

Tracking and Detecting Depression Level using Facial Recognition and PEN & IQ Test

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Abstract: This study presents a novel approach to monitoring and tracking depression levels using facial recognition technology, the Perceived Emotional Neglect (PEN) test, and an IQ test. The hypothesis driving this research is that there exist specific changes in facial expressions associated with depression, as well as an overall decline in cognitive function, which can be quantified using these tests. The proposed methodology consists of two phases: the first phase analyzes depression-related changes in facial expressions, while the second phase employs the PEN and IQ tests to determine the severity of depression. The main objective of this research is to develop a technique for tracking and detecting depression levels, which could potentially facilitate early diagnosis and treatment of depression.

Keywords: Facial Recognition, Mental Health, Classification, Algorithms, Artificial Intelligence, CNN.

I. INTRODUCTION

Depression is a prevalent and debilitating mental health disorder that can significantly affect an individual's well-being, relationships, and overall quality of life. It is crucial to identify and address depression early on to provide appropriate interventions and support. As technology continues to advance, there is a growing interest in leveraging its potential to aid in the diagnosis and treatment of mental health conditions, including depression.

One innovative approach being explored is the use of facial recognition technology, along with the Perceived Emotional Neglect (PEN) test and IQ testing, to monitor and track depression levels. Facial recognition technology has gained significant attention in recent years due to its ability to analyze facial expressions and emotions accurately. By employing this technology, researchers aim to detect specific changes in facial expressions that may be indicative of depression.

The first phase of this proposed methodology involves analyzing depression-related changes in facial expressions. Facial recognition software can be utilized to detect subtle cues and markers that may be associated with depression, such as decreased expressiveness, frowning, or other negative facial expressions. By capturing and analyzing these facial features, researchers can develop algorithms or models to quantify and track changes in facial expressions over time. In the second phase, the PEN test and IQ test are administered to assess the individual's mood and cognitive functioning, respectively. The PEN test evaluates the perceived emotional neglect experienced understanding, and responsiveness. This test helps provide additional insights into the emotional aspects of depression.

Simultaneously, the IQ test measures various cognitive abilities, including memory, attention, problem-solving, and reasoning. The objective is to identify any decline in cognitive function that may be associated with depression. Combining the results of these tests with the facial expression analysis can provide a more comprehensive understanding of an individual's depression levels. The ultimate goal of this proposed approach is to develop a reliable and objective technique for monitoring and detecting depression levels. Early diagnosis is critical for timely intervention and effective treatment. By leveraging facial recognition technology, PEN testing, and IQ testing, this approach aims to provide a more accurate and comprehensive assessment of depression. It can potentially facilitate early detection, allowing healthcare professionals to intervene promptly and provide appropriate support to individuals experiencing depression.

It is important to note that this approach is still in the research and development stage. Further studies are needed to validate its effectiveness and reliability. Additionally, ethical considerations, such as privacy and data security, must be carefully addressed when implementing facial recognition technology in mental health assessments.

II. LITERATURE SURVEY

Depression is a common mental health problem in our society. [1] Many people suffer from it and we need ways to detect it early. To do that, we need data about depression. This paper summarizes ten different datasets that researchers can use to study depression. It includes information about how the data was collected, what it measures, and how it was labeled. There is also a table that makes it easy to compare the different datasets.

Depression is a serious mental health condition that can affect daily life.[2] Researchers have been using machine learning models to detect emotions in audio, visual, and text data. They are now working on a model that uses images and videos to determine the level of depression in individuals. The model will classify people into categories based on their level of depression: Minimal, Mild, Moderate, or Severe. The two important parts of this model are the video input and the Beck Depression Inventory II, a questionnaire used to diagnose depression. By analyzing these components and comparing them to emotion and inventory vectors, the model will produce visual graphics to represent the individual's level of depression.

Mental health is a very important issue, especially for people who work.[3] The busy lifestyle and workload can lead to mental health problems like mood disorders and anxiety disorders. This means that working professionals are more at risk of developing mental health problems. Companies provide mental health care benefits to their employees, but that is not always enough. In this research paper, we looked at data from a mental health survey in 2019 that included information from working professionals in both tech and non-tech industries. We analyzed the data to find out which personal or professional factors can affect an employee's mental health or predict the likelihood of them developing mental health problems. We used machine learning algorithms to build models that can accurately predict an employee's mental health based on the identified features. We measured the performance of these models using precision and recall. Overall, the goal of this research is to better understand how working conditions affect mental health and to develop tools that can help companies support their employees' mental health.

Facial expressions are an easy way to show how someone is feeling.[4] The Facial Expression Recognition system has many uses, such as understanding human behavior, detecting mental health problems, and creating synthetic human expressions. This research paper is a quick study of facial expression recognition and compares different methods of recognizing facial expressions using two datasets: JAFFE and CK. The paper focuses on appearance-based techniques, which means analyzing the visual appearance of facial features. Recently, a feature extraction technique called HOG has become popular for facial expression recognition. The paper found that using HOG feature gives good recognition rates in facial expression recognition. Combining LBP with LGC and combining HOG with other features like LDP and wavelets also improved recognition rates. Overall, this research aims to find the best ways to recognize facial expressions, which can be useful in many areas of study.

The popularity of social networking sites has grown rapidly, [5] but it has also led to problematic usage. Psychological disorders like cyber relationship addiction, information overload, and net compulsions are becoming more common. These disorders can be hard to detect early because they are passive, which means it takes a long time for clinical intervention. However, researchers argue that online behavior can be used to actively recognize these disorders. The challenge is that mental states cannot be observed directly from online activities. So, the researchers propose a framework that uses machine learning to identify possible cases of social network psychological disorders by extracting features from social network data. They tested their system with users in online social networks and improved accuracy by using a random forest classification model. The research analyzed large datasets and identified characteristics of three types of mental disorders. These results can help identify users of social networks who may have possible mental disorders.

This paper describes a computer system that can recognize facial expressions in pictures and videos.[6] It uses a technique called Histogram of Oriented Gradients (HOG) and Support Vector Machine (SVM) to analyze the face and its parts, and identify distinctive features. The system was tested on two well-known databases of facial expressions, and it achieved accuracy rates of 97.62% and 98.61%.

This study [7] aimed to investigate whether seeing faces covered by a Hijab evokes any special neural activity in people from the same cultural tradition. Nine volunteers were shown pictures of faces with and without a Hijab, as well as neutral pictures, and their brain activity was measured using EEG. The results suggest that there was no special neural response to Hijab-covered faces in the volunteers. However, the volunteers paid more attention to faces than to Hijab-covered faces, as indicated by differences in brain activity in certain areas of the brain.

Technological advancements have changed how people communicate, with social networks like Twitter, Facebook, Telegram, and Instagram becoming popular platforms for sharing thoughts and emotions. Researchers use these platforms to detect depression-related behavior and activity, analyzing text to extract important information. [8] Social networks provide valuable data on the onset of depression, such as low sociability, self-focused behavior, and high activity rates during both day and night. In this study, researchers used five machine learning classifiers to detect depression in tweets, and found that the LSTM classification model outperformed other baseline models for both balanced and imbalanced data sets.

III. MATERIALS AND METHODS:

1. Participants:

- A diverse group of participants, including individuals with and without depression, should be recruited for the study.
- Informed consent should be obtained from all participants, ensuring their understanding of the study's purpose, procedures, and data usage.

2. Facial Recognition Software:

- Utilize a facial recognition software or algorithm capable of accurately capturing and analyzing facial expressions.
- Consider using state-of-the-art facial recognition models trained on large datasets to enhance accuracy.

3. Data Collection:

- Capture high-quality images or videos of participants' faces under standardized conditions, ensuring consistent lighting, background, and camera settings.
- Collect a sufficient number of facial samples from each participant to enable robust analysis and validation.

4. Facial Expression Analysis:

- Develop an algorithm or model to detect and analyze facial expressions associated with depression.
- Train the model using labeled data, with depression levels indicated by self-report questionnaires or clinical assessments.
- Identify relevant facial features and expressions linked to depression, such as decreased smiling, increased frowning, or other nonverbal cues.
- Apply the trained model to the collected facial samples to detect and quantify depression-related facial expression changes.

5. Perceived Emotional Neglect (PEN) Test:

- Administer the PEN test to participants to assess their emotional awareness, understanding, and responsiveness.
- The PEN test typically involves self-report questionnaires or scales designed to measure perceived emotional neglect experienced by individuals.
- Use established PEN test protocols and scoring methods to evaluate emotional aspects related to depression.

6. IQ Test:

- Administer an IQ test to participants to evaluate their cognitive functioning.
- Select a standardized and validated IQ test that covers multiple cognitive domains, such as memory, attention, problem-solving, and reasoning.

- Follow the established procedures for administering and scoring the IQ test to obtain reliable and comparable results.

7. Data Analysis:

- Correlate the results obtained from facial expression analysis, PEN test, and IQ test to identify potential relationships and patterns.
- Statistical analysis, such as correlation coefficients or machine learning algorithms, can be employed to assess the strength and significance of these relationships.
- Explore the feasibility of combining the results from different measures to create a comprehensive depression detection model.

8. Ethical Considerations:

- Adhere to ethical guidelines and regulations regarding data privacy, informed consent, and participant confidentiality.
- Protect participants' identity and personal information during data collection, analysis, and storage.
- Ensure the anonymity and security of collected data, considering encryption, access controls, and secure storage practices.

9. Validation and Replication:

- Conduct validation studies with larger and diverse participant samples to establish the reliability and generalizability of the proposed methodology.
- Replicate the study with different populations and cultural contexts to assess the cross-cultural validity of the approach.

10. Limitations:

- Acknowledge potential limitations of facial recognition technology, such as variations in accuracy based on factors like lighting conditions, pose, or ethnic diversity.
- Consider the subjective nature of self-report assessments like the PEN test and potential biases in IQ testing.
- Address potential confounding factors, such as co morbidities or medication, that may influence facial expressions, emotional neglect perception, or cognitive functioning.

IV. PROPOSED SYSTEM

Mental illness has a profound impact on peoples functioning, health and quality of life. detecting early warnings of depression or any other mental illness is challenging. The proposed system provides a hybrid architecture of facial based emotion and PEN and IQ tests. combination of above technologies providing promising results for depression, mental state and self-control.

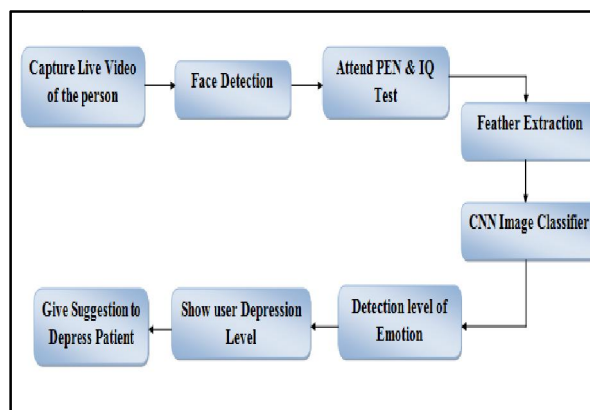


Figure 1: Proposed System Diagram
DOI: 10.48175/568

In our system the emotions are continuously monitored based on which the information for classification of mental illness of the person is obtained. using the information obtained, it conducts psychology test to diagnose the severity of the mental condition. the output of the combination of these two parameters are classified to determine the probabilities of identifying the mental state and depression level. and provide recommendation such as "Lacks of concentration", "Need to be focused", "Need some entertainment".

V. OBJECTIVE OF SYSTEM

The objective is to identify any decline in cognitive function that may be associated with depression. Combining the results of these tests with the facial expression analysis can provide a more comprehensive understanding of an individual's depression levels. The ultimate goal of this proposed approach is to develop system with hybrid architecture of facial expression recognition and psychometric tests with a reliable and objective technique for monitoring and detecting depression levels. Early diagnosis is critical for timely intervention and effective treatment. By leveraging facial recognition technology, PEN testing, and IQ testing, this approach aims to provide a more accurate and comprehensive assessment of depression. It can potentially facilitate early detection, allowing healthcare professionals to intervene promptly and provide appropriate support to individuals experiencing depression.

ADVANTAGES

- System can easy to used.
- Used application from anywhere

SYSTEM REQUIREMENTS

- **Software Used:**
 1. Software - Visual studio, jupyter notebook
 2. Technologies - python, deep learning, OpenCV, flask
 3. Database - SQLite
 4. Datasets - FER-2013
- **Hardware Used:**
 1. Processor - i3 or above
 2. Hard Disk - 150 GB
 3. Memory - 8 GB RAM

VI. ALGORITHMS

The Convolution Neural Network (CNN) based approach provides a better way that is less sensitive to Depression detection using image processing. However, the CNN approach is complex and can increase computational time, which at the end reduce its effectiveness on a system where the speed is essential. In this study we propose a CNN network which is fast, and insensitive to detect the depression. It is tested on different dataset such as FRE-2013 and performs in relatively comparable performance. Our evaluation shows that the proposed shallow CNN network performs at 93.9% accuracy and reaches much faster speed than its competitors.

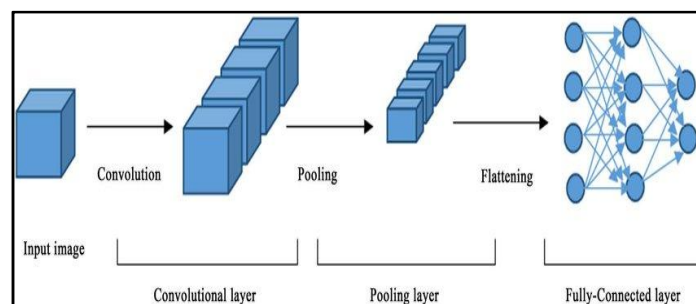


Fig: CNN architecture for image dataset

VII. RESULTS AND COMPARATIVE STUDY

Implementing a real-time depression detection system requires a combination of hardware and software components. In this section, we will outline the steps involved in creating a working depression detection system, including data collection, model training, and real-time inference.

Data Collection: The first step is to collect data on human face images dataset. This can be done using a variety of sensors, such as cameras, emotion sensors. The goal of data collection is to obtain a large and diverse set of training data that accurately represents the range of depression.

Model Training: Once we have collected a large and diverse set of training data, we can use this data to train a machine learning model. We have use haarcascade model for face recognition and used CNN for face emotion recognition and classification it extracts features from the images provided through video and give use the depression detection result.

Once we have trained our model, we can use it for real-time Depression detection. To implement real-time inference, we would need to use a computer vision library, such as OpenCV, to process the video footage captured by the cameras. We would then use the trained model to classify each frame of video and provide result to the user.

VIII. OUTCOMES

This system will provide the best test for the user. It will helpful to the user to identify their depression. The system also provides counselling section with the doctor to overcome their problems. It is real time system even can use at any place.

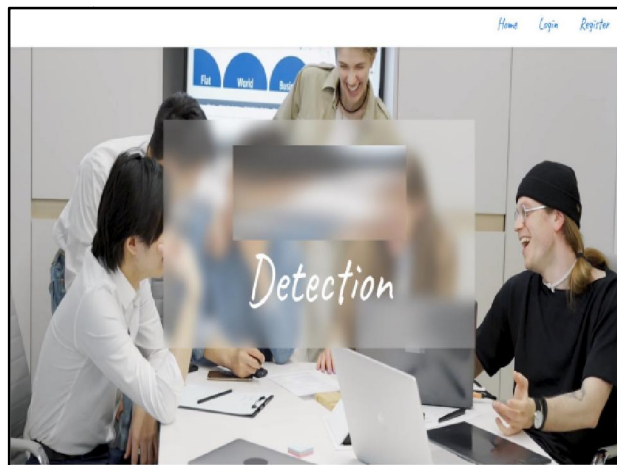


Fig: Home Page of System

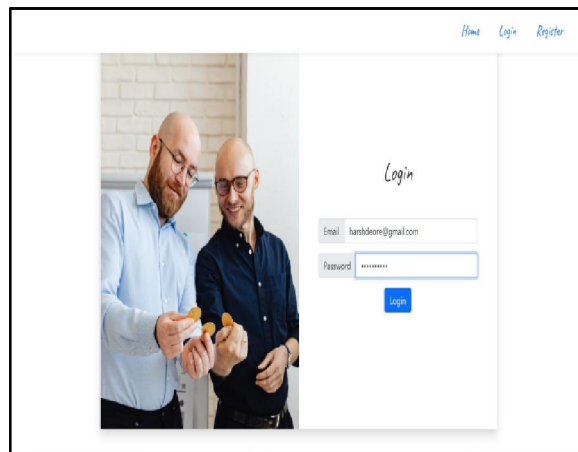


Fig: Login Page of System

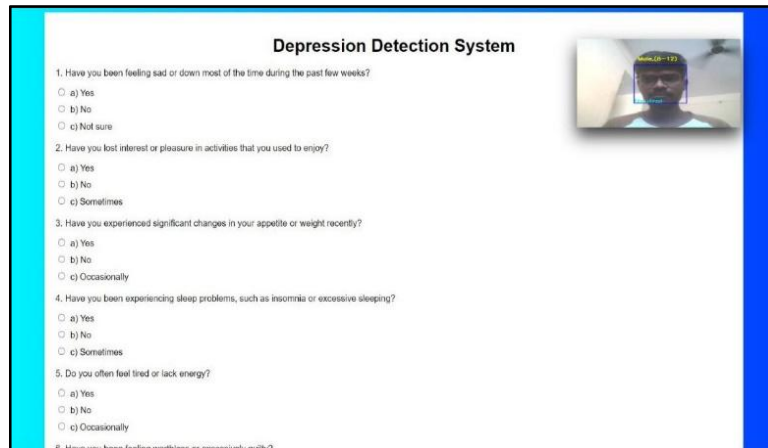


Fig: Face Detection & PEN, IQ Test Page of System

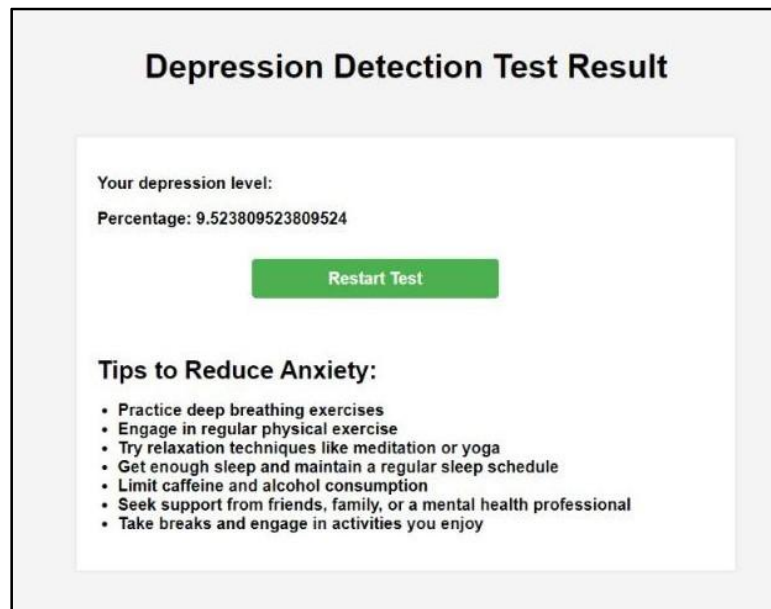


Fig: Result Page of System

IX. CONCLUSION

In conclusion, tracking and detecting depression levels using facial recognition, PEN, and IQ tests can be a valuable tool for early detection and intervention for individuals at risk of developing or already suffering from depression. The proposed system utilizes facial recognition technology to detect changes in facial expressions and mood, as well as PEN and IQ tests to analyze cognitive function. By integrating these technologies, the proposed system can provide a comprehensive assessment of an individual's mental state, allowing for early detection. , this project has the potential to provide a cost-effective and efficient method for detecting and monitoring depression levels in individuals. This can lead to timely intervention and treatment, improving the quality of life of individuals suffering from depression

X. FUTURE WORK

In future We will evaluate the efficiency of our proposed method using a set of various psycholinguistic features. We show that our proposed method can significantly improve the accuracy and classification error rate. In addition, the result shows that in different experiments Decision Tree (DT) gives the highest accuracy than other ML approaches to find the depression.

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