Real time-Employee Emotion Detection system (RTEED) using Machine Learning

[1]Prof. Vishal R. Shinde, [2]Ms.Kartika R Sonawane, [3]Mr. Ashwin D Bhawar,
[4]Mr. Hrithik D Walam.

[1]Asst.Prof,[2,3,4]UG Student,[1,2,3,4]Computer Engg. Dept. Shivajirao S. Jondhle College of Engineering & Technology, Asangaon, Maharashtra, India.

[1]mailme.vishalshinde@gmail.com,[2]sonawanekartika109@gmail.com,[3]bhawarashwin321@gmail.com,[4]walamhrithik69@gmail.com

Abstract-Employee health and well-being are now the most important considerations in the workplace. Because it will have an impact on both an employee's productivity and the contribution of the team. In the end, automatic facial expression analysis using machine learning has developed over the past few decades into an intriguing and busy study subject. In order to automatically identify employee emotions in real time using machine learning, the Real Time Employee Emotion Detection System (RTEED) has been proposed in this work. The RTEED system assists the company in monitoring employee wellbeing, and any identified emotions are sent to the appropriate employee through messages. Employees are able to make better judgements, focus better at work, adopt healthier lifestyles, and work in more productive ways as a result. Multi-PIE at CMU Machine learning models are trained using face data. Each employee will have a webcam that can record their real-time facial expression. The RTEED system is intended to recognize six different emotions through the captured image, including happy, sadness, surprise, fear, disgust, and rage.[1]

Keywords-Machine Learning, Real Time, EEG, RTEED, HMM.

I. INTRODUCTION

In numerous fields, including healthcare, e-commerce, logistics and supply chain management, and agriculture, artificial intelligence (AI) and machine learning (ML) are currently being actively applied. AI is now widely used in all facts of corporate life. So, company leaders must make the best use of modern technology. Pattern recognition and pattern classification issues are largely addressed by machine learning approaches. Particularly, for many years now, these methods have been applied in electroencephalography and the identification of face expression or emotions (EEG).As a result, in the current environment, employee emotion detection is crucial to the success and wellbeing of both employers and employees. Since even the smallest difference usually produces a distinct form of expression, identifying variances in facial muscle is a difficult undertaking. Since emotions are always influenced by their surroundings, different people will exhibit the same feeling in different ways, or others will do so differently. In order to automatically identify employee emotions in real time using machine learning, the Real Time Employee Emotion Detection System (RTEED) has been proposed in this work. By providing the relevant signals, this system enables the employer to monitor the employee's well-being.[1]

II. AIMS AND OBJECTIVE

a) Aim

The goal of this paper is to create a reliable automatic system that can categorize a group's perceived emotion as Positive, Neutral, or Negative. In addition, the system need to function properly on any device, regardless of the user's device's processing capacity.[1]

b) Objective

- Examine various techniques for identifying group emotions in the wild.
- Analyze the effectiveness of the various techniques and models.
- Create a web application with an associate Android app that would enable people to upload an image for emotion identification from their Computer or capture one right away using their smartphone or tablet's camera.
- Also, make sure that the desktop and mobile applications' user interfaces are simple to use.

III. LITERATURE SURVEY

Paper1:Development of a Real-Time Emotion Recognition System Using Facial Expressions and EEG based on machine learning and deep neural

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network methods:

Throughout the past few decades, real-time emotion identification has been an important area of study. This paper aims to classify the emotional expressions of autistic children and physically disabled people (deaf, dumb, and bedridden) based on facial landmarks and electroencephalograph (EEG) signals by creating an algorithm for real-time emotion recognition using virtual markers through an optical flow algorithm that is successful in uneven lighting and subject head rotation. In the experiment for identifying facial emotions, 55 college students (35 men and 25 women) voluntarily participated. Their average age was 22.9 years. To gather EEG signals, 19 undergraduate students volunteered. At the initial stage of facial and eye detection, Haar-like features are employed. Subsequently, using the mathematical model technique, virtual markers are placed on predetermined areas of the subject's face based on a facial action coding system, and the markers are tracked using the Lucas-Kande optical flow algorithm.[4]

Paper2:- Detection of Stress Using Image Processing and Machine Techniques:

real-time non-intrusive video is taken in this system, which determines a person's emotional state by analysing their facial expression. It recognises an individual emotion in each video frame and determines the stress level over the course of several hours of video capture. The system employs a strategy that enables the system to train a model and analyse changes in feature prediction. The levels of specific hormones such as cortisol are used to routinely detect stress. In fact, the goal of this paper is to automate the process of detecting stress without the involvement of a doctor or psychiatrist. The outcomes of this model can then be precisely predicted using a binary decision criterion.[5]

Paper3: Value directed learning of gestures and facial displays:

This paper approach for creating decision-theoretic models of facial emotions and movements from video data is presented in this study. It believe that a facial expression or gesture's relationship to context, actions, and results contains the meaning that it conveys to a viewer. The utility of facial expressions and gestures must be evaluated by an agent who wants to take advantage of these linkages. Using unlabeled observations of a person's face and gestures, the environment, as well as the agent's own behaviors and utility function, this study shows how an agent can learn correlations between these variables. The agent identifies groups of nonverbal human behaviors, as well as which are crucial for selecting actions that maximize utility over potential outcomes. An agent can concentrate resources on identifying only the behaviors that are useful to distinguish thanks to this value-directed model learning.[6]

IV. EXISTING SYSTEM

One of the most effective, fast, natural, and powerful ways for people to express their feelings and intentions is through their faces. The work on emotion recognition in the current system is based on digital signal processing, taking into account the Galvanic skin reaction, blood volume, pupil dilation, and skin temperature. However, other research on this subject uses visual cues (head movement, eye closure, etc.) and a variety of physiological signals to track how stressed a person is while they are at work. These measurements are uncomfortable to use in practice and are obtrusive. Every sensor reading is compared to a stress index, which is a threshold number for determining the level of stress.[1]

V. COMPARATIVE STUDY

Table 1 : Comparative Analysis

Sr. No	Paper Name	Author/ Publication	Technology	Advantage	Disadvantage
1.	Development of a Real-Time Emotion Recognition System Using Facial Expressions and EEG based on machine learning and deep neural network methods	Aya Hassouneh, A.M.Mutawa, M.Murugappan	Deep Neural network methods	In this paper it aims to classify physically disabled people (deaf, dumb, and bedridden) and Autism children's emotional expressions.	It has limitations such as light intensity, face position, and background changes.
2.	Detection of Stress Using Image Processing and Machine Learning Techniques	Nisha Raichur, Nidhi Lonakadi, Priyanka Mural	Image Pre-Processing	Image processing and deep learning are combined to detect continuous stress and reduce future health hazards.	It is difficult to implement on larger areas.
3.	Value directed learning of gestures and facial displays	J. Hoey; J.J. Little	Learning decision	This paper presents a method for learning decision models of facial expressions and gestures from video data.	Low resolutions of face images.

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VI. PROBLEM STATEMENT

The facial expression images collected in real life are very uncontrollable, and these uncontrollability increase facial expressions. Real time Employee Emotion Detection System has been proposed to automatically detect employee emotions in real time using machine learning. RtEED system helps the employer can check well-being of employees and identified emotion will be intimated to respective employee through messages.

VII. PROPOSED SYSTEM

In this paper, the system assists the employer in monitoring the employee's well-being by providing the relevant signals. Emotion recognition is the act of determining human expression from both facial and verbal expression. These feelings include anxiety, distaste, surprise, rage, disdain, disgust, happiness, sadness, and so on. These feelings are extremely subdued. Hence, recognizing emotions is both a difficult task and an important one. shows the technique for real-time emotion detection of employees. With a webcam, the employee's image is recorded. The image is cropped after locating the face. The image has already been processed to allow for any necessary resizing. The best match location in the image is discovered during feature extraction. To determine the employee's feelings, a few key best match places in the photograph are chosen. The employee's recognized emotions are finally shown on the monitor.[1]

VIII. ALGORITHM

Algorithm for employee emotion detection :

Step 1: Start

Step 2: Define data generators

train_dir=os.path.join(settings.MEDIA_ROOT,'data','train')

val_dir=os.path.join(settings.MEDIA_ROOT, 'data','test')

Step 3 :

To detect the different parameter of emotions using libraries Django==2.2 & keras==2.2.5 & matplotlib==3.5.3 for generating image.

train_datagen=ImageDataGenerator(rescale= 1. / 255)

val_datagen=ImageDataGenerator(rescale=1. / 255)

Step 4:

#Create the Model

model = Sequential()

model.add(Conv2D(32,kernel_size=(3, 3), activation='relu', input_shape=(48, 48, 1)))

model.add(Conv2D(64, kernel_size=(3, 3), activation='relu'))

Step 5: Training of Convolutional Neural Networks (CNN) to calculate the parameters

train_generator=train_datagen.flow_from_dir ectory(train_dir,

Test the algo using the testing set to analyse its performance.

Finally, the trained model is used to make detection on new data using the given method.

Step 6 : Display the result.

Step 7: Stop.

IX. MATHEMATICAL MODEL

1. Convolutional Neural Networks (CNN):

A CNN consists of multiple layers of filters that are trained to detect different features in an image. The output of the final layer is fed into a fully connected neural network that produces the emotion label.

The mathematical equations used in a CNN include:

Convolutional Layer:

$$z^{[l]}_{i,j,k}=b^{[l]}_k+\sum_{s=0}^{f[l]-1}\sum_{k'=1}^{n[l-1]}\omega^{[l]}_{r,s,k',k}\ a^{[l-1]}_{i+r,j+s,k'}$$

Activation Function :

$$a^{[l]}_{i,j,k}=\max\left(0,z^{[l]}_{i,j,k}\right)$$

Pooling Layer:

$$a^{[l]}_{i,j,k}=max_{r,s}\ a^{[l-1]}_{i\times s+r,j\times s+s,k}$$

Fully Connected Layer:

$$z^{[L]}_k=\sum_{i=1}^{n^{[L\,1]}}\omega^{[L]}_{i.k}\ a^{[L-1]}_i+\ b^{[L]}_k$$

Activation Function (Softmax):

$$\hat{Y}k=\frac{e^{z^{[L]}_k}}{\sum_{j=1}^{n^{[L]}}e^{z^{[L]}_j}}$$

2. Support Vector Machines (SVM):

An SVM works by finding the hyperplane that maximally separates the classes in the input space. The mathematical equations used in an SVM include:

Objective Function:

$$min_{w,b,\varepsilon}\ \frac{1}{2}\ \|w\|^2+\ c\sum_{i=1}^{m}\ \varepsilon_i$$

subject to:

$$y^{(i)}\left(w^T\ x^{(i)}+b\right)\geq 1-\varepsilon_i\ \ \varepsilon_i\ \geq 0$$

Kernel Function:

$$k\left(x^{(i)},x^{(j)}\right)=\ \emptyset(x^{(i)})^T\emptyset(x^{(j)})$$

Decision Function:

$$y(x)=sign(\sum_{i=1}^{m}\alpha_i y^i\ k\left(x,x^{(i)}\right)+b)$$

3. Hidden Markov Models (HMM):

An HMM works by assuming that the underlying states of a sequence are hidden and can only be observed through emissions. The mathematical equations used in an HMM include:

Forward Algorithm:

$$\alpha_t(i)=P\left(O_1,O_{2,\ldots,O_t},s_t=i\middle|\lambda\right)$$

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$= [\sum_{i=1}^{N} \alpha_{t-1}(j)a_{ji}]b_i(O_t)$

Backward Algorithm:

$\beta_t(i) = p(O_{t+1}, O_{t+2}, \ldots, O_T | s_t = i, \lambda) = \sum_{j=1}^{N} a_{ij}b_j(O_{t+1})\beta_{t+1}(j)$

Description:

Collect Data: Collect a dataset of employee facial expressions that are labeled with corresponding emotions such as happy, sad, angry, etc.

Pre-process Data: Pre-process the dataset by normalizing the image data, resizing the images, cropping the image.
Split Data: Split the pre-processed dataset into training, validation, and testing sets.
Define Algorithm: Define a Convolutional Neural Networks (CNN) with input nodes representing the image data and output nodes representing the emotion labels.

Algorithm Training: Train the CNN using the training set to estimate the parameters of the conditional probability distributions.
Algorithm Testing: Test the CNN using the testing set to evaluate its performance on unseen data.

Result Analysis: In this step, the output is

analyzed by Implementing the RTEED system in real-time by capturing the employee facial expressions using a camera, pre-processing the images, and feeding them into the trained Bayesian Network to predict the corresponding emotions in real-time.

X. ADVANTAGES

- Using machine learning, the Real Time Employee Emotion Detection System (RTEED) has been developed to automatically identify employee emotions in real time..
- The RTEED system demonstrates its effectiveness in precisely detecting an employee's sentiment, cropping an image in real-time using a webcam for a certain amount of time.

XI. DESIGN DETAILS

Fig.2: Emotion Detection Result

Description:

This project website is based on Python and Django. In this above Fig.2 Employee emotion is detected is shown where neutral parameter is detected.

XII.CONCLUSION

Thus we have tried to implement the paper "Real time-Employee Emotion Detection system (RTEED) using Machine Learning" , Chandra prabha K S, Shwetha A. N, Kavitha M, Dr.R Sumathi, ICICV (2021) and the conclusion is as follow: Detecting an employee's emotions is becoming increasingly important in various organizations for the success and prosperity of their business. The RTEED system is proposed in this paper to detect an employee's emotions in real time using machine learning algorithms. The RTEED demonstrates its efficiency by capturing an image in real time using a webcam for a predefined period, cropping the image, and accurately detecting an employee's emotion.

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