## DETECTING AND ANALYZING FACIAL FEATURES OF PEOPLE WITH DEPRESSION

**PROJECT REPORT PHASE 1**

***Submitted by***

## MOHMAED RAHUL 19BECSE027

## MANYAM KISHORE 19BECSE025

**INENI HARSHI 19BECSE019**

*in partial fulfillment for the award of the degree*

*of*

## BACHELOR OF ENGINEERING IN

**COMPUTER SCIENCE AND ENGINEERING**



**Karpagam Academy of Higher Education**

## COIMBATORE – 641021

**TAMILNADU INDIA**

**MAY 2022**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

### This is to certify that the project entitled

## DETECTING AND ANALYZING FACIAL FEATURES OF PEOPLE WITH DEPRESSION

is the bonafide record of project work done by

## MOHMAED RAHUL 19BECSE027

## MANYAM KISHORE 19BECSE025

**INENI HARSHI 19BECSE019**

### of B.E Computer Science and Engineering during the year 2019-2020

Mrs K.Tharageswari Dr.R.Santhosh

### Project Guide Head of the Department

Submitted for the project Viva-Voce examination held on

Internal Examiner External Examiner

## DECLARATION

I affirm that the project work titled **“DETECTING AND ANALYSING FACIAL FEATURES OF PEOPLE WITH DEPRESSION”** submitted in partial fulfillment for the award of **B.E COMPUTER SCIENCE AND ENGINEERING** is the original work carried out by me. It has not formed the part of any other project work submitted forward of any degree or diploma, either in this or any other University.

## NAME REG NUM

## MOHMAED RAHUL 19BECSE027

## MANYAM KISHORE 19BECSE025

**INENI HARSHI 19BECSE019**

### I certify that the declaration made by the above candidates is true.

Signature of the Guide

#### Mrs K.Tharageshwari

#### AP/CSE

**ACKNOWLEDGEMENT**

Any organized and systematic work calls for the co-operation and co-ordination of a team of people. My project is no exception to this. Hence, these pages find the space for thanking all those who have directly and indirectly contributed to the completion of this work in a successful manner.

I express my gratitude to **Dr.R.Vasanthakumar, B.E. (Hons)., D.Sc.,** President, Karpagam Charity trust, for his encouragement and support in this project work.

I sincerely thank **Shri.K.Murugaiah, B.E.,**CEO, Karpagam Educational Institutions, for his constant support and enduring encouragement for the successful completion of the dissertation.

I sincerely thank **Prof.Dr.S.Sudalaimuthu**, Vice Chancellor of Karpagam Academy of Higher Education, for his encouragement and support in this project work.

I sincerely thank **Dr.M.Palaniswamy,** Registrar of Karpagam Academy of Higher Education, for his encouragement and support in this project work.

My special thanks to **Dr.P.Palanivelu,** Controller of Examinations, Karpagam Academy of Higher Education, for his timely help for the progress of this work for his valuable suggestion and timely help.

I express my heartfelt thanks to **Dr.G.K.D.Prasanna Venkatesan,** Dean, Faculty of Engineering, Karpagam Academy of Higher Education, for his encouragement and support in this project work.

I express my heartfelt thanks to **Dr.R.Santhosh,** Professor and Head, Department of Computer Science and Engineering, Faculty of Engineering, Karpagam Academy of Higher Education, for his encouragement and valuable guidance in this project work.

I would like to extend my heartfelt thanks to our guide **Mrs K.Tharageswari**  Assistant Professor, Department of Computer Science and Engineering**,** Karpagam Academy of Higher Education, for his encouragement in carrying out this project work.

I also express my thanks to my parents, my friends, well-wishers for their encouragement and best wishes in the successful completion of this dissertation.

## DETECTING AND ANALYZING FACIAL FEATURES OF PEOPLE WITH DEPRESSION

1. **ABSTRACT**

Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest. Also called major depressive disorder or clinical depression, it affects how you feel, think and behave and can lead to a variety of emotional and physical problems. You may have trouble doing normal day-to-day activities, and sometimes you may feel as if life isn't worth living.

The primary care clinics and emergency departments lack simple and effective tools for screening people with depression.

This study proposes a novel method to detect stage of depression using facial images. Various experiments are designed to obtain the convolutional neural network (CNN) model by transfer learning based on a large-scale dataset (9870 images from people of depression and 19,567 images from GP (the general population)).

1. **INTRODUCTION**

Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest. Also called major depressive disorder or clinical depression, it affects how you feel, think and behave and can lead to a variety of emotional and physical problems. You may have trouble doing normal day-to-day activities, and sometimes you may feel as if life isn't worth living.

This could leads to:

* Feelings of sadness, tearfulness, emptiness or hopelessness
* Angry outbursts, irritability or frustration, even over small matters
* Loss of interest or pleasure in most or all normal activities, such as sex, hobbies or sports
* Sleep disturbances, including insomnia or sleeping too much
* Tiredness and lack of energy, so even small tasks take extra effort
* Reduced appetite and weight loss or increased cravings for food and weight gain
* Anxiety, agitation or restlessness
* Slowed thinking, speaking or body movements
* Feelings of worthlessness or guilt, fixating on past failures or self-blame
* Trouble thinking, concentrating, making decisions and remembering things
* Frequent or recurrent thoughts of death, suicidal thoughts, suicide attempts or suicide
* Unexplained physical problems, such as back pain or headaches

1. **SOLUTION**

The better practice in clinical screening, facial feature detection technology for people suffering from depression using convolutional neural networks (CNN) is meaningful.

CNN has an advantage over other machine learning algorithms in feature learning and has made breakthroughs in computer vision. It can automatically extract features based on an end-to-end model without manually transforming features.

The aim of this study was to detect and classify facial images of people suffering from depression and the general population (GP) by CNN to assist clinical screening.

1. **Design and procedure**

We plan to execute three main processes: First, 2416 images and 256 videos of 71 People suffering from depression, and 103 videos of 103 GP were collected.

The details would be collected from a mobile health (mHealth) app .The time range of the data in the mHealth app was from 30 invalid or blurred ones would be removed.

Third, to eliminate external distracting information, such as the background, clothes, or accessories, face cropping was performed on them to remove the images of face occlusion.

To facilitate the batch processing of the CNN model, all images were resized to 224 x 224 **pixels.** After the above preprocessing, the images of People suffering from depression (9870) and the GP (19,567) were merged.

Diagram

Description automatically generated

Based on the 70/30 principle, these images were shuffled and randomly divided these images into a training dataset and a test dataset. The CNN model was trained in the training dataset and calculated the accuracy, sensitivity, and specificity in the test dataset.

1. **Quantitative Analysis of Facial Features and Visualization**

The interpretability of the CNN model is useful to explain why it predicts what it predicts. The feature map referred to the result of output captured by the filter on the output of the previous layer of the network. The gradient weighted class activation mapping (Grad-CAM) technique was applied to visualize the high-dimension information of the CNNmodel. Then wequantitatively analyzed whether there were significant differences in features between People suffering from depression and the GP in each facial area.

The analysis process that automatically counted the number of facial features in different facial areas in the input images was constructed.

**LITERATURE REVIEW**

**Study on determining the Big-Five personality traits of an individual based on facial expressions**

In 2015 E-Health and Bioengineering Conference (EHB), 1-6, 2015

Previous studies revealed an increasing interest in determining the personality and behavior of individuals in areas such as career development and counseling, personalized health assistance, mental disorder diagnosis as well as detection of physical diseases with personality shift symptoms. Current ways of determining the Big-Five personality types involve completing a questionnaire, that takes an impractical amount of time and it cannot be used often. Our research aims building a novel non-invasive system to determine Big-Five personality traits based on facial features acquired using Facial Action Coding System. Results show links between the FACS action units present at maximum intensities in facial features and the personality traits of the individual. Moreover, the system built offers over 75% accuracy in predicting openness to experience, as well as neuroticism and extraversion and proves practical, offering results in no more than 3 minutes compared to the amount of time taken to complete a questionnaire.

**Combining global and local convolutional 3d networks for detecting depression from facial expressions**

In 2019 14th IEEE International Conference on Automatic Face & Gesture Recognition (FG 2019), 1-8, 2019

Deep learning architectures have been successfully applied in video-based health monitoring, to recognize distinctive variations in the facial appearance of subjects. To detect patterns of variation linked to depressive behavior, deep neural networks (NNs) typically exploit spatial and temporal information separately by, e.g., cascading a 2D convolutional NN (CNN) with a recurrent NN (RNN), although the intrinsic spatio-temporal relationships can deteriorate. With the recent advent of 3D CNNs like the convolutional 3D (C3D) network, these spatio-temporal relationships can be modeled to improve performance. However, the accuracy of C3D networks remain an issue when applied to depression detection. In this paper, the fusion of diverse C3D predictions are proposed to improve accuracy, where spatio-temporal features are extracted from global (full-face) and local (eyes) regions of subject. This allows to increasingly focus on a local facial region that is highly relevant for analyzing depression. Additionally, the proposed network integrates 3D Global Average Pooling in order to efficiently summarize spatio-temporal features without using fully-connected layers, and thereby reduce the number of model parameters and potential over-fitting. Experimental results on the Audio Visual Emotion Challenge (AVEC 2013 and AVEC 2014) depression datasets indicates that combining the responses of global and local C3D networks achieves a higher level of accuracy than state-of-the-art systems.

**Association Between Dispositional Mindfulness, Clinical Characteristics, and Emotion Regulation in Women Entering Substance Use Disorder Treatment: an fMRI Study**

Dispositional mindfulness (DM) is associated with emotion regulation (ER) in healthy populations and may be protective for individuals with substance use disorders (SUD). We tested hypotheses concerning the associations of DM with ER, mental health symptoms, drug use severity, and behavioral and brain metabolic responses during an emotional Go-Nogo task.

Methods

Women entering an SUD treatment program (N= 245) self-reported on the Five Facet Mindfulness Questionnaire (FFMQ); Depression, Anxiety, and Stress Scale (DASS-21); Addiction Severity Index (ASI); and Difficulties in Emotion Regulation Scale (DERS). A subgroup of 45 women completed the emotional Go-Nogo task while undergoing fMRI. Associations between DM and self-reported ER and clinical characteristics were tested in the full sample. Associations between DM and behavioral and neural responses during the Go-Nogo emotion regulation challenge were tested in the fMRI sub-sample.

**Dynamic multimodal measurement of depression severity using deep autoencoding**

In IEEE journal of biomedical and health informatics 22 (2), 525-536, 2017

Depression is one of the most common psychiatric disorders worldwide, with over 350 million people affected. Current methods to screen for and assess depression depend almost entirely on clinical interviews and self-report scales. While useful, such measures lack objective, systematic, and efficient ways of incorporating behavioral observations that are strong indicators of depression presence and severity. Using dynamics of facial and head movement and vocalization, we trained classifiers to detect three levels of depression severity. Participants were a community sample diagnosed with major depressive disorder. They were recorded in clinical interviews (Hamilton Rating Scale for Depression, HRSD) at seven-week intervals over a period of 21 weeks. At each interview, they were scored by the HRSD as moderately to severely depressed, mildly depressed, or remitted. Logistic regression classifiers using leave-one-participant-out validation were compared for facial movement, head movement, and vocal prosody individually and in combination. Accuracy of depression severity measurement from facial movement dynamics was higher than that for head movement dynamics, and each was substantially higher than that for vocal prosody. Accuracy using all three modalities combined only marginally exceeded that of face and head combined. These findings suggest that automatic detection of depression severity from behavioral indicators in patients is feasible and that multimodal measures afford the most powerful detection.

**Depression detection based on deep distribution learning**

In 2019 IEEE International Conference on Image Processing (ICIP), 4544-4548, 2019

Major depressive disorder is among the most common and harmful mental health problems. Several deep learning architectures have been proposed for video-based detection of depression based on the facial expressions of subjects. To predict the depression level, these architectures are often modeled for regression with Euclidean loss. Consequently, they do not leverage the data distribution, nor explore the ordinal relationship between facial images and depression levels, and have limited robustness to noisy and uncertain labeling. This paper introduces a deep learning architecture for accurately predicting depression levels through distribution learning. It relies on a new expectation loss function that allows to estimate the underlying data distribution over depression levels, where expected values of the distribution are optimized to approach the ground-truth levels. The proposed approach can produce accurate predictions of depression levels even under label uncertainty. Extensive experiments on the AVEC2013 and AVEC2014 datasets indicate that the proposed architecture represents an effective approach that can outperform state-of-the-art techniques.

1. **CONCLUSION**

Depression disorders continue to attract attention—however, there is a lack of simple and efficient tools in clinical screening, especially in primary care clinics. This paper is, to the best of our knowledge, the first study to apply the CNN model using transfer learning to screen People suffering from depression by using facial images. Large-scale datasets were prepared, and various experiments were designs to optimize this model.