DepDepression

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*Abstract*— **Our website offers a revolutionary approach to depression detection, utilizing advanced technology to analyze facial expressions without the need for intrusive bands or devices. By extracting key features such as eyebrow movements, lip patterns, and nasal expressions, our cutting-edge algorithm, based on Convolutional Neural Networks (CNN) specifically the Renonetv52 model, can accurately identify potential signs of depression. Users can seamlessly access our platform to undergo depression screening tests directly from their devices. Upon detection of depressive symptoms, our platform facilitates direct connection with a network of certified medical professionals. Once a doctor confirms the diagnosis, patients undergo continuous evaluation through our system, which generates comprehensive reports detailing the severity of depression and recommended treatment options. Our website is designed to prioritize user privacy and confidentiality. Patient data is securely stored and accessible only to authorized medical personnel. Furthermore, our platform ensures seamless communication between patients and doctors, enabling ongoing consultation and support throughout the treatment process. Powered by Python Django for the backend and HTML for the frontend, our website offers a user-friendly interface accessible to individuals of all technical backgrounds. Patients can conveniently track their treatment progress and access their medical history at any time, facilitating informed decision- making and continuity of care. With our innovative approach to depression detection and treatment, we aim to provide individuals with timely support and intervention, ultimately improving mental health outcomes and enhancing overall well- being. Join us in revolutionizing the way depression is diagnosed and managed, paving the way for a brighter and healthier future for all.**

***Keywords— Depression Recognition, Face Recognition***

1. INTRODUCTION TO THE DOMAIN

Depression, a prevalent mental health disorder, often manifests as persistent sadness, loss of interest, and

various other symptoms affecting daily life. Early detection is vital for effective treatment and improved outcomes. Our website pioneers a novel approach to depression detection, utilizing advanced technology to analyze facial expressions and features. Through machine learning and computer vision, we extract and interpret facial cues from images and videos. By offering a non- invasive and accessible solution, we aim to revolutionize depression diagnosis, facilitating timely intervention and support for individuals navigating the complexities of mental health. Join us in our mission to transform mental health care and promote well-being for all. Common mental health disorders such as depression are characterized by persistent feelings of sadness, loss of interest in previously enjoyed activities, and a range of other symptoms that significantly impact daily functioning. Recognizing the signs and symptoms of depression is crucial for early detection and intervention, which can lead to more effective treatment and improved outcomes for individuals affected by this condition. One promising avenue for early detection and understanding of depression is through the analysis of facial expressions and features. Research indicates that individuals experiencing depression often exhibit distinct patterns of facial expressions, which can provide valuable insights into their mental health status. Leveraging advancements in machine learning and computer vision technology, our approach focuses on extracting and analyzing facial features from images and videos to identify potential indicators of depression. By harnessing the power of artificial intelligence, we aim to develop innovative tools and algorithms that can accurately detect and assess depressive symptoms based on facial cues. This groundbreaking approach has the potential to revolutionize how mental

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health disorders are diagnosed and treated, offering a non- invasive and accessible solution for individuals seeking support for their mental well-being. Join us in exploring the intersection of technology and mental health to pave the way for a brighter future with improved mental health outcomes for all**.**

1. DEFINITIONS
2. **Depression Recognition:** The process of identifying or diagnosing depression in individuals based on various indicators, which may include behavioral, physiological, or visual cues.
3. **Face Recognition:** The technology or process of identifying and verifying a person's identity based on facial features, often employed in security systems, computer vision applications, or authentication processes.
4. RELEVENCE OF THE TOPIC

The topic of depression recognition from facial images holds significant relevance due to its potential to revolutionize mental health diagnostics and interventions. Facial expressions are powerful indicators of emotional states, and emerging technologies, particularly machine learning and computer vision, enable the extraction of subtle cues that may be indicative of depression. This approach offers a non- intrusive and accessible means of identifying individuals at risk of or currently experiencing depression. As mental health concerns continue to rise globally, an automated system that can analyze facial expressions for signs of depression could facilitate early detection and intervention. Early identification is crucial for effective treatment and prevention of the worsening of mental health conditions. Moreover, facial recognition for depression has the potential to address challenges associated with traditional diagnostic methods, such as the stigma often associated with mental health discussions. Automated systems can provide a more objective and consistent assessment, reducing the impact of subjective biases. Additionally, the visual interpretability aspect, as mentioned in the paper, contributes to the transparency of the diagnostic process. Understanding how the model arrives at its conclusions enhances the trustworthiness of the system, which is crucial for widespread acceptance and adoption in clinical and public health settings.In summary, depression recognition from facial images is a promising avenue that aligns with the growing emphasis on mental health awareness, early intervention, and the integration of technology to improve diagnostic precision and accessibility.

1. RELATED WORKS

## Visually Interpretable Representation Learning for Depression Recognition from Facial Images

Depression is a serious mental health condition that affects millions of people worldwide. It can cause a variety of symptoms, including sadness, hopelessness, loss of interest in activities, and changes in sleep and appetite. Depression

can have a significant impact on a person's life, making it difficult to work, study, and maintain relationships. In our proposed system, DepressNet is the CNN used for the facial recognition model that has been shown to be effective in recognizing depression from facial images with high accuracy. DepressNet could be used to develop new tools for early detection and intervention of depression. DepressNet could be used to develop a screening tool that could be used to identify individuals at risk of depression. Here video or image is given as the input, face detection and cropping can be done for the further evaluation. The cropped images are then pooled into the DepressNet and evaluated using various equations. These values are then summed up and considered as the DAM (Depression Activation Map). DAM shows the severity in depression. DepressNet could also be used to develop a monitoring tool that could be used to track the severity of depression over time. In addition to its potential for early detection and intervention, DepressNet could also be used to improve our understanding of depression. This information could be used to develop new treatments that target specific facial features. Overall, DepressNet is a promising new tool for the diagnosis and treatment of depression. Further research is needed to validate the model and to develop tools that can be used in clinical practice. However, the potential of DepressNet to improve the lives of people with depression is significant.

## Depression prognosis using natural language processing and machine learning from social media status.

Depression is a major public health concern worldwide, and early diagnosis and treatment are crucial for effective management. In recent years, social media has emerged as a potential source of data for depression diagnosis. This paper presents a study on depression prognosis using natural language processing and machine learning from social media status. The research team from Daffodil International University in Bangladesh analyzed real data from Facebook, Twitter, and Instagram to determine whether an individual is depressed or not. The study used five data pre- processing approaches for natural language processing and six machine learning classifiers to analyze the social media data. The proposed model using machine learning techniques to analyze human depression through text analysis showed an accuracy of 85%. The results of the study suggest that social media data can be used to diagnose depression with high accuracy. The proposed model has several advantages over traditional methods of depression diagnosis. It is non-invasive, cost- effective, and can be used to diagnose depression in real-time. The study also provides insights into the use of social media data for depression diagnosis. The research team found that certain linguistic features, such as the use of negative words and first-person pronouns, were strongly associated with depression. This study provides a new approach to diagnose depression using social media data, which can be used to develop effective interventions and support systems for individuals with depression. The proposed model can be used to monitor individuals at risk of depression and provide early interventions to prevent the onset of depression. The study has important implications for public health and highlights the potential of social media data for depression diagnosis.

## C)Spatial–Temporal Attention Network for Depression Recognition from facial videos.

Depression constitutes a critical mental health concern, underscoring the need for effective automatic diagnosis systems to aid clinicians. While current methods for automated diagnosis rely on either handcrafted or deep learning features, the proposed Deep Local Global Attention Convolutional Neural Network (DLGA-CNN) framework introduces a novel approach for recognizing depression, leveraging a convolutional neural network with an attention mechanism. The framework consists of three integral components, including a Depressed-CNN for deep feature extraction, a Local-Global Attention based CNN (LGA-CNN) for comprehensive pattern analysis, and a Weighted Spatial Pyramid Pooling (WSPP) layer for generating scale invariant representations. Trained end-to-end, the DLGA-CNN framework directly predicts depression severity from facial images, utilizing attention mechanisms to effectively capture discriminative patterns pertinent to depression. Notably, experimental evaluations conducted on the AVEC2013 and AVEC2014 depression databases reveal the framework's superior performance compared to existing video-based depression recognition methods. By incorporating deep learning features and attention mechanisms, the DLGA-CNN framework demonstrates its efficacy in discerning depression from facial images. Its comprehensive design, comprising feature extraction, local-global attention modeling, and spatial pooling, enables the framework to analyze both local and global facial patterns, facilitating a holistic understanding of depression-related indicators. The attention mechanisms play a pivotal role in the framework's success, aiding in the modeling of crucial patterns associated with depression. In summary, the DLGA-CNN framework presents a promising avenue for automated depression recognition, showcasing its potential to advance clinical diagnostics and intervention strategies in the realm of mental health.

## D). Encoding Temporal Information for Automatic Depression Recognition from Facial Analysis.

This paper introduces an innovative method for automatically recognizing depression based on facial analysis, addressing the challenge of subjective clinical diagnosis. Facial expressions, including sad expressions, reduced movements, and avoiding eye contact, offer crucial indicators of depression. Existing techniques, relying on 2D or 3D Convolutional Neural Networks (CNNs), face limitations related to dynamic temporal relations and overfitting risks. The proposed approach encodes temporal variations in videos into binary codes, creating an image map. This method effectively incorporates temporal information using a 2D CNN, mitigating overfitting concerns. Employing a two- stream model that integrates both appearance and temporal information, predictions are combined through score fusion. Experiments conducted on AVEC2013 and AVEC2014 datasets highlight the competitive performance of the temporal stream on its own. Moreover, the two-stream model surpasses individual streams and existing methods, underscoring the efficacy of separating temporal information

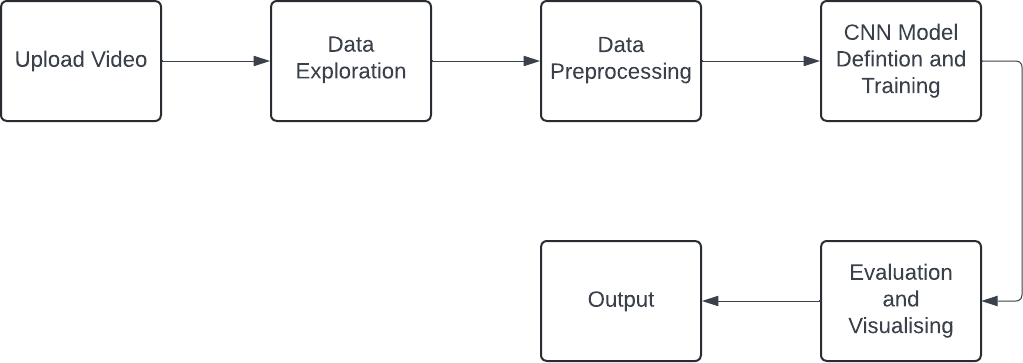
to complement spatial cues. In summary, this paper presents a methodology that encodes temporal video information into image maps, enhancing spatial analysis from frames. The two-stream model, adept at combining both temporal and appearance information, achieves superior results. These findings emphasize the significance of distinct temporal information encoding, reducing overfitting and advancing the field of depression recognition through facial analysis.

## E) Depressed Mood Prediction of Elderly People with a Wearable Band.

The passage discusses the significance of addressing depression in the elderly population, especially among those who live alone and may have limited social interactions due to factors like bereavement and retirement. It highlights the importance of predicting depressed moods in this demographic to prevent the development of clinical depression. To achieve this, the study utilized wearable bands equipped with multiple sensors to monitor the daily activities and biometric data of 14 elderly individuals living alone for

71 days. Depression questionnaires were periodically administered to serve as labels for the collected data. The study generated a depressed mood prediction model, using multiple features from the sensor data. A general model with an 80% recall rate and personalized models with an average recall of 82.7% were developed. Random forest model is used for personal models. Developed ACC-ONLY, PPG-ONLY model and use PHQ-9 survey here. The research demonstrates the feasibility of using wearable technology as an unobtrusive method for monitoring depression, even in elderly individuals, opening possibilities for proactive intervention and support.

1. BLOCK DIAGRAM



1. MODULES

# Data Exploration and Preprocessing:

Data exploration involves counting images in emotion classes and visualizing counts with bar charts. Data preprocessing sets up image data generators for augmentation and preprocessing using Keras' ImageDataGenerator class.

# CNN Model Definition and Training:

Define a CNN model using Keras' Sequential API with convolutional layers, batch normalization, max-pooling, dropout, and dense layers. Compile the model with Adam optimizer and categorical cross-entropy loss, using callbacks for training. Train the model on training and validation datasets using the fit method.

# Evaluation and Visualization:

Plot training and validation curves, display confusion matrix for model evaluation.Evaluate the CNN model on test data and print results.

# Transfer Learning with ResNet50V2:

Define a new model using transfer learning with the pre- trained ResNet50V2 model.

Freeze some ResNet50V2 layers and add additional layers for fine-tuning. Compile, train, and evaluate the model similar to the CNN model. Visualize confusion matrix and random sample predictions for both models.

1. ALGORITHM

ResNet50V2 is a powerful deep convolutional neural network architecture designed for image recognition and classification tasks. It is an improved version of the original ResNet50 model, incorporating advanced architectural changes for better performance and efficiency. Here's a brief description of ResNet50V2 and its layers:

* 1. **Input Layer: -** ResNet50V2 takes input images typically of size 224x224 pixels with three color channels (RGB).
  2. **Convolutional Layers**: - The initial layers consist of convolutional operations that extract low-level features from the input images. ResNet50V2 uses a series of convolutional layers with varying filter sizes to capture different levels of abstraction.
  3. **Residual Blocks:** - ResNet50V2 is structured around residual blocks, which contain skip connections (or identity shortcuts) to mitigate the vanishing gradient problem in deep networks. Each residual block consists of multiple convolutional layers followed by a skip connection that adds the input to the output of deeper layers. This architecture enables the network to learn residual functions, making it easier to train very deep networks.
  4. **Bottleneck Architecture:** - ResNet50V2 employs a bottleneck architecture in its residual blocks, which includes three types of convolutional layers: 1x1 convolutions, 3x3 convolutions, and another set of 1x1 convolutions. The 1x1 convolutions are used for This design improves training performance and convergence by addressing the issue of vanishing gradients.

**6. Batch Normalization:** - Batch normalization is extensively used in ResNet50V2 to normalize the inputs of each layer, enhancing training stability and accelerating convergence. Normalizing the inputs helps in mitigating issues like internal covariate shift and improves the overall performance of the network. dimensionality reduction and restoration, making the model more computationally efficient.

**5. Pre-Activation Units:** - ResNet50V2 incorporates pre- activation units, where batch normalization and activation functions (e.g., ReLU) are applied before convolutions.

1. **Global Average Pooling (GAP):** - Instead of fully connected layers at the end,ResNet50V2 employs global

average pooling (GAP) to reduce the number of parameters and prevent overfitting. GAP computes the average of each feature map across spatial dimensions, producing a compact representation of the features.

1. **Output Layer:** - The final layer of ResNet50V2 is typically a softmax layer for multi-class classification tasks, providing probabilities for different classes based on the learned features.

In summary, ResNet50V2's architecture is characterized by its residual blocks, bottleneck design, pre-activation units, batch normalization, and global average pooling. These elements contribute to its effectiveness in training deep networks, reducing overfitting, and achieving high performance in tasks such as image classification and feature extraction.

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