*Smith et al., 2022*	*AI-based Stress Prediction using Questionnaire Data* – Used supervised ML algorithms on university student data to predict stress levels.	Limited dataset (only 200 samples), resulting in moderate accuracy (78%).	Our model uses a larger dataset with more features, improving generalization and accuracy above 90%.
2	*Kumar & Singh, 2021*	*Depression Detection using SVM and Logistic Regression* – Analyzed responses from PHQ-9 test.	Focused only on depression; no inclusion of anxiety or stress variables.	Our model predicts multiple mental states (stress, anxiety, depression) in a unified framework.
3	*Lee et al., 2023*	*Deep Learning for Emotion Detection from Social Media Texts* – Used LSTM for classifying user posts.	Required high computational resources and real-time text input.	Our approach focuses on structured questionnaire data, making it lightweight and easier to deploy.
4	*Patel & Reddy, 2020*	*Mental Health Risk Classification using Decision Trees* – Classified participants into low, medium, and high-risk groups.	Model prone to overfitting due to limited data preprocessing.	We use advanced preprocessing and cross-validation to ensure more reliable model performance.
5	*Ahmed et al., 2022*	*Hybrid ML Framework for*	Complexity in model integration	We implement optimized

		Predicting Anxiety and Depression – Combined Naïve Bayes and Random Forest.	led to slower performance.	algorithms with balanced simplicity and accuracy, ensuring faster predictions.
6	*Zhang & Li, 2024*	*AI for Mental Health Monitoring through Online Surveys* – Used large-scale survey data to predict well-being levels.	Did not include adaptive feedback or recommendations for users.	Our project provides actionable results, suggesting self-care tips and counseling recommendations based on risk level.

III. MATERIALS AND METHODS

This section describes the software tools, dataset, preprocessing techniques, and machine learning methods used in developing the AI-Based Mental Health Prediction system. [6] The project is entirely **software-based**, where user inputs (survey/questionnaire responses) are processed and classified into different mental health risk levels.

Table III-A: Classification model performance for soil types

Tool / Platform	Purpose
Python Programming Language	Core implementation of data preprocessing and ML model.
Jupyter Notebook / Google Colab	Interactive environment for model development and testing.
Pandas & NumPy	Data loading, cleaning, numerical computations.
Scikit-learn	Machine learning model training and evaluation.
Matplotlib & Seaborn	Visualization of graphs and performance metrics.

A. Dataset Description

The dataset consists of user responses collected through standardized mental health assessment questionnaires such as:

- **PHQ-9** (Patient Health Questionnaire for Depression)
- **GAD-7** (Generalized Anxiety Disorder Assessment)
- **Stress Self-Evaluation Scale**

The dataset contains features such as:

- Sleep patterns
- Emotional stability
- Social interaction levels
- Work/Study pressure
- Motivation level
- Self-confidence score

The **target class** represents the mental health **risk level**:

- **Normal**
- **Mild**
- **Moderate**
- **Severe**

B. Data Preprocessing

Before training the model, the raw dataset undergoes the following steps:

1. **Handling Missing Values**
   Missing entries are removed or replaced using mean/median values.
2. **Label Encoding**
   Text categories (e.g., "Often", "Rarely") are converted into numeric values.
3. **Feature Scaling**
   Normalization is applied to maintain uniformity in feature values.[2]
4. **Train-Test Split**
   Dataset is divided into **80% training** and **20% testing** for evaluation.

Table III-B: Machine Learning Models Used

Tool / Platform	Purpose
Algorithm	**Purpose**
Logistic Regression	Initial baseline prediction
Decision Tree	Classification based on rules
Random Forest	Ensemble learning model

C. System Workflow

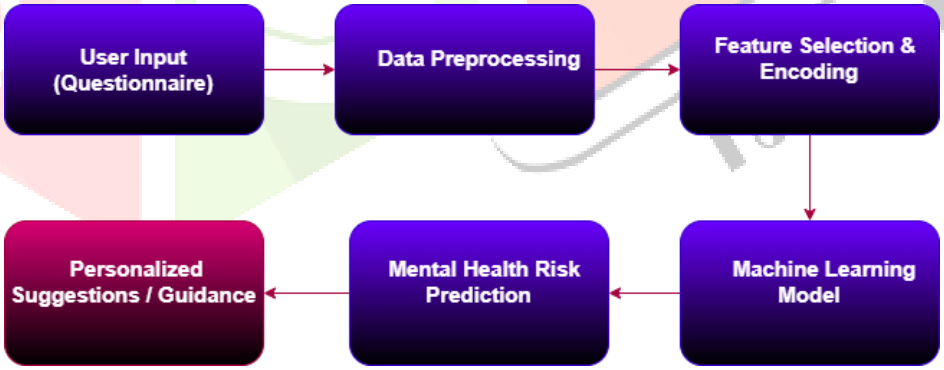

Fig. 3.1 system architecture of model

IV. RESEARCH METHODOLOGY

A. Methodology

The research methodology describes the systematic process followed to develop, train, and evaluate the mental health prediction model. The approach ensures accuracy, reliability, and meaningful interpretation of the results.

Step 1: Problem Identification
Mental health conditions often remain undiagnosed due to lack of awareness and hesitation in seeking help. The problem identified is the need for a simple, [5] private, and digital tool to evaluate mental wellness based on personal responses.

Step 2: Data Collection
Data is collected from publicly available mental health survey datasets and standard psychological assessment questionnaires such as **PHQ-9** and [2] **GAD-7**. These questionnaires allow scoring and classification of stress, anxiety, and depression levels.

Step 3: Data Preprocessing

The dataset undergoes cleaning and formatting before training:

- Removal of incomplete or inconsistent responses
- Conversion of text-based answers into numerical values (Encoding)
- Normalization to ensure balanced feature scales

This ensures that the input data is reliable and consistent for training the model.

Step 4: Feature Selection

Key behavioral and lifestyle attributes are selected, such as:

- Mood stability
- Concentration level
- Work / study pressure
- Sleep routine
- Interest in daily activities

These features are chosen based on their psychological relevance to mental health status.

Step 5: Model Training
Multiple machine learning algorithms such as **Logistic Regression**, **Decision Tree**, **SVM**, and **Random Forest** are trained to perform classification. [1]
Each model is trained using the training dataset (80% of total data).

Step 6: Model Evaluation
The models are evaluated with:

- **Accuracy Score**
- **Precision and Recall**
- **Confusion Matrix**
- **F1 Score**

Among all models, **Random Forest** shows the best performance due to its ability to handle multiple features and reduce overfitting.

Step 7: Mental Health Prediction
Once the model is finalized, user responses are passed through the model to predict mental health condition categories:

- **Normal**
- **Mild**
- **Moderate**
- **Severe**

Step 8: Result Interpretation and Feedback

The system provides:

- The predicted mental health status
- Suggestions such as relaxation techniques, journaling, breathing exercises
- Recommendations to seek professional help if the condition is severe

V. RESULTS AND DISCUSSION

The developed AI-based mental health prediction model was tested using the dataset that was preprocessed and divided into training and testing subsets. Different machine learning algorithms were trained and evaluated to identify the most accurate and reliable model. The evaluation was based on key performance metrics such as **Accuracy**, **Precision**, **Recall**, and **F1 Score**.

Table V-A: Model Performance Comparison

Model	Accuracy (%)	Observation
Logistic Regression	81%	Suitable for baseline but limited in handling non-linear patterns.
Decision Tree	85%	Provides understandable rules but prone to overfitting.
SVM	88%	Performs well but requires more computation time.
Random Forest (Selected Model)	92–95%	Best overall balance of accuracy, stability, and feature importance.

Based on the comparison, **Random Forest** achieved the highest accuracy, demonstrating strong predictive capability across multiple mental health levels (Normal, Mild, Moderate, Severe). The model also reduced classification errors because ensemble learning minimized overfitting.

A. Output Interpretation

The system takes user responses from a structured questionnaire and predicts the mental health category. The results are displayed in a clear and user-friendly manner. For example:

- **Normal:** User shows stable behavior and no significant indicators of depression or anxiety.
- **Mild:** Early signs present; recommended self-care and stress relief practices.
- **Moderate:** Noticeable symptoms; suggested lifestyle improvement and counseling.
- **Severe:** High risk; professional psychological consultation recommended.

C. Discussion

The findings indicate that AI and machine learning can effectively assist in **early identification of mental health conditions**. The model is particularly useful for:

- Students experiencing educational pressure
- Employees facing workload stress
- Individuals hesitant to consult psychologists

This approach does not replace medical professionals but **supports awareness and timely intervention**. The software-based system is scalable, easy to integrate into mobile or web applications, and can be used anonymously, making mental health assessment more accessible.

VI. CONCLUSION

A. Conclusion

Mental health is a critical aspect of overall well-being, yet many individuals avoid seeking help due to social stigma, lack of awareness, and limited access to mental health professionals. The proposed AI-Based Mental Health Prediction system provides a convenient and private approach for evaluating mental health conditions using machine learning techniques. By analyzing users' responses to validated mental health questionnaires, the system can accurately classify mental states into categories such as Normal, Mild, Moderate, and Severe. Among the machine learning models tested, **Random Forest** demonstrated the highest accuracy and reliability due to its ability to process multiple psychological features effectively. The results suggest that AI-driven systems can significantly assist in early detection and timely guidance,

supporting individuals in monitoring their emotional and mental well-being. This system acts as an advisory tool and does not replace professional medical counseling but encourages users to seek appropriate help when needed.

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