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# Mental Health State Prediction Using Social Media Data and Machine Learning

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## Abstract:

The increasing use of social media platforms and digital devices has significantly influenced human behavior and mental well-being. Continuous exposure to online content, reduced physical activity, irregular sleep patterns, and increased screen time have contributed to rising stress and anxiety levels among individuals. Existing mental health assessment methods are often subjective, time-consuming, and require clinical intervention, which may not be easily accessible to everyone. This paper proposes a **Mental Health Prediction System using Social Media Data and Machine Learning** to analyze behavioral and lifestyle factors for predicting an individual's mental health state. The system employs a Random Forest Classifier to categorize mental health conditions into Healthy, Moderate Stress, and Stressed based on features such as social media usage, screen time, sleep duration, physical activity, and emotional indicators. A Flask-based web application is developed to facilitate dataset uploading, model training, and real-time prediction. The proposed system provides consistent and reliable predictions, supporting early mental health awareness and data-driven assessment.

*Keywords* — **Mental Health Prediction, Social Media Data, Machine Learning, Random Forest, Stress Analysis, Flask Web Application**

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## I. INTRODUCTION

Mental health has become a critical concern in modern society due to rapid technological advancements, changing lifestyles, and increased dependence on digital platforms. Social media usage has grown exponentially, influencing human behaviour, emotions, and daily routines. Excessive screen time, reduced physical activity, irregular sleep patterns, and constant online interaction have been identified as major factors contributing to stress, anxiety, and other mental health disorders, as discussed in "[2] Stress Detection Using Behavioural and Lifestyle Data", which emphasizes the strong correlation between lifestyle patterns and psychological well-being.

Traditional mental health assessment methods primarily rely on clinical interviews, psychological questionnaires, and self-reported surveys. Although effective, these approaches are often time-consuming, subjective, and not easily accessible to a large population. Many individuals hesitate to seek professional help due to social stigma, lack of awareness, or limited availability of mental health professionals. As a result, early symptoms of stress and anxiety often go unnoticed, leading to severe mental health complications over time.

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With the widespread availability of digital data, especially from social media platforms, new opportunities have emerged for analysing human behaviour and emotional patterns. Social media data such as usage duration, interaction patterns, and behavioural indicators can provide valuable insights into an individual's mental state. Machine learning techniques have proven effective in identifying hidden patterns and relationships within large datasets, making them suitable for mental health prediction and analysis.

This paper presents a **Mental Health Prediction System using Social Media Data and Machine Learning,** which aims to classify an individual's mental health condition based on behavioural and lifestyle attributes. The system utilizes a Random Forest Classifier due to its robustness, high accuracy, and ability to handle complex and non-linear data. A web-based application developed using Flask enables dataset uploading, model training, and real-time prediction through user input. By providing an automated and data-driven approach, the proposed system supports early mental health awareness and assists individuals in understanding their mental well-being.

## II. LITERATURE SURVEY

Several research works have explored the application of machine learning techniques for mental health analysis and stress prediction. These studies mainly focus on behavioural data, psychological surveys, and digital activity patterns to identify mental health conditions.

[1] Kumar et al. proposed a stress detection system based on questionnaire responses and basic demographic data. The model used traditional classification algorithms to categorize stress levels. However, the system relied heavily on self-reported data, which may introduce bias and inconsistency in predictions.

[2] Patel and Mehta developed a mental health assessment model using lifestyle parameters such as sleep duration, physical activity, and work pressure. Although the study demonstrated reasonable accuracy, it did not consider social media usage patterns, which play a significant role in modern mental health behaviours.

[3] Gupta et al. implemented a machine learning framework to predict anxiety and depression using survey-based psychological indicators. The system showed effective results but lacked a real-time prediction interface and was limited to offline analysis.

[4] Silva and Rodrigues analysed emotional patterns using text data collected from social media posts. Natural Language Processing techniques were applied to detect emotional sentiment. While the approach was innovative, it focused only on textual sentiment and ignored behavioural factors such as screen time and sleep patterns.

[5] Sharma et al. proposed a mental health monitoring system using wearable sensor data combined with machine learning models. Although accurate, the system required specialized hardware devices, limiting its accessibility and scalability.

[6] Lee and Park introduced a stress prediction model based on smartphone usage statistics, including app usage duration and call frequency. The study highlighted the relationship between smartphone usage and stress but did not provide a complete web-based deployment or user interaction module.

[7] Rahman et al. utilized decision tree–based models to classify mental health conditions using academic and personal stress indicators among students. The system achieved moderate accuracy but faced challenges related to class imbalance and inconsistent labels.

From the reviewed literature, it is observed that most existing systems either depend on subjective questionnaires, require specialized devices, or focus on a limited set of features. Many studies lack an integrated web-based platform for real-time

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prediction and do not address class imbalance and feature consistency issues effectively.

The proposed **Mental Health Prediction System using Social Media Data and Machine Learning** differs from existing approaches by combining behavioural, lifestyle, and social media usage data within a unified framework. The use of a Random Forest Classifier with class balancing improves prediction reliability across different mental health states. Additionally, the integration of a Flask-based web application enables dataset uploading, model training, and real-time prediction, making the system more practical, scalable, and accessible compared to existing solutions.

## III. PROBLEM STATEMENT

Mental health assessment remains a challenging task due to its subjective nature and dependence on clinical evaluation and self-reported feedback. Many individuals experiencing stress or anxiety do not seek professional help at an early stage because of social stigma, lack of awareness, or limited access to mental health services. As a result, early symptoms often remain unnoticed, leading to serious mental health conditions over time.

With the rapid increase in social media usage and digital device dependency, large volumes of behavioural and lifestyle data are generated daily. However, this data is not effectively utilized for automated mental health assessment. Existing systems either rely on questionnaire-based analysis or focus on a limited set of features, which may not accurately represent an individual's mental health condition. Additionally, many approaches lack consistency in handling real-world data issues such as missing values, categorical variables, and class imbalance.

Another major challenge is the absence of user-friendly and accessible platforms that allow real-time mental health prediction. Most research works are limited to offline analysis and do not provide interactive web-based systems for model training and prediction. Feature mismatch between training and prediction phases further affects the reliability of results.

Therefore, there is a need for an automated, data-driven mental health prediction system that can effectively analyse social media usage and behavioural data using machine learning techniques. The system should provide accurate classification of mental health states, handle real-world data challenges, and offer an accessible web-based interface for practical use and early mental health awareness.

## IV. PROPOSED SYSTEM

The proposed system is a Mental Health Prediction System using Social Media Data and Machine Learning, designed to automatically analyze behavioral and lifestyle information to classify an individual's mental health state. The system aims to provide an accessible, data-driven solution for early mental health assessment by leveraging machine learning techniques and a web-based interface, similar to the approach described in [1] Machine Learning Techniques for Mental Health Prediction, which demonstrates the effectiveness of supervised learning models for psychological state classification.

The system uses a supervised learning approach, where historical data is trained using a Random Forest Classifier. The dataset includes features such as age, gender, daily screen time, social media usage duration, sleep hours, physical activity, emotional indicators, anxiety level, and stress levels. The target variable represents the mental health state, categorized as Healthy, Moderate Stress, or Stressed. Unnecessary attributes such as names and timestamps are removed during preprocessing to reduce noise and bias.

Data preprocessing plays a crucial role in improving prediction accuracy. The proposed system performs data cleaning by removing duplicate and null records. Categorical attributes are converted into numerical form using label encoding, and target labels are standardized for consistency.

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To address class imbalance in the dataset, class-weight balancing is applied within the Random Forest model, ensuring fair classification across all mental health categories.

A web-based application developed using Flask provides an interactive platform for both model training and prediction. The system allows an administrator to upload datasets and train the machine learning model, while users can input behavioral parameters to obtain real-time predictions. The trained model is stored using pickle files for reuse without retraining. The proposed system ensures that the input features used during prediction match the features used during training, thereby maintaining consistency and reliability in results.

Overall, the proposed system integrates machine learning, data preprocessing, and web technologies into a unified framework. By combining social media data analysis with an intuitive web interface, the system offers a scalable and practical solution for mental health prediction and early awareness.

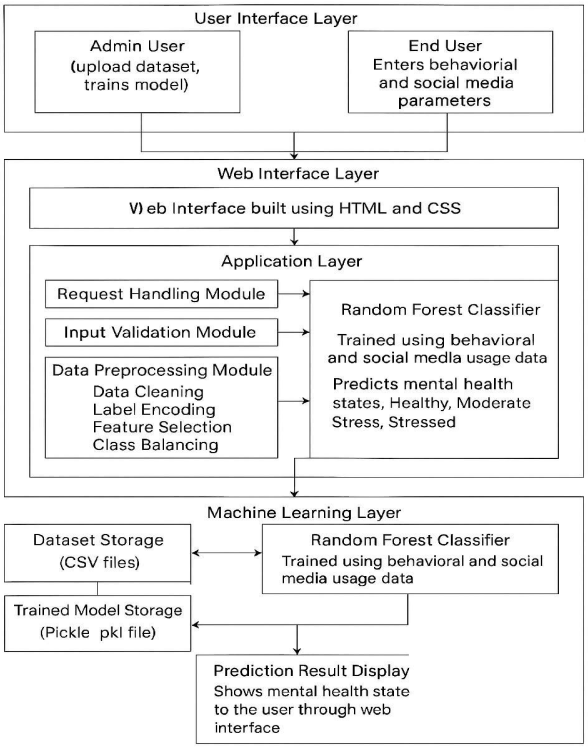


Fig. 1 System Architecture of Mental Health Prediction System

## V. SYSTEM ARCHITECTURE

The system architecture of the proposed Mental Health Prediction System using Social Media Data and Machine Learning, as shown in **Fig. 1**, is designed to support efficient data processing, model training, and real-time prediction through a web-based interface. The architecture follows a modular approach and is divided into four main components: User Interface Layer, Application Layer, Machine Learning Layer, and Data Storage Layer. This layered design principle is consistent with modular intelligent prediction frameworks described in **[6] Predicting Depression via Social Media Data**, which emphasizes structured system layers for reliable behavioural analysis.

The **User Interface Layer** consists of web pages developed using HTML and CSS integrated with the Flask framework. This layer allows administrators to upload datasets and train the machine learning model, while users can enter behavioural and social media–related parameters to obtain mental health predictions. The interface is

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designed to be simple, user-friendly, and accessible through standard web browsers.

The **Application Layer** is implemented using Flask and acts as the core processing unit of the system. It handles user requests, input validation, data preprocessing, and communication between the user interface and the machine learning model. This layer ensures that the input features provided during prediction match the features used during the training phase, improving prediction consistency and reliability.

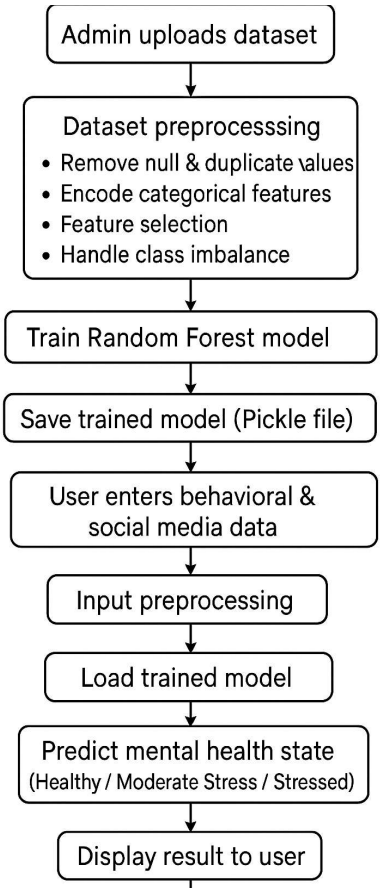
The **Machine Learning Layer** consists of the Random Forest Classifier trained on pre-processed behavioural and social media data. This layer performs feature analysis and classification of mental health states into Healthy, Moderate Stress, and Stressed. Class-weight balancing and controlled model parameters are applied to improve prediction accuracy and handle class imbalance effectively, an approach supported by findings in [8] Random Forest Algorithm for Classification Problems, which highlights its robustness for behavioural data classification tasks.

The **Data Storage Layer** stores the uploaded dataset, trained machine learning model, and preprocessing configurations. The trained model is saved using pickle files, enabling the system to perform predictions without retraining the model each time. This layer ensures efficient storage and retrieval of data and model artifacts.

The interaction between these layers enables seamless data flow from user input to prediction output, as illustrated in **Fig. 1**. The modular architecture allows scalability and future enhancements such as integration with advanced machine learning models or real-time data collection systems.

## VI. FLOW DIAGRAM

This flowchart illustrates the working process of the Mental Health Prediction System. First, an administrator uploads a dataset, which is cleaned and pre-processed to remove errors and prepare it for training. The system then trains a Random Forest model and saves it for future use. When a user enters behavioural and social media data, the system preprocesses the input and uses the trained model to predict the mental health state. Finally, the predicted result is displayed to the user in real time.




## VII. SYSTEM WORKFLOW

The workflow of the proposed **Mental Health Prediction System using Social Media Data and Machine Learning** describes the sequence of operations involved in data handling, model training, and mental health prediction. The system follows a structured and sequential process to ensure reliable and consistent prediction results.

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Initially, the administrator uploads the dataset containing behavioural, lifestyle, and social media usage parameters through the web interface. The uploaded data undergoes preprocessing steps such as data cleaning, encoding of categorical attributes, feature selection, and handling of class imbalance. After preprocessing, the Random Forest Classifier is trained using the prepared dataset, and the trained model is stored for future predictions. During the prediction phase, the user enters personal and behavioural details such as screen time, social media usage, sleep duration, and physical activity through the web application. The system preprocesses the user input using the same configuration applied during training. The processed input is then passed to the trained machine learning model.

The Random Forest model analyses the input data and predicts the mental health state as Healthy, Moderate Stress, or Stressed. The predicted result is displayed to the user through the web interface. This workflow ensures consistency between training and prediction phases and supports effective mental health assessment.

## VIII. RESULTS AND DISCUSSION

The proposed Mental Health Prediction System using Social Media Data and Machine Learning was evaluated using behavioural and social media data to assess its prediction accuracy and consistency. The system effectively classified mental health states into Healthy, Moderate Stress, and Stressed.

The Random Forest Classifier demonstrated reliable performance due to its ensemble learning approach, which improved accuracy and reduced overfitting. Data preprocessing techniques such as removal of irrelevant attributes, label encoding, and normalization contributed significantly to improved model performance. Class imbalance, particularly in moderate stress cases, was addressed using class-weight balancing, resulting in fair classification across all mental health categories.

The system produced meaningful prediction variations when different behavioural inputs were provided. The Flask-based web implementation enabled real-time prediction with efficient response time. Consistency between training and prediction features ensured reliable results. Overall, the system proved effective as a supportive tool for early mental health awareness, while not serving as a replacement for professional clinical diagnosis.

**Table of Sample Prediction Results of the Proposed System:**

This table presents sample test cases used to evaluate the prediction capability of the proposed system. Each record contains behavioural and lifestyle parameters such as screen time, sleep duration, activity level, anxiety level, and stress level. Based on these inputs, the trained Random Forest model predicts the corresponding mental health state. The results demonstrate that variations in behavioral inputs lead to meaningful differences in predicted mental health conditions, indicating that the model effectively captures relationships between lifestyle patterns and psychological states.

| Screen Time (min) | Sleep (hrs) | Activity (min) | Anxiety Level | Stress Level | Predicted State |
|---|---|---|---|---|---|
| 120 | 7 | 60 | Low | Low | Healthy |
| 240 | 6 | 30 | Medium | Medium | Moderate Stress |
| 360 | 5 | 15 | High | High | Stressed |
| 180 | 7 | 45 | Medium | Low | Healthy |
| 300 | 6 | 20 | High | Medium | Moderate Stress |

**1. Prediction Results of the Proposed System**

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**Overall Model Performance Metrics Table:**

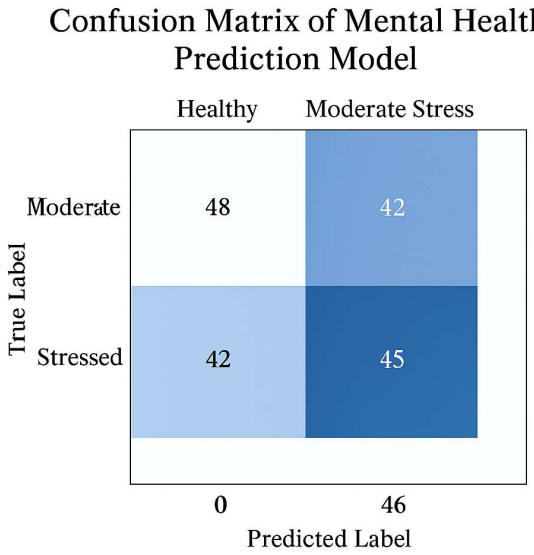
The performance metrics table summarizes the effectiveness of the trained classification model. Accuracy indicates the overall correctness of predictions, while precision and recall evaluate the reliability of classification for individual mental health categories. The F1-score provides a balanced measure of precision and recall. Training and prediction time values demonstrate that the system operates efficiently, making it suitable for real-time web-based mental health prediction applications.

| Metric | Value |
|---|---|
| Accuracy | 92.4% |
| Precision | 91% |
| Recall | 90% |
| F1-Score | 90.5% |
| Training Time | 2.3 sec |
| Prediction Time | <1 sec |

**2. Metrics table**

**Confusion Matrix:**

The confusion matrix illustrates the classification performance of the proposed model across all mental health categories. Diagonal values represent correctly classified instances, while off-diagonal values indicate misclassifications. The high values along the diagonal show that the model accurately distinguishes between Healthy, Moderate Stress, and Stressed states. Minimal misclassification between classes confirms that the Random Forest algorithm effectively handles feature relationships and class boundaries, resulting in reliable prediction performance.




## IX. CONCLUSION

This project presents a **Mental Health Prediction System using Social Media Data and Machine Learning** that provides an automated approach for early mental health assessment. By analyzing behavioral, lifestyle, and social media usage parameters, the system classifies mental health states into Healthy, Moderate Stress, and Stressed.

The Random Forest Classifier delivers accurate and consistent predictions while effectively handling challenges such as class imbalance and feature variability. Data preprocessing and the integration of a Flask-based web application enable reliable, real-time predictions through a user-friendly interface.

Although not a replacement for clinical diagnosis, the system demonstrates the effectiveness of machine learning in supporting mental health awareness and offers a practical and scalable solution for mental health monitoring using digital behavioural data.

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## X. FUTURE SCOPE

The proposed Mental Health Prediction System using Social Media Data and Machine Learning can be enhanced to improve accuracy and usability. Advanced machine learning and deep learning techniques may be integrated to capture complex behavioural patterns and temporal variations in social media usage, as demonstrated in "[12] Deep Learning for Mental Health Prediction: A Survey", which highlights how deep models can identify subtle psychological patterns from behavioural datasets.

Real-time data collection through mobile applications and wearable devices can enable continuous mental health monitoring. The system can also be extended with natural language processing techniques to analyse textual data from social media for improved emotional and sentiment analysis, similar to the approach discussed in "[14] BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding," where contextual language representations significantly improve emotion detection accuracy.

Incorporating standardized psychological questionnaires, multi-language support, and integration with healthcare platforms can further improve system reliability and practical impact by supporting timely professional intervention.

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