

# DEPRESSION DETECTION USING ARTIFICIAL INTELLIGENCE THROUGH VOCAL AND VISUAL EXPRESSIONS

Tejas Maskhe<sup>1</sup>, Akanksha Sawant<sup>2</sup>, Rushikesh Shintre<sup>3</sup>, Raj Washivale<sup>4</sup>, Prof. Swapnaja Ubale<sup>5</sup>

<sup>1</sup> Students and <sup>2</sup>Project Guide of Zeal College of Engineering, Pune

Savitribai Phule Pune University, Pune

Maharashtra, India

\*\*\*

**Abstract-**Depression is a major mental health disorder that is rapidly affecting lives worldwide. Depression not only impacts emotional but also physical and psychological state of the person. Its symptoms include lack of interest in daily activities, feeling low, anxiety and frustration, loss of weight and even feeling of self-hatred. Our contribution, an artificial intelligent system is proposed to monitor depression. It can predict the scales of Beck depression inventory II (BDI-II) from vocal and visual expressions. First, different visual features are extracted from facial expression images. Deep learning method is utilized to extract key visual features from the facial expression frames. Second, spectral low level descriptors and mel-frequency cepstral coefficients features are extracted from short text segments to capture the vocal expressions.

**Key Words:** Artificial system, deep learning, depression, facial expression, regression, vocal expression, etc.

## 1. INTRODUCTION

Psychological health of people proves a vital role on their life performance. Neglecting this can result in several problems such as stress, anxiety, depression etc. These problems need to be detected and controlled at the initial stages itself for the better mental health of the people. Detecting depression in a vast no of college students is challenging task. Most of the people are totally unaware that they may be having depression. If at all they are aware of it, some people conceal their depression from everyone. So an automated system is required that will pick out the person who are dealing with depression. A system has been proposed here which captures frontal face of cameras people, extracts the facial features from each frame and analyses these facial features to detect signs of depression in them. This system will be trained with of frontal face images of happy, contempt and disgust faces. The presence of these features in the image frames will be analyzed to predict depression in the person.

Depression is a common psychological phenomenon, more than just sadness. People with depression may experience a lack of interest and pleasure in daily activities, significant weight loss or gain, insomnia or excessive sleeping, lack of energy, inability to concentrate, feelings of worthlessness or excessive guilt and recurrent thoughts of death or suicide.

About 350 million people worldwide suffer from depression, which is approximately 5% of the world's total population. Depression is a leading cause of disability worldwide, and is a major contributor to the overall global burden of disease. Depression causes one death every 40 seconds worldwide; statistically the second leading cause of death among 15-29 year olds globally in 2012.

Automatic depression assessment based on visual cues is a rapidly growing research domain. The present exhaustive review of existing approaches as reported in over sixty publications during the last ten years focuses on image processing and machine learning algorithms. Visual manifestations of depression, various procedures used for data collection, and existing datasets are summarized. The review outlines methods and algorithms for visual feature extraction, dimensionality reduction, decision methods for classification and regression approaches, as well as different fusion strategies. A quantitative meta-analysis of reported results, relying on performance metrics robust to chance, is included, identifying general trends and key unresolved issues to be considered in future studies of automatic depression assessment utilizing visual cues alone or in combination with visual cues. The proposed work also carried out to predict the depression level according to current input of visual and vocal using deep learning.

## 2. LITERATURE SURVEY

Many studies have been conducted to identify the precise facial expressions that are related to depression. A study has been conducted for finding out Action Units (AU) related to different emotions exhibited by depressed patients [1]. The presence of AU12 which is associated with emotion smile was low in highly depressed patients. The presence of AU14 related to emotion contempt and AU10 related to emotion disgust was also present along with AU12. The video data for this study was collected through clinical interviews of depressed patients as well as non-depressed patients. The results showed that AU14 related to emotion contempt proved most accurate for depression detection

Features related to eye movement to understand the eye activity of the depressed and features related to head pose movement to understand the head movement behavior of the depressed has been done in [2]. The classification of the

features related to eye activity showed higher significance in detecting severe depression. Detection of depression from facial features can be done by measuring 'Multi-Scale Entropy' (MSE) on the patient interview video. [4] MSE helps to find out the variations that occur across a single pixel in the video. The entropy levels of highly expressive, non-depressed patients were high. The entropy level was low for depressed patients who were less expressive of their emotions.

Another study presented a technique which uses analysis of facial geometry along with analysis of speech for depression detection [3]. This work says that the expressions associated with depression are found to be in lower frequencies in smaller duration videos. Therefore, longer time videos need to be captured for effective depression detection. Datasets are also created by capturing videos of patients while answering clinical interviews. Interviews recorded were for both for depressed patients as well as non-depressed patients. Videos are also recorded from the diagnosis of depression till the patient has improved. [1][4]. Studies showed that there is a significant relation between facial features and vocal behavior of the depressed [5].

### 3. PROPOSED METHODOLOGY

The aim of this paper is to build an artificial intelligent system that can automatically predict the depression level from a user's visual and vocal (textual) expression. The system is understood to apply some basic concepts of how parts of the human brainwork. This can be applied in robots or machines to provide human cognitive like capabilities, making intelligent human machine applications.

- 1) The framework architecture is proposed for automatic depression scale prediction that includes frame/segment level feature extraction, dynamic feature generation, feature dimension reduction, and regression;
- 2) Various features, including deep features, are extracted on the frame-level that captured the better facial expression information;
- 3) A new feature (FDHH) is generated by observing dynamic variation patterns across the frame-level features;
- 4) Advanced regressive techniques are used for regression.

### 4. MATHEMATICAL MODEL

Let S be the Whole system which consists:

$$S = \{IP, V, PRO, OP\}.$$

Where,

- A. IP is the input of the system.
- B. Pro is the procedure applied to the system to process the given input.
- C. OP is the output of the system.

#### 1. Surveillance video:

V= Is the Input Video

**Input: {Video dataset}**

**Output :{ Video convert into module }**

I shows the architecture of our 3D CNN model.

The model has convert convolution layers,

Apply algorithm: CNN model is a binary classification

#### 2. Video strumming:

**Input: {video}**

**Output :{ Depression Detection }**

Significant to detect facial expression in input video.

### 5. ARCHITECTURE

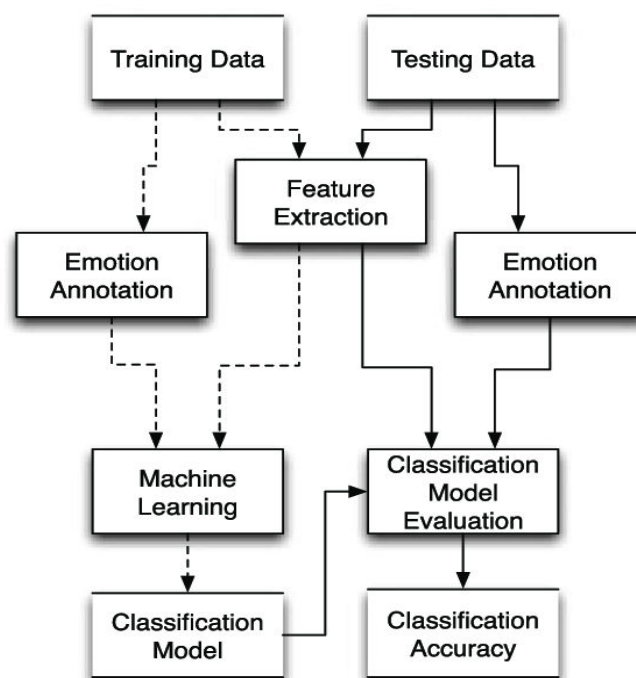
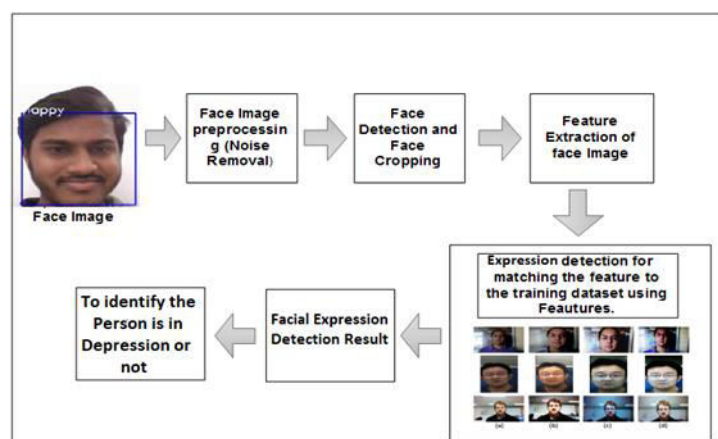
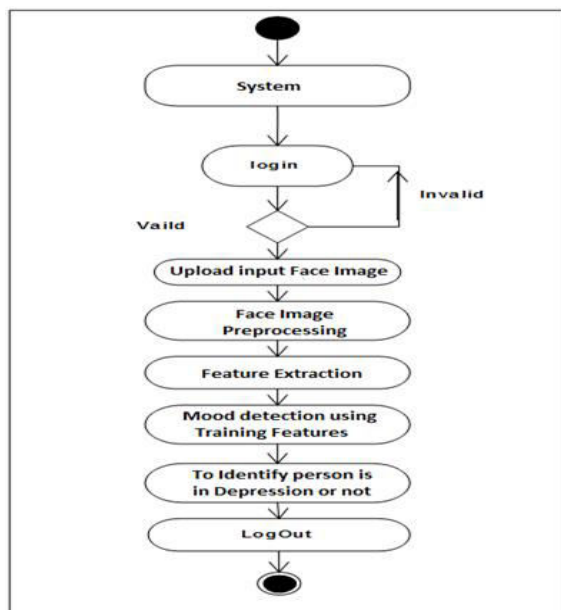


Fig -1: System architecture





**Fig -2:** Activity Diagram

## 6. CONCLUSIONS

By using this project we detect depression at early stage which helps to take appropriate treatment on primary stage. Emotion is known to contain important information regarding a person's psychological state.

It is one of the best media through which one can identify whether the patient is in controlled state or depressed state. Thus, a facial emotion-based depression detection system could serve as a screening tool to assist mental health professionals in identifying clinically depressed persons.

## 6. ACKNOWLEDGEMENT

I would prefer to give thanks the researchers likewise publishers for creating their resources available. I'm conjointly grateful to guide, reviewer for their valuable suggestions and also thank the college authorities for providing the required infrastructure and support.

## 7. REFERENCES

- [1] Girard, Jeffrey M., Jeffrey F. Cohn, Mohammad H. Mahoor, Seyedmohammad Mavadati, and Dean P. Rosenwald. "Social risk and depression: Evidence from manual and automatic facial expression analysis." In Automatic Face and Gesture Recognition (FG), 10th IEEE International Conference and Workshops on, pp. 1-8. IEEE, 2013.
- [2] Alghowinem, Sharifa, Roland Goecke, Jeffrey F. Cohn, Michael Wagner, Gordon Parker, and Michael Breakspear. "Cross-cultural

## 5. Activity Diagram

detection of depression from nonverbal behaviour." In Automatic Face and Gesture Recognition (FG), 11th IEEE International Conference and Workshops on, vol. 1, pp. 1-8. IEEE, 2015.

[3] Pampouchidou, A., O. Simantiraki, C-M. Vazakopoulou, C. Chatzaki, M. Padiaditis, A. Maridaki, K. Marias et al. "Facial geometry and speech analysis for depression detection." In Engineering in Medicine and Biology Society (EMBC), 39<sup>th</sup> Annual International Conference of the IEEE, pp. 1433-1436. IEEE, 2017.

[4] Harati, Sahar, Andrea Crowell, Helen Mayberg, Jun Kong, and Shamim Nemati. "Discriminating clinical phases of recovery from major depressive disorder using the dynamics of facial expression." In Engineering in Medicine and Biology Society (EMBC), 38<sup>th</sup> Annual International Conference of the, pp. 2254- 2257. IEEE, 2016.

[5] Cohn, Jeffrey F., Tomas Simon Kruez, Iain Matthews, Ying Yang, Minh Hoai Nguyen, Margara Tejera Padilla, Feng Zhou, and Fernando De la Torre. "Detecting depression from facial actions and vocal prosody." In Affective Computing and Intelligent Interaction and Workshops. ACII 2009. 3rd International Conference on, pp. 1-7. IEEE, 2009.

[6] Tasnim, Mashrura, Rifat Shahriyar, Nowshin Nahar, and Hossain Mahmud. "Intelligent depression detection and support system: Statistical analysis, psychological review and design implication." In e-Health Networking, Applications and Services (Healthcom), 18th International Conference on, pp. 1-6. IEEE, 2016.

[7] Pampouchidou, Anastasia, Kostas Marias, Manolis Tsiknakis, P. Simos, Fan Yang, and Fabrice Meriaudeau. "Designing a framework for assisting depression severity assessment from facial image analysis." In Signal and Image Processing Applications (ICSIPA), International Conference on, pp. 578-583. IEEE, 2015.

[8] Maddage, Namunu C., Rajinda Senaratne, Lu-Shih Alex Low, Margaret Lech, and Nicholas Allen. "Video-based detection of the clinical depression in adolescents." In Engineering in Medicine and Biology Society, (EMBC), Annual International Conference of the IEEE, pp. 3723-3726. IEEE, 2009.

[9] Meng, Hongying, Di Huang, Heng Wang, Hongyu Yang, Mohammed Al-Shuraifi, and Yunhong Wang. "Depression recognition based on dynamic facial and vocal expression features using partial least square regression." In

Proceedings of the 3<sup>rd</sup> ACM international workshop on  
Audio/visual emotion challenge, pp. 21-30. ACM, 2013