



(RESEARCH ARTICLE)



Mental health detection using sentiment analysis

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Abstract

Mental health challenges such as stress, anxiety, and depression will continue to become increasingly prevalent in modern society, making early identification essential for promoting emotional well-being. This project will present an advanced Mental Health Detection System using Sentiment Analysis to analyze user-generated text and identify emotional states, including Positive, Stress, Anxiety, and Depression. The system will employ Natural Language Processing (NLP) techniques to preprocess textual data and will convert it into meaningful numerical representations using word embeddings. A deep learning model based on Long Short-Term Memory (LSTM) will be utilized to capture contextual information and enhance classification accuracy. In addition to predicting emotional states, the system will provide confidence scores and personalized recommendations. The application will be implemented as a web-based platform to deliver real-time results.

Keywords: Mental Health Detection; Sentiment Analysis; Natural Language Processing; LSTM; Word Embeddings

1. Introduction

Mental health has become a critical concern in recent years due to increasing stress, anxiety, depression, and other psychological issues. With the rapid growth of digital communication, individuals frequently express their emotions and thoughts through social media, chat platforms, and online forums. These textual expressions provide valuable insights into a person's mental state.

Traditional mental health assessment methods rely on clinical interviews and self-reported surveys, which are often time-consuming, subjective, and not easily accessible to everyone. Moreover, these approaches lack real-time monitoring and early detection capabilities. As a result, there is a growing need for automated systems that can analyze user-generated data efficiently and accurately.

Advancements in Artificial Intelligence (AI), Natural Language Processing (NLP), and Machine Learning (ML) have made it possible to develop intelligent systems for detecting mental health conditions. By analyzing textual data using sentiment analysis and deep learning models such as LSTM, it is possible to identify emotional patterns and predict mental health states. This project focuses on developing a system that leverages these technologies to provide timely insights and support.

1.1. Need for the Study

Despite the availability of mental health awareness programs, early detection and continuous monitoring remain major challenges. Many individuals hesitate to seek professional help due to social stigma, lack of awareness, or limited access to healthcare services.

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Existing systems often focus on basic sentiment classification and fail to capture deeper emotional patterns from text data. They may also lack real-time analysis, personalization, and actionable recommendations. This limits their effectiveness in real-world applications.

1.2. Objectives of the Study

The main objectives of this project are

- To develop a mental health detection system using sentiment analysis
- To implement deep learning models such as LSTM for emotion classification
- To analyze user-generated textual data for identifying mental health conditions
- To provide real-time predictions and feedback based on user input
- To design a user-friendly interface for easy interaction
- To improve accuracy and reliability in detecting emotional patterns
- To support early detection and awareness of mental health issues

2. Literature Review

Existing mental health detection systems mainly rely on basic sentiment analysis and traditional machine learning techniques, which often limit their accuracy and effectiveness in real-time applications. Recent research has introduced advanced Machine Learning and Deep Learning models to analyze textual and behavioral data, improving the identification of emotional patterns and mental health conditions.

Some studies focus on structured clinical data, while others utilize social media and user-generated content for analysis. Although these approaches enhance prediction accuracy, they still face several challenges such as lack of real-time processing, limited scalability, data privacy concerns, and dependency on large datasets.

Overall, most existing systems address only specific aspects of mental health detection and fail to provide a complete solution. These limitations highlight the need for an intelligent system that integrates sentiment analysis, deep learning, and real-time processing for accurate and efficient mental health monitoring.

2.1. Machine Learning for Multimodal Mental Health Detection: A Systematic Review of Passive Sensing Approaches [1] Chun Yong Chong (2024)

This study presents a comprehensive review of machine learning techniques applied to multimodal data for mental health detection. The system analyzes data collected from multiple sources such as smartphones, social media platforms, wearable devices, audio, and video inputs. It highlights the use of supervised learning, neural networks, and ensemble models to identify mental health conditions effectively. The research emphasizes that combining multiple data modalities significantly improves prediction accuracy compared to single-source analysis. However, it also identifies challenges such as data privacy concerns, high computational costs, and the need for large datasets.

2.1.1. Methodologies and Algorithms

The study utilizes various machine learning techniques, including supervised learning models, deep neural networks, and ensemble methods. It integrates multimodal data sources to enhance prediction performance and capture diverse behavioral patterns.

2.1.2. Accuracy and Limitations

The study reports improved accuracy through multimodal integration but lacks specific performance metrics. Limitations include high computational requirements, data privacy issues, and dependency on large-scale datasets.

2.2. A Comprehensive Review of Predictive Analytics Models for Mental Illness Using Machine Learning Algorithms [2] Md. Moinul Islam (2024)

This paper reviews different predictive analytics models used in mental illness detection, including machine learning and deep learning approaches. It analyzes data from surveys, social media, and sensor-based inputs. The study highlights the importance of feature extraction and preprocessing techniques in improving model accuracy and reliability. It also discusses the advantages and limitations of different algorithms and stresses the need for more generalized and robust models.

2.2.1. Methodologies and Algorithms

The study focuses on supervised learning, deep learning, and ensemble techniques. It emphasizes preprocessing methods such as feature selection, normalization, and data cleaning to enhance model performance.

2.2.2. Accuracy and Limitations

The research suggests improved accuracy with proper preprocessing and hybrid models. However, it lacks real-time implementation and faces challenges in generalizing models across different datasets.

2.3. Prediction of Mental Health Treatment Adherence using Machine Learning Algorithms [3] Priyanshu Rawat (2023)

This research focuses on predicting patient adherence to mental health treatments using machine learning techniques. It utilizes structured clinical and behavioral data to make predictions. The study demonstrates that machine learning models can effectively identify whether patients will follow treatment plans, which is crucial for improving healthcare outcomes.

2.3.1. Methodologies and Algorithms

The study uses algorithms such as Logistic Regression, Support Vector Machine (SVM), Random Forest, and Decision Trees. These models are trained on structured clinical datasets to predict adherence behavior.

2.3.2. Accuracy and Limitations

The models achieve good prediction accuracy on structured data. However, the system is limited in handling unstructured data such as text or social media inputs, reducing its applicability in real-world scenarios.

2.4. Comparison of Selected Machine Learning Algorithms in the Analysis of Mental Health Indicators [4] Izabela Rojek (2023)

This paper compares various machine learning algorithms for analyzing mental health indicators. It evaluates models such as Logistic Regression, SVM, Random Forest, Decision Tree, and Naïve Bayes. The study concludes that no single algorithm performs best in all situations and that performance depends on data quality and type.

2.4.1. Methodologies and Algorithms

The research applies multiple classification algorithms and compares their performance based on different datasets and evaluation metrics.

2.4.2. Accuracy and Limitations

The study shows that model performance varies across datasets. It lacks a unified approach and suggests combining models to improve accuracy and efficiency.

2.5. A Review of Machine Learning and Deep Learning Approaches on Mental Health Diagnosis [5] Gummi Karen Iyortsuun (2023)

This study reviews both machine learning and deep learning approaches used in mental health diagnosis. It focuses on models such as Naïve Bayes, SVM, LSTM, RNN, and Artificial Neural Networks. The research highlights the effectiveness of deep learning models, especially LSTM, in analyzing unstructured textual data from social media.

2.5.1. Methodologies and Algorithms

The study uses traditional machine learning models along with deep learning architectures like LSTM and RNN to process textual and behavioral data.

2.5.2. Accuracy and Limitations

Deep learning models show higher accuracy in handling complex and unstructured data. However, challenges include data imbalance, lack of labeled datasets, and high computational complexity.

2.6. Comparison of Accuracy of Existing and Proposed Systems

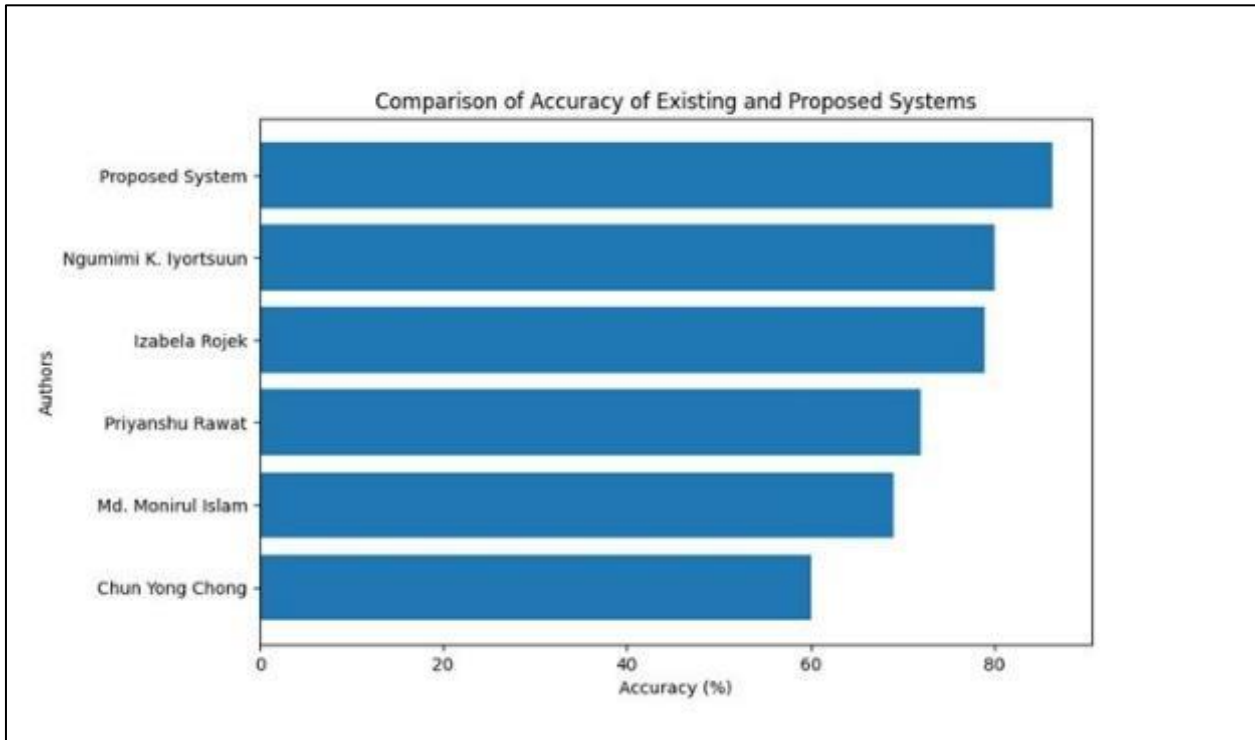


Figure 1 Comparison of Accuracy of Existing and Proposed Systems

Figure 1 The graph compares the accuracy of existing mental health detection approaches with the proposed system. Existing methods show moderate performance due to limitations in data handling, model efficiency, and reliance on traditional machine learning techniques. In contrast, the proposed system achieves higher accuracy by integrating Natural Language Processing (NLP) and an LSTM-based deep learning model, enabling better analysis of textual data and improved detection of mental health conditions. This results in more accurate and reliable predictions compared to existing approaches.

2.7. Comparative Analysis of Existing Systems with Proposed Model

Table 1 Comparative Analysis of Existing Research on Mental Health Detection Systems

Name of the Paper	Year	Techniques Used	Accuracy	Limitations
Machine Learning for Multimodal Mental Health Detection: A Systematic Review of Passive Sensing Approaches	2024	Supervised Learning, Neural Networks, Ensemble Models, Multimodal Data Analysis	High	High computational cost, data privacy issues, requires large datasets
A Comprehensive Review of Predictive Analytics Models for Mental Illness Using Machine Learning Algorithms	2024	Supervised Learning, Deep Learning, Ensemble Methods, Feature Extraction Techniques	Moderate to High	Lack of generalized models, performance depends on data quality
Prediction of Mental Health Treatment Adherence using Machine Learning Algorithms	2023	Logistic Regression, SVM, Random Forest, Decision Trees	Moderate	Depends on structured clinical data, not suitable for unstructured text
Comparison of Selected Machine Learning Algorithms in the Analysis of Mental Health Indicators	2023	Logistic Regression, SVM, Random Forest, Decision Tree, Naïve Bayes	Moderate	No single best model, performance varies with dataset

A Review of Machine Learning and Deep Learning Approaches on Mental Health Diagnosis	2023	Naïve Bayes, SVM, LSTM, RNN, ANN	High	Data imbalance, lack of labeled datasets, computational complexity
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As evident from Table 1, existing systems for mental health detection utilize various machine learning and deep learning techniques, achieving moderate to high accuracy. Most studies emphasize the effectiveness of combining multiple models and using diverse data sources to improve prediction performance. However, common limitations include high computational requirements, data privacy concerns, dependency on large datasets, and challenges in handling unstructured data. In contrast, the proposed system focuses on efficient text-based analysis using NLP and LSTM, aiming to provide accurate, scalable, and real-time mental health detection.

3. Methodology

The proposed Mental Health Detection System consists of multiple modules, including Data Preprocessing, Sentiment & NLP Analysis, LSTM-Based Emotion Classification, User Interface, and Result Interpretation. These components are integrated into a unified web-based framework. The workflow begins with the user providing an input text, which is then cleaned, tokenized, and converted into numerical embeddings. NLP features are extracted and processed, after which the LSTM model analyzes the textual patterns to detect the underlying emotion. The system finally generates predictions along with confidence scores and personalized recommendations. This structured approach enables accurate, automated, and real-time emotion detection for improved mental health awareness.

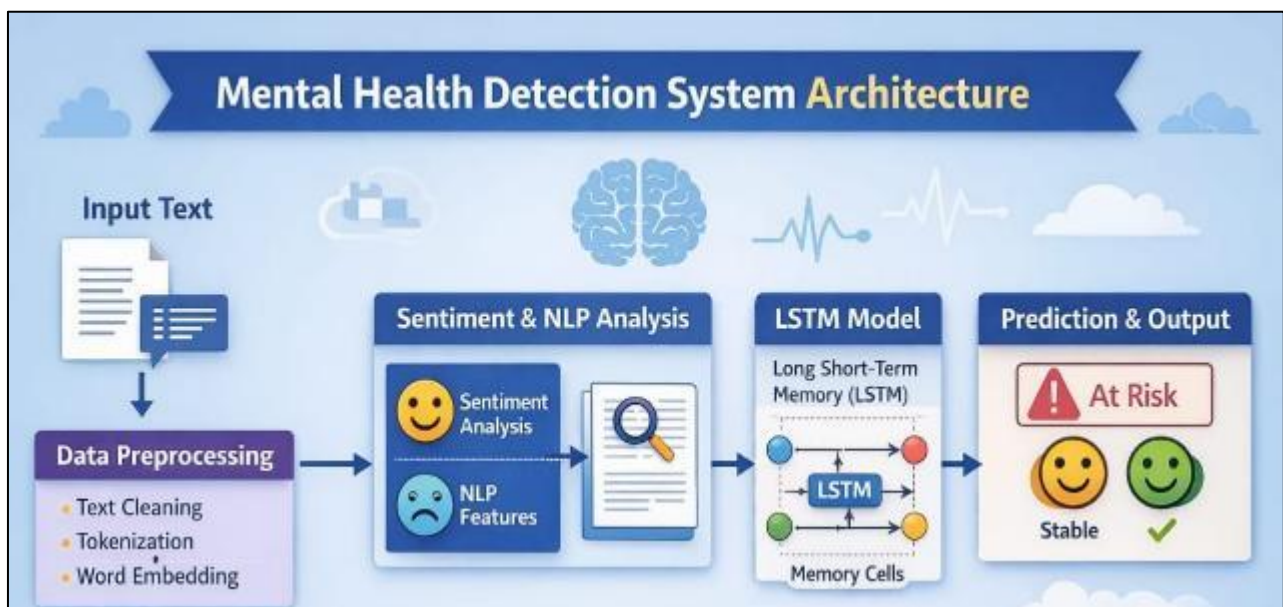


Figure 2 System Architecture for Proposed System

The proposed system follows a structured workflow that integrates text preprocessing, NLP-based feature extraction, and LSTM-driven classification to ensure precise emotional prediction.

- Step 1: User Login and Authentication

Users log into the system through a secure authentication interface to access the emotion detection module.

- Step 2: Input Text Submission

The user enters a sentence or paragraph describing their thoughts or emotional state in the provided text box.

- Step 3: Data Preprocessing

The input text undergoes preprocessing steps such as text cleaning, tokenization, and word embedding to convert raw text into a machine-readable format.

- Step 4: NLP & Sentiment Feature Extraction

Natural Language Processing techniques extract linguistic and semantic features, enabling the system to understand emotional cues within the text.

- Step 5: LSTM-Based Emotion Analysis

The processed features are fed into the LSTM model, which identifies emotional patterns based on learned memory representations.

- Step 6: Emotion Prediction

The system predicts the user's emotional state (e.g., anger, sadness, joy, fear) along with a confidence percentage.

- Step 7: Risk Level Identification

Based on the detected emotion, the system categorizes the user as Stable or At Risk, providing deeper insight into their mental state.

- Step 8: Recommendation Generation

The system displays a personalized recommendation to help guide the user toward positive coping strategies.

- Step 9: User Interface Display

The prediction, confidence score, and recommendation are displayed on a clean and interactive interface for easy interpretation.

4. Results and Discussion

The proposed Mental Health Detection System was evaluated under various simulated conditions to assess its performance in emotion recognition and user interaction. The system incorporates a web-based interface, secure authentication, and a deep learning-based LSTM model for real-time emotional state detection from user-entered text.

The results indicate that the system effectively identifies emotional patterns, provides accurate predictions, and offers meaningful recommendations based on the detected emotional state. This enables a smooth user experience and enhances emotional awareness through intelligent feedback.

4.1. Initial Display

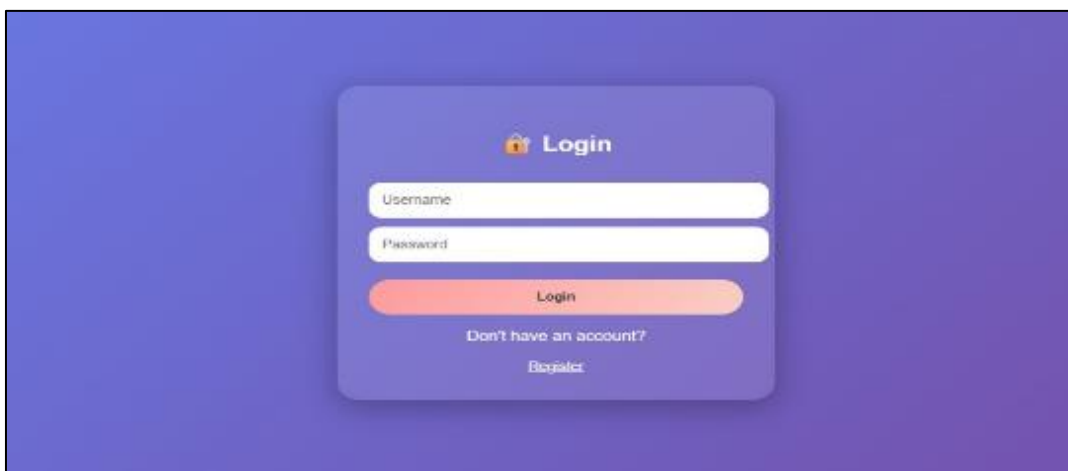


Figure 3 Login Interface

The above figure 3 displays the system login page, where users can securely authenticate using their credentials. The interface includes input fields for username and password, along with an option to register for new users. The simple and modern design ensures easy and intuitive access to the platform.

4.2. Mental Health Detection Interface

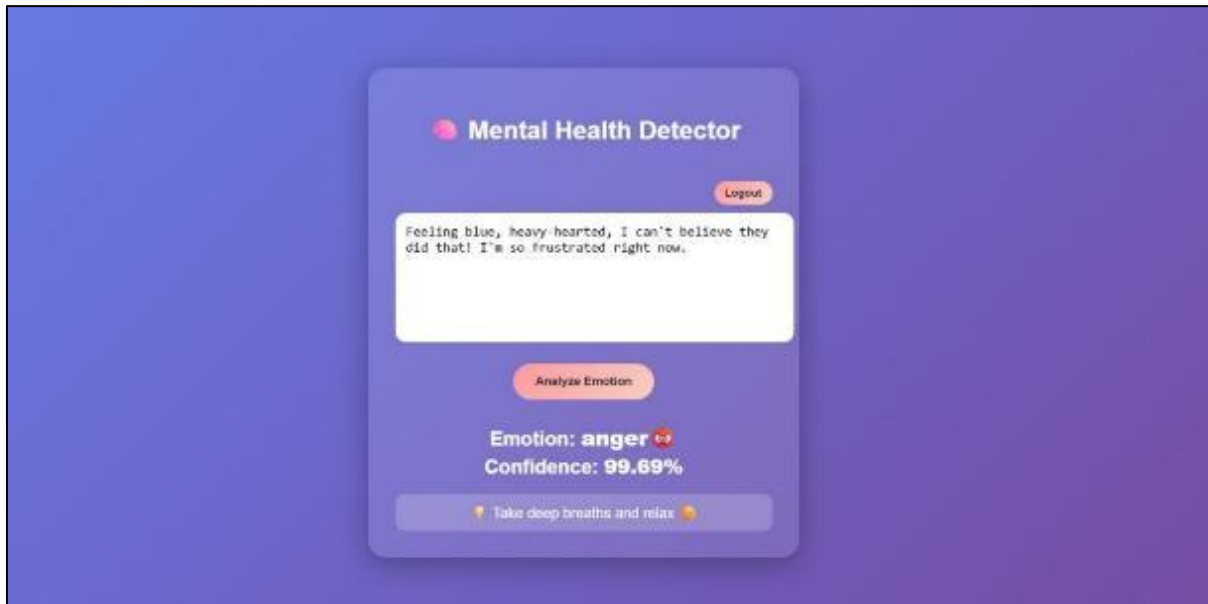


Figure 4 Mental Health Detection Output

The above figure 5 represents the main detection interface. Users can enter their thoughts or emotional expressions in the provided text area. Upon submitting the text, the system processes it using the LSTM model and displays:

Detected Emotion (e.g., anger, joy, sadness, fear, etc.)

Confidence Score generated by the deep learning model

Recommendation based on the detected emotion

This output demonstrates the system’s capability to accurately analyze emotional content and provide meaningful recommendations aimed at promoting emotional well-being.

Table 2 Functional and Performance Testing of the Proposed System

Test Case ID	Module	Test Description	Expected Output	Status
TC-001	Authentication	Valid user login	User logged in successfully	Pass
TC-002	Authentication	Invalid login attempt	Error message displayed	Pass
TC-003	Registration Module	New user registration	User account created successfully	Pass
TC-004	Text Input Module	Enter emotional text input	Text accepted and displayed in input field	Pass
TC-005	Preprocessing Module	Clean and tokenize input text	Processed text generated for model input	Pass
TC-006	ML Model (LSTM)	Predict emotion from input text	Emotion predicted accurately	Pass
TC-007	Emotion Detection	Classify emotional state	Emotion label (Anger, Sadness, Happiness, etc.) shown	Pass

TC-008	Confidence Display	Show prediction confidence score	Confidence percentage (e.g., 37.1%) displayed	Pass
TC-009	Recommendation Module	Provide suggestions based on detected emotion	Mental health suggestions displayed	Pass
TC-010	UI/Dashboard	Display analysis results	Emotion, confidence, and suggestions shown clearly	Pass
TC-011	Logout Module	User logout	User redirected to login page	Pass

From the above Table 2, all test cases passed successfully, indicating that each module of the Mental Health Detection System performs as expected. The system demonstrates stable, accurate, and reliable performance in tasks such as user authentication, text processing, emotion detection using the LSTM model, and result visualization. Overall, the system ensures efficient operation and provides consistent outputs under different conditions.

5. Conclusion

The proposed Mental Health Detection System demonstrates how Deep Learning and Natural Language Processing can be effectively applied to analyze emotional states and support mental well-being. By integrating an intuitive web interface, secure user authentication, and an LSTM-based emotion detection model, the system enables accurate identification of emotional patterns from user-entered text.

The system successfully achieves its core objectives, including

- Accurate emotion detection using Deep Learning (LSTM)
- Real-time text processing for instant emotional analysis
- User-friendly interface for seamless interaction
- Personalized recommendations based on detected emotion
- Reliable and scalable system performance

Overall, the system provides a meaningful and accessible solution for understanding emotional health, enabling users to gain insights into their mental state and receive supportive recommendations. This project highlights the potential of AI-driven tools in promoting emotional awareness and contributing to early mental health support.

6. Future Enhancement

The system can be further enhanced by adding a mobile application for improved accessibility, cloud deployment for better scalability, and support for advanced Deep Learning models to increase detection accuracy. Features such as voice-based emotion analysis, multilingual support, and real-time emotional alerts can strengthen user engagement. Additionally, personalized recommendations, progress tracking, and integration with professional mental health platforms can make the system more effective and user-friendly.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there is no conflict of interest.

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