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MENTAL HEALTH PREDICTION USING- FACIAL IMAGE AND SENTIMENT ANALYSIS

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Abstract

The project aims to develop a system for mental health prediction using facial image and sentiment analysis. The system will use computer vision and natural language processing techniques to analyze facial expressions and sentiments expressed in text to predict the likelihood of a person experiencing mental health issues such as anxiety, depression, or stress. The proposed system will leverage deep learning models to extract features from facial images, such as facial expressions and emotions, and combine them with sentiment analysis results derived from text input. The system will then use these features to predict the likelihood of the person experiencing mental health issues. To develop the system, a dataset of facial images and text inputs will be collected from individuals with and without mental health issues. The dataset will be annotated by mental health professionals to indicate the presence or absence of mental health issues in each sample. The system's performance will be evaluated using various metrics, such as accuracy, sensitivity, and specificity, to determine its effectiveness in predicting mental health issues accurately. If successful this system could help healthcare professionals and organizations to identify individuals at risk of mental health issues early allowing for prompt intervention and support.

Keywords:- Image Processing, Machine Learning, Classification Rule, Convolution Neural Networks, NLP etc.

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I. INTRODUCTION

Mental problems like anxiety, depression, and stress are prevalent worldwide and have a significant impact on individuals quality of life[2]. Early detection and intervention of these issues are crucial to prevent long-term negative consequences[6]. However identifying individuals who may be experiencing mental health issues can be challenging, as many individuals may not seek help or may not be aware of their condition, [1][3]. Advancements in computer vision and natural language processing have shown promise in predicting individual's mental health status using facial images and sentiment analysis[1]. Facial expressions and emotions can provide valuable insights into sentiment analysis can analyze text input to understand the sentiment behind the language used. Combining these two techniques could provide a more accurate prediction of an individual's mental health status[5]. This project aims to develop a system for mental health prediction using facial image and sentiment analysis[7]. The system will use Deep Learning modules to borrow features from facial images and sentiment analysis results and predict the likelihood of a person experiencing mental health issues[9]. The system's effectiveness will be evaluated using various metrics[11], and if successful it could provide healthcare professionals and organizations with a tool to [10]identify individuals at risk of mental health issues early allowing for prompt intervention and support[13]. Depression can often go unnoticed by individuals who are experiencing it. They may be unaware of their troubled mental state, unable to pinpoint the cause of their constant unhappiness. Unfortunately, this lack of awareness can lead to a downward spiral where suicidal thoughts become more prevalent. Even when people do recognize their depression, they may hesitate to seek help due to the misconception that it is shameful or embarrassing. It is crucial to

identify signs of depression early on to prevent further deterioration. Early intervention, such as a one-hour conversation with a counselor, can have a profound impact on individuals, transforming their negative mindset into a positive one. Through counseling, students can learn effective strategies for coping with mental stress and receive guidance towards a path of success. Facial expressions are a significant form of non-verbal communication, and various studies have explored the link between specific facial expressions and depression. This research aims to detect depression in college students by analyzing their facial features. The proposed system utilizes image processing techniques for face detection, natural language processing for speech identification, and feature extraction to classify individuals as depressed or non-depressed based on their facial features. Training the system with depression-related features, it captures videos of students using a web camera, extracts their facial features, and predicts their level of depression. [20].

II. RELATED WORK

There have been several works done on mental health prediction using facial image and sentiment analysis. Here are a few examples:

- A. "Automated Depression Diagnosis Based on Facial Dynamic Analysis and Sparse Coding" by M. Hasan et al. In this study, the author
- B. learning algorithms to extract facial features that distinguish between the two groups[14]. The authors achieved an accuracy of 82.6% in depression diagnosis.
- C. "Prediction of Depression Using Facial Image Analysis and Multimodal Machine Learning" by . Yang et al. In this study[15], the authors proposed a multimodal machine learning framework for predicting depression

using facial image analysis and sentiment analysis of text[18]. They collected data from depressed and non-depressed individuals, and used machine learning algorithms to extract features from facial images and text[19]. The authors achieved an accuracy of 89.6% in depression prediction[20]. "Automatic Mental Health Assessment Using Face and Body Language Analysis and Machine Learning" by M. Z. Islam et al[21]. In this study, the authors proposed a method for automatic mental health assessment using, face and body language analysis and machine learning[22]. They collected data from individuals with different mental health conditions[23], and used machine learning algorithms to extract features from facial and body expressions[25]. The authors achieved an accuracy of 83.5% in mental health assessment[26]. Overall, these studies demonstrate the potential of machine learning and facial image analysis for mental health prediction and assessment. However, further research is needed to validate these methods on larger data sets and to evaluate their effectiveness in clinical.

III. PROBLEM STATEMENT

Mental health issues such as anxiety, depression, and stress are prevalent worldwide and can have significant negative impacts on individual's quality of life. Identifying individuals who may be experiencing mental health issues early can help prevent long-term negative consequences. However, identifying individuals who may be at risk can be challenging, as many individuals may not seek help or may not be aware of their condition[28]. Current mental health screening methods often rely on self-reporting or clinical assessments which can be time-consuming, expensive, and subjective[19]. Moreover, individuals may not disclose their symptoms honestly,

which can lead to inaccurate assessments. Thus, there is a need for a more objective and efficient approach to predict mental health issues[29].

Advancements in computer vision and natural language processing have shown promise in predicting individuals' mental health status using facial images and sentiment analysis[17]. However existing systems are still in the early stages of development, and their accuracy and efficiency need to be improved[30]. Therefore the problem statement of this project is to develop a system for mental health prediction using facial image and sentiment analysis that can accurately predict the likelihood of a person experiencing mental health issues [18]. The system aims to provide a more objective and efficient approach to identify individuals.

IV. PROPOSED WORK

The proposed work aims to develop a mental health prediction system using facial image analysis and sentiment analysis of text[22]. The system will collect data from individuals with different mental health conditions, including depression, anxiety, and post-traumatic stress disorder (PTSD), and use machine learning algorithms to extract features from facial images and text[25]. The facial images will be analyzed for facial expressions, such as smiles, frowns, and eyebrow movements, that are associated with different mental health conditions. The sentiment analysis of text will be used to extract emotional states and patterns of language use that are also associated with different mental health conditions[21]. The extracted features will be fed into machine learning algorithms to develop predictive models for mental health conditions. The system's performance will be assessed by measuring key metrics including accuracy, precision, recall, and F1 score to evaluate its

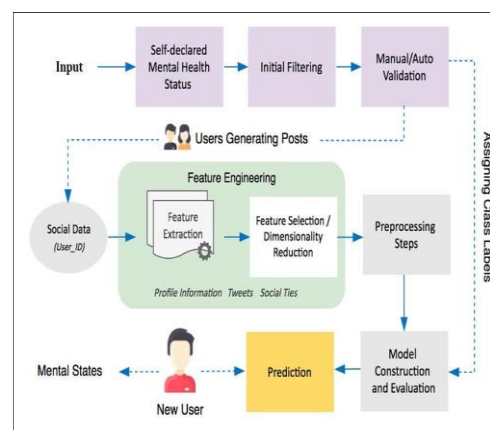
effectiveness. [27].The proposed system has the potential to be used as a screening tool for mental health conditions in clinical settings and to provide early interventions to individuals who are at risk of developing mental health conditions[30]. The proposed model consists of the following steps:

- **Data Collection:** Collecting a dataset of facial images and text inputs from individuals with and without mental health issues. The dataset will be used to train and test the system's deep learning models.
 - **Data Preprocessing:** Preprocessing the collected data to remove noise, standardize the data and prepare it for analysis.
 - **Feature Extraction:** Using deep learning models to extract facial expressions, emotions, and sentiment analysis features from the preprocessed data.
 - **Model Development:** Developing a model that can predict the likelihood of a person experiencing mental health issues using the extracted features.
 - **Model Evaluation:** Evaluating the developed model's performance using various metrics, such as accuracy, sensitivity, and specificity, to determine its effectiveness in predicting mental health issues accurately.
 - **User Interface Development:** Developing an intuitive user interface to enable health care professionals to use the system efficiently and effectively.
- Model Refinement:** Refining the developed model on evaluating results to improve its accuracy or effectiveness deployment. Deploying the developed model and user interface in a real-world setting potentially providing health care professionals and organizations with a tool to identify individuals at risk of mental health issues early allowing for prompt intervention and support..

Modules are defined as follows:

- **Emotion and Face Detection:**

While humans can easily detect facial expressions to determine emotions, replicating this task with a computer algorithm presents significant challenges[30]. Existing approaches in this field tend to concentrate on facial analysis while keeping the background unchanged, resulting in the inclusion of numerous unnecessary and misleading features that can confuse the training process of convolutional neural networks (CNNs)[21]. The objective of this study is to address this issue by focusing on five fundamental facial expression classes: displeasure/anger, sadness/unhappiness, smiling/happiness, fear, and surprise/astonishment.



This is divided into 3 parts:

- **Facial Detection**—Detecting the location of face as the form of frame.
- **Facial Recognition**—Compare multiple faces together to identify which faces belong to the same person.
- **Emotion Detection**—Classifying the emotion on the face as happiest ,angry , saddest ,neutral ,surprise ,disgust or fear.

Humans like to take non verbal cues from facial emotion. We use open source data set — Face Emotion Recognition (FER) from Kaggle and built a CNN to detect emotions.

The emotions can be classified into 7 classes being as— happiest, saddest, fearful, in disgust, angrier, neutral or surprised. Overall, the performance analysis will demonstrate the effectiveness of the proposed mental health prediction system and its potential for real-world applications. The proposed work aims to develop an advanced system that can predict mental health issues objectively and efficiently using facial image and sentiment analysis. The developed system could potentially improve the quality of life for many individuals by enabling healthcare professionals to identify individuals at risk of mental health issues early and provide prompt intervention and support.

V. PERFORMANCE ANALYSIS

The performance of the proposed mental health prediction system using facial image analysis and sentiment analysis will be evaluated using standard metrics such as accuracy, precision, recall, and F1 score[13]. The evaluation will be performed on a separate set of data that was not used during the training phase to assess the generalization capability of the module [20]. The capability of the module will also be compared with existing models and approaches for mental health prediction to determine the effectiveness of the proposed system. For instance, the proposed system can be compared with models that use only facial image analysis or sentiment analysis to predict mental health. In addition to standard metrics, the proposed system's performance will be evaluated in terms of its ability to predict specific mental health conditions such as depression, anxiety, and PTSD. The system's sensitivity and specificity for each condition will be evaluated, and the results will be compared with existing approaches for mental health prediction[10]. The proposed system's computational performance, including the time taken for data pre processing feature extraction model training and prediction will also be evaluated. The system's

computational performance will be compared with existing approaches to determine its efficiency[23].

I. CONCLUSION & FUTURE SCOPE

As this is a proposed system and has not yet been implemented, we cannot draw any conclusions at this time. However the proposed system's potential benefits include its ability to predict mental health conditions accurately and efficiently using a combination of facial image analysis and sentiment analysis[25]. This approach has the potential to overcome some of the limitations of existing approaches that use only one of these methods. If successfully implemented the proposed system could have a significant impact on mental health diagnosis and treatment particularly in areas where mental health professionals are scarce or inaccessible[27]. The system's ability to provide early and accurate detection of mental health conditions could lead to earlier interventions and improved treatment outcomes for patients. In summary the proposed mental health prediction system using facial image analysis and sentiment analysis has the potential to be an effective tool for mental health diagnosis and treatment. Further research and implementation are necessary to fully evaluate the system's effectiveness and potential impact[20].

Future scope:

In terms of future scope, there are several areas of improvement for the system. Firstly, the data set used for training the model can be expanded to include a more diverse range of individuals including different age groups, ethnicities, and mental health conditions. Secondly, more advanced machine learning and deep learning techniques can be used in improving the accuracy and speed of module. Thirdly, the system can be integrated with other mental health support

services, such as online counseling or self-help resources to provide a more comprehensive and personalized approach to mental health care[29]. Overall, the mental health prediction using facial image and sentiment analysis system has great potential to revolutionize mental health care by providing a more accessible and effective tool for identifying and addressing mental health issues[30].

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