WWW.IJRPR.COM

International Journal of Research Publication and Reviews

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

An Integrated System for Depression Detection, Analysis, and Providing Personalized Support.

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A B S T R A C T

This project focuses on leveraging advanced artificial intelligence (AI) techniques for precise depression detection, analysis, and the development of a personalized support system. Employing natural language processing (NLP), machine learning (ML), and deep learning (DL), our approach aims to enhance accuracy in identifying at-risk individuals. NLP analyzes textual data for sentiment and emotion, while ML processes behavioral and physiological signals. Deep learning methods, including neural networks, extract intricate patterns for a nuanced understanding of depression.

The project also incorporates reinforcement learning to create a dynamic support system that adapts interventions based on individual responses. This personalized approach ensures tailored resources, coping mechanisms, and recommendations. Ultimately, this research aims to revolutionize mental health care by providing timely, accurate, and personalized interventions for individuals experiencing depression.

Keywords: Depression Detection, Decision Trees, LSTM layer, Sentiment Analysis, CNN, Facial Emotion

1. Introduction

Depression, a global mental health concern, demands scalable and accessible detection methods. Traditional diagnostic approaches, often hindered by accessibility issues, prompt the need for machine learning solutions. This paper introduces a novel method that combines facial expression recognition and sentiment analysis models to predict depression status.

Amidst the escalating global challenge of depression, our groundbreaking integrated system harnesses the power of advanced artificial intelligence (AI) techniques, including Naive Bayes, Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM), and others, to redefine depression detection and support. Beyond conventional methods, this system not only identifies depressive symptoms but also tailors' interventions based on individual needs. By leveraging AI for behavioral analysis, linguistic pattern recognition, and physiological data interpretation, our system aims to enhance the accuracy of early depression detection.

However, our emphasis extends beyond detection, focusing on personalized support. Through adaptive interventions, real-time feedback, and tailored psychoeducation modules, the system dynamically responds to individual nuances. This approach seeks to destigmatize mental health, empower users in their self-care journey, and ultimately improve overall well-being.

This introduction explains how Naive Bayes, CNN, and other AI approaches operate together, and it lays the groundwork for a thorough examination of the algorithms that power our system. In order to provide a brief yet revolutionary method for managing depression, a variety of algorithms are used to both diagnose the illness and lead each person on a customized road to recovery.

2. Methodology

The proposed methodology for depression detection integrates text analysis and facial expression detection within a unified system. The approach comprises three main stages: General Architecture, Sentiment Analysis, textual analysis, and Facial Expression Recognition.

2.1. General Architecture:

The overall system involves user interaction through a web application where the user provides an image and text. The provided text undergoes sentiment analysis using an LSTM-based model, while facial expressions in the user image are detected using a CNN model. The results from these models are then compared to determine the user's depression status.

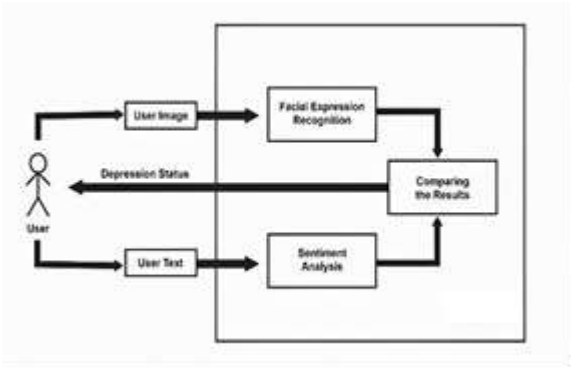

Fig. 1 – General Architecture.

2.2. Sentiment Analysis:

The sentiment analysis process comprises three stages: preprocessing, tokenizing, and prediction. In preprocessing, the user's raw text is converted to lowercase, removing non-alphanumeric characters. Tokenization follows, where the processed text is split into constituent parts. The tokens then pass through an embedding layer, converting them into real-valued vectors. These vectors are further processed by an LSTM layer, and a dense layer with SoftMax activation produces the final sentiment prediction, with 0 and 1 representing negative and positive sentiments, respectively.

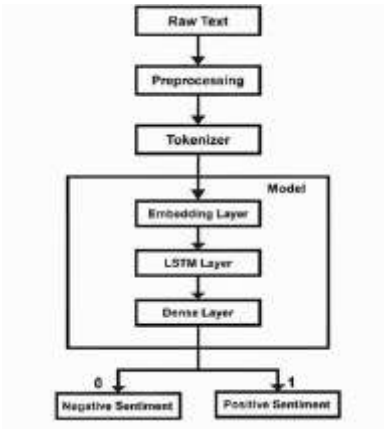

Fig. 2 – Sentimental Analysis.

2.3. Facial Expression Recognition:

Facial expression recognition employs a VGG16 has three fully connected layers and 13 convolutional layers followed by max-pooling, with dropout layers between them to prevent overfitting. The final block includes 3 fully connected layers, and the output layer is a 13- way SoftMax classifier for different facial expressions. The model's input is a 224 x 224 grayscale image, and its output is the probability distribution of 7 classes: 'angry,' 'disgust,' 'fear,' 'happy,' 'sad,' 'surprise,' and 'neutral.'

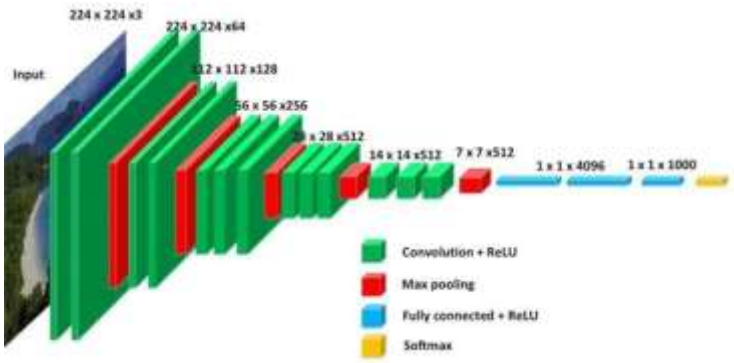

Fig. 3 – VGG-16.

2.4. Combining Models:

To predict the user's depression status, facial expression and textual analysis are performed independently on the provided image and text. Both models are trained with separate databases and optimized for better results.

3. Conclusion

In summary, this project introduces a pioneering method for depression detection by combining sentiment analysis and facial expression recognition. The system's architecture allows seamless user interaction, processing both text and image inputs to predict depression status comprehensively. The sentiment analysis model captures nuanced linguistic patterns using preprocessing, tokenizing, and LSTM layers. Simultaneously, the facial expression recognition model, with a CNN structure, accurately classifies facial expressions, adding a vital visual dimension to the analysis.

By leveraging advanced AI technologies, this integrated system showcases a nuanced, personalized, and effective approach to depression detection and support. While continuous refinement and ethical considerations are crucial, the methodology laid out in this project establishes a solid foundation for future advancements in mental health technology.

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