WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Mental Health Assessment System Using Machine Learning Mindscape: Empowering Mental Health

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ABSTRACT—

This study presents an innovative, data-driven approach to enhance mental health support through a system named MindScape. It is a web-based platform that leverages Artificial Intelligence (AI) to identify stress and emotional imbalance. Specifically, it utilizes Convolutional Neural Networks (CNN) for emotion recognition via video analysis and Natural Language Processing (NLP) to enable interactive chatbot communication. Users interact with the system by submitting video inputs and responding to structured queries, allowing real-time analysis of emotional states. MindScape offers users immediate feedback, sentiment interpretation, and tailored mental health resources, making it an accessible and private solution for emotional well-being monitoring.

Keywords — Mental Well-being, Emotion Detection, AI, NLP, Chatbot, Stress Analysis, Sentiment Analysis, CNN, Flask Framework, Video Processing.

I. INTRODUCTION

Mental health has increasingly become a global concern, particularly in today's high-pressure digital world marked by social detachment and elevated stress. Conditions like anxiety, depression, and emotional exhaustion are on the rise, impacting not only individual life quality but also work efficiency and social relationships. Despite growing awareness, barriers such as social stigma, limited access to professional care, financial hurdles, and long waiting periods hinder people from receiving timely mental health support.

Common psychological concerns often go unrecognized or untreated due to these constraints. MindScape aims to address this issue by offering an AI-powered online system that evaluates users' emotional states based on facial expressions and text interactions. The goal is to deliver immediate, personalized mental health insights and suggestions to support mental wellness. MindScape provides a smart, user-friendly, and discreet environment that enables early identification and management of emotional distress. Leveraging CNN and NLP, it analyzes both visual and textual data to generate relevant support in real time.

II. MOTIVATION

Mental health issues are often overlooked or underreported despite being one of the most critical aspects of overall wellbeing. In today's fast-paced world, individuals face increasing pressure from academic, professional, and social environments. This has led to a noticeable rise in cases of anxiety, depression, burnout, and in severe cases, suicidal ideation. However, several barriers prevent people from seeking timely help:

1. Social Stigma: Many individuals avoid seeking help due to fear of judgment or embarrassment.Accessibility
2. Issues: Mental health services are not uniformly available, especially in rural or underdeveloped regions.
3. Cost and Time: Professional therapy and counseling can be expensive and time-consuming.
4. Lack of Early Detection: Often, people are unaware they are experiencing psychological distress until it escalates.

III. PROBLEM DEFINITION

Issues like anxiety, stress, and depression frequently remain undiagnosed until they become severe, mainly due to stigma, limited resources, and the high cost of care. Many people remain unaware of their emotional condition due to a lack of real-time tools that can offer early intervention. Current mental health systems often fail to provide prompt, affordable, and accessible assistance. Mindspace is designed to bridge this gap by incorporating AI techniques such as CNN for facial emotion identification and NLP for real-time chatbot-based evaluations, delivering timely insights and tailored mental health support.

IV.LITERATURE SURVEY

Author(s)	Method/Mo del Used	Application Area	Key Findings / Accuracy
Neha S. et al. [1]	Deep Learning	Emotion Recognition & Depression Detection	Explores DL models for detecting emotional states and depression from text/speech
H. Ghanadian et al. [2]	Large Language Models, Synthetic Data Generation	Suicidal Ideation Detection	Proposes socially- aware synthetic data to improve LLM-based suicide risk detection
A.Abilkaiyr kyzy A. et al. [3]	Dialogue Systems, Digital Twin Modeling	Early Mental Illness Detection	Develops a dialogue system aiming for early detection using digital twin approach
Kumar, A., & Sahu et al. [4]	Natural Language Processing	Mental Health (General Review)	Reviews NLP challenges and opportunities in mental health diagnostics
Dale, J. et al. [5]	Emotion Recognition Techniques (Various Methods)	Emotional Recognition	Provides a broad overview of emotion recognition methods and their practical applications

V. PROPOSED METHOD AND ALGORITHM

A. Proposed Methodology

The **MindScape** system combines computer vision, artificial intelligence, and natural language understanding to deliver a comprehensive mental health evaluation tool through a web interface. The solution follows a modular framework and includes the following components:

1. **User Interface & Authentication**
    - Users register and securely log in via the website.
    - The front-end is created using **HTML**, **CSS**, and **JavaScript**, while **Flask** is used as the backend.
2. **Emotion Recognition through Video Analysis**
    - Users submit recorded video clips.
    - Frames are extracted and preprocessed using **OpenCV** for further emotional analysis.
3. **Recommendation Engine**
    - Based on emotion and sentiment outcomes, the system delivers customized resources like:
        - Relaxation videos (e.g., curated YouTube content)
        - Self-care strategies and tips
4. **Model Development & Training**

- Various machine learning models are employed for different modules, such as **CNN** for emotion detection and **KNN** for classification refinement.

B. ALGORITHMS

1. CNN

Highlight extraction will be done using Convolutional Brain Organization in the proposed research paper. Instead of selecting individual highlights, CNN can extract specific elements from the image data. Created loads are separated from the various layers of CNN, for example, convolution layers, pooling layers, actuation layer and completely associated layers. The organization's most important task is the convolution layer, which extracts highlights from the preparation picture data

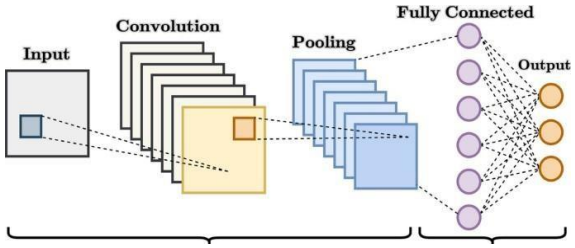


Fig1. CNN Architecture

2. NAVIS BAYES CLASSIFIER

The Naive Bayes Classifier is a simple probabilistic model based on Bayes' Theorem. It assumes that all features are independent and calculates the probability of each class given the input data. The class with the highest probability is chosen as the prediction. It is commonly used for text classification due to its speed and effectiveness.

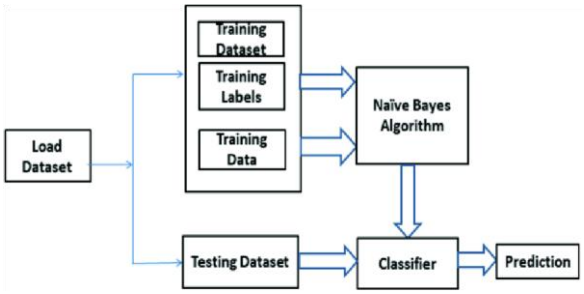


Fig 2. NBV Architecture

VI. RESULTS AND DISCUSSION

To evaluate the performance of MindScape, the following experiments were conducted:

A dataset of **600 video samples** was used for training the CNN-based emotion recognition model, while **60 unseen videos** were used for testing.

The model successfully identified dominant emotions like **sadness**, **fear**, **happiness**, and **anger** from facial features.

After training over **100 epochs**, the model achieved an **overall accuracy of 85%**.

For the chatbot sentiment analysis module:

A separate set of **200 textual responses** was analyzed using NLP techniques such as **TextBlob** and **NLTK**.

The system demonstrated a sentiment classification accuracy of **88%**, and could detect stress signals and suicidal tendencies with consistency.

Visual analysis (Figures 5–8) showed consistent model improvement:

Loss decreased steadily over epochs.

Accuracy graphs confirmed the robustness of both emotion recognition and sentiment analysis modules.

A **confusion matrix** validated the CNN model's classification reliability across emotional categories.

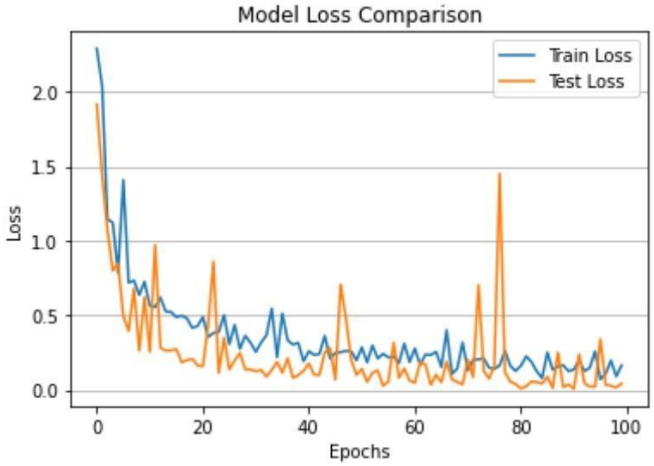


Fig 3. Loss Graph of CNN

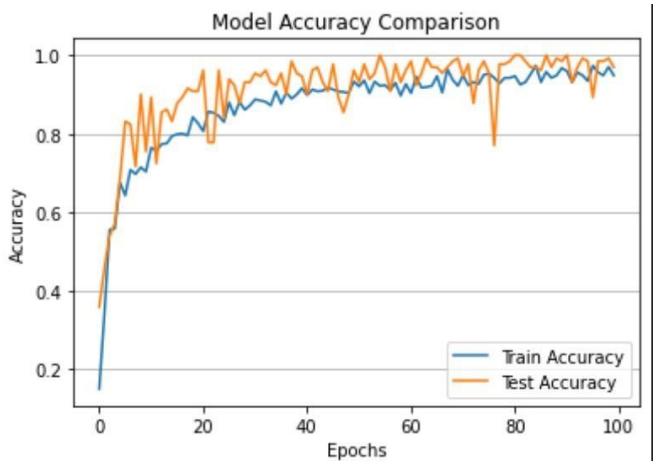


Fig 4. Accuracy Graph of CNN

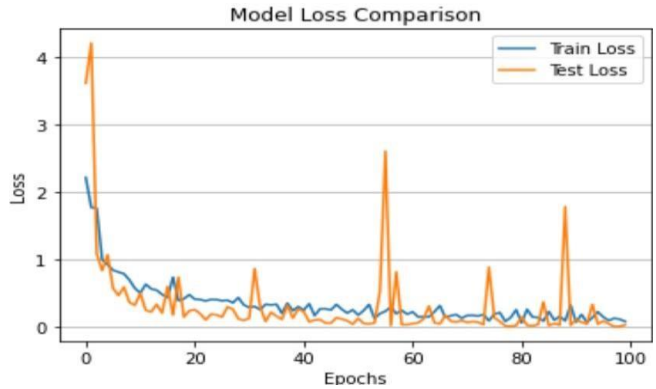


Fig 5. Loss Graph for Stress Detection

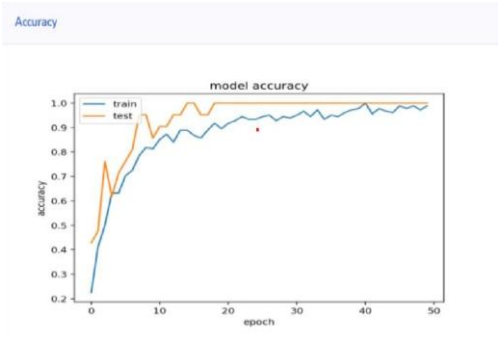
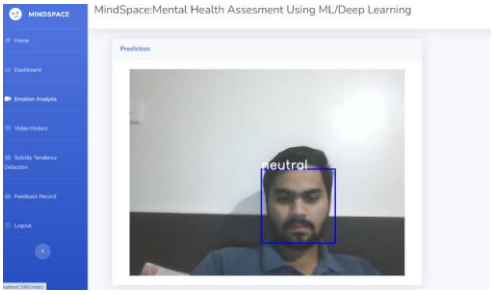
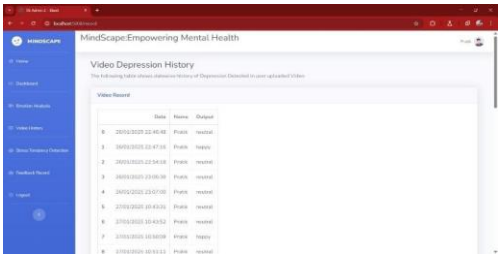


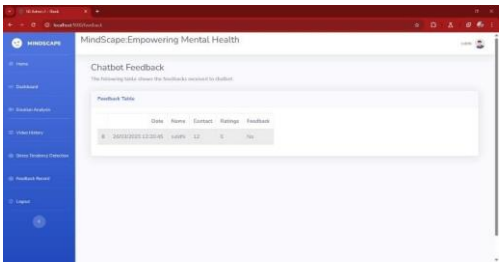
Fig6. Accuracy Graph for Stress Detection

Fig 7. Confusion Matrix

A. Results







VII.CONCLUSION

Mind Scape offers an intelligent, web-based platform that leverages **AI technologies** to support mental health care. By processing both facial cues through CNN and text inputs via NLP, the system can assess a user's emotional condition in real time and suggest relevant mental wellness resources. With proven accuracy (85% in video analysis and 88% in sentiment classification), MindScape stands out as a scalable, private, and user-friendly tool for early mental health intervention. Its success reflects the growing role of AI in democratizing access to psychological support.

VIII. REFERENCES

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