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Machine learning based Real time-Employee Emotion Detection

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Abstract: *These days, companies care most about their workers' physical and mental wellness. Because it will have a negative impact on both the individual's and the team's output. For the last several decades, autonomous facial expression analysis has been a hot topic in the field of machine learning. In this research, we propose the use of machine learning to implement a real-time employee emotion detection system (RtEED). The RtEED system enables employers to monitor staff morale, with recognised emotions conveyed to the relevant staff member through automated messaging. As a result, workers will be able to make more informed choices, increase their focus at the office, and start leading healthier, more productive lives. A machine learning model is trained using the CMU Multi-PIE Face Data. Each worker will have access to a camera that can record their expressions in real-time. The RtEED system is programmed to recognise six feelings—happiness, sorrow, surprise, fear, disgust, and anger—in the form of a photograph. Accomplishment of goals shown by the results.*

Keywords: *Artificial intelligence, emotion detection , facial expression analysis, machine learning.*

I. INTRODUCTION

Healthcare, e-commerce, logistics and supply chain, agriculture, and other fields are just few of the many that are making use of AI and ML today. Artificial intelligence (AI) is used widely nowadays in many facets of business. Thus, company leaders must maximise the benefits of modern technology.

Pattern recognition and pattern classification challenges are two areas where machine learning methods are put to good use.

Particularly, these methods have been employed for many years in electroencephalography (EEG) and face expression or emotion recognition[1]. With the rise of the Internet of Things (IoT) and its use in creating "smart" environments such as hospitals, homes, cities, and businesses, facial expression analysis has also attracted a lot of interest.

ISSN: 2366-1313

To recognise emotions, either from a person's facial expressions or their words, is known as emotion recognition. Some examples of these feelings include: fear, disdain, disgust, rage, surprise, sadness, happiness, apathy, and neutrality. Subtleties abound in these feelings. Consequently, recognising feelings is both a difficult and essential endeavour.

One of the most effective, direct, and natural ways for humans to convey their feelings and intentions is via facial expression. Company policy prohibits staff, in certain situations like visiting hospitalised patients, from displaying any signs of emotion. As a consequence, an emotion identification system for humans is essential for successful communication and positive outcomes. Emotion detection in photos and videos has been shown to be a difficult problem, despite the fact that it seems easy to the naked sight.

In the past, employers seldom considered workers' mental health while making decisions. Recent years, however, have seen a surge in studies on the impact that employees' feelings have on the workplace as a whole. Since emotions immediately impact various factors in the present, including customer care service, employee retention, organisational capital investment, and so on, it stands to reason that a company's performance is closely tied to the morale of its workforce. Therefore, in the current context, detecting employee emotions is crucial to the success and well-being of both employees and employers.

The subtle changes in facial muscle constantly result in distinctive expressions, making it a difficult job to detect them. Since feelings change depending on the circumstances, people might show different levels of the same emotion even while they are in the same room.

In this research, we propose the use of machine learning to implement a real-time employee emotion detection system (RtEED). Employers may use this technology to ensure their workers are okay by sending them check-in texts.

The paper is structured as follows. Section II focuses on research studies that investigate the detection of emotions in the workplace. In Part III, we go down the details of the RtEED system that has been suggested. The experimental design and outcomes are detailed in Section IV.

Section V has some last thoughts on the matter.

II. LITERATURE SURVEY

Researchers' efforts to improve emotion recognition are dissected in this section.

ISSN: 2366-1313

Facial expressions are represented and recognised in order to discern emotions.

A. Representation of facial expressions

Using a set of predetermined characteristics extracted from the original face picture, an automated facial expression recognition [2] is utilised to accurately depict the faces. The optimum characteristics are used to reduce expression variance within classes while increasing variation across classes. Optimal qualities have consistently led to successful identification. Existing research [3,4,5,6] used flow analysis to simulate muscular actions. The flow estimations were very sensitive to motion discontinuities and picture registration errors, and they were disrupted by both non-rigid motion and illumination changes. Facial geometry analysis, in which the positions and contours of faces are retrieved for the representation, was frequently employed in facial representation. Geometric feature-based representations rely on the detection and monitoring of precise and reliable face characteristics, which may be challenging to accommodate in many scenarios.

Facial expression modelling is another kind of representation. The face expressions were culled using a holistic spatial analysis [8]. The facial changes were extracted using a Gabor wavelet analysis applied either to the targeted area or to the whole face. Donato et al. [9] used principal component analysis to identify facial expressions. When compared to other methods for analysing facial images, the performance of the Gabor-wavelet representation stands out as very promising. The time and memory requirements of calculation are a downside of Gabor-wavelet representations. Therefore, Local Binary Patterns are often employed[15].

Recognising facial expressions (B)

Face expressions may be categorised using a variety of methodologies and tools, such as Neural Networks, Support Vector Machines, and so on. In the work of Lyons et al. [7], LDA is utilised to examine the training photos in order to generate discriminant vectors.[13][14]. The most difficult problem with facial expression recognition is doing it at low resolutions.

recognition method since high-definition video input is not now feasible for use in real-time software. The LBP method eliminates this issue, since research has shown its effectiveness even at low facial image resolutions. Another restriction is that only still photos, which do not capture the dynamic expressions of the face, may be used in the identification process. Basile[10] argued that utilising moving

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pictures will lead to more reliable facial emotion recognition.

Another drawback of existing approaches to facial emotion detection is that recognition systems often only take into account the frontal, high-resolution faces that have been captured under strict laboratory conditions. However, this cannot happen in real time since they only gather low-resolution photos. Using such low-quality photos has made expression recognition a challenging challenge in practise. The Viola-Jones technique, together with Haar feature selection and AdaBoost training algorithm, is utilised to identify the orbital and nasal areas. However, there is a downside to even this algorithm. Only frontal shots perform adequately.

III THE PROPOSED ARCHITECTURE

A. Identifying Workers' Emotions in Real-Time

The Real-time Employee Emotion Detection system is shown in Figure 1. A camera records the worker's picture.

The picture is analysed to locate the face, and once found, it is trimmed. To facilitate further resizing, the picture is pre-processed. The optimal picture location for a given feature is determined throughout the feature extraction process. To determine how an employee is feeling, we choose a small number of key best match spots in the image. The employee's recognised emotions are then shown on the screen.

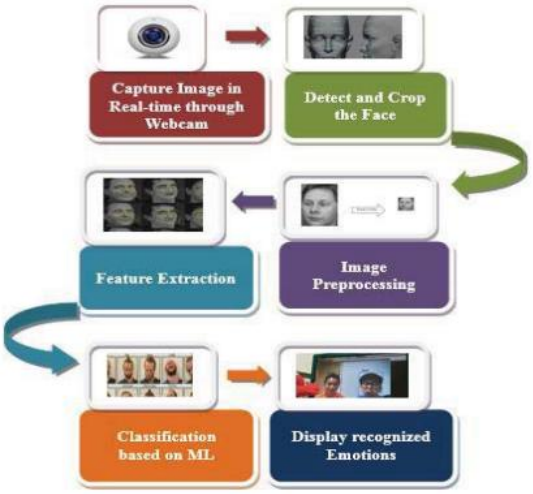

Figure 1. Block Diagram of Real-time Emotion Detection System.

The proposed Algorithm: Algorithm:

Real-time Employee Emotion Detection //Recognizes the emotions of the employee in the image captured and displays it Input: Employee image captured using webcam Output: Display of recognized emotions of the employee

Step1: Capture the image of the employee using webcam.

Step2: Detect the face in the image and crop it.

Step2.1: Select Haar-like features

Step2.2: Create an integral image

ISSN: 2366-1313

Step2.3: Select subset of features which helps more to identify face in image

Step2.4: Create classifier cascades

Step3: Pre-process the image for required size.

Step4: Find the best match position in the image.

Step5: Identify the emotions of the employee by choosing few important best match positions in the image.

Step6: Display the recognized emotions and also intimate the same to the concerned authority via message.

Step7: End

IV EXPERIMENTAL SETUP AND RESULTS

Priming A.

The Raspberry Pi is a small, inexpensive computer. The whole model after training is transferred to the Raspberry Pi. Every worker has access to a computer and a camera. The RtEED programme, which allows employees to track and share work-related expenses, will be placed on each worker's personal computer. After logging in, the user will be presented with tools to create a visual representation of the emotions identified by the RtEED system. Each worker's camera will be linked to a Raspberry Pi computer. Every half an hour, a camera will record an employee's expression, and that data will be sent to a Raspberry Pi. Several different OpenCV algorithms are utilised to analyse an employee's facial expressions. In the background, picture pixel values are calculated using the TensorFlow Python framework. Java and java script are used to create the user interface and the back end of a web application. Six different feelings may be identified by the RtEED system: joy, sorrow, surprise, fear, disgust, and rage. The experimental configuration of the RtEED system is shown in Figure 2.

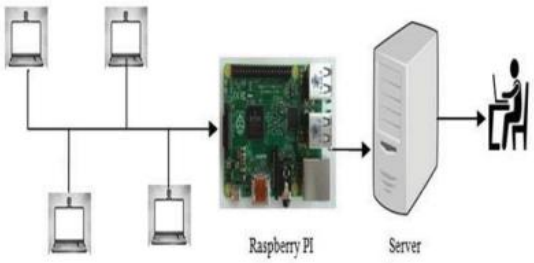

Figure 2. Experimental setup

B. The Origin of the Information

The RtEED system calls for a minimum of two data sets. Both play important roles: one in training a model, the other in validating its accuracy.

The model is trained using an existing data source, namely the CMU Multi-PIE Face Database. There are a total of 750,000 pictures included, with 337 persons taken into account. The photographs for the dataset were taken over the course of five

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months and four separate photoshoots from a total of 15 different vantage points under 19 different lighting scenarios. Facial expressions of workers are recorded in real-time through camera for use in validating the model.

RtEED system construction criterion C

Here, we'll go through the algorithms that make up the RtEED process and how they're employed at each stage.

Using a webcam, take a picture of an employee:

Every half hour, a camera will record an employee's expression.

Identify the existence of a face in the collected picture and crop it out; this is the focus of Module 2. Viola Jones algorithm, a deep learning system, is used to identify human faces in the photo. There are four primary phases to this method for finding and extracting the face from the capture picture.

a. Choosing Haar-like characteristics: Here, the picture is separated into brighter and darker areas based on the pixel values.

When making an integral picture, the values of adjacent pixels are combined together, since they will all contribute to the same quality.

b) Putting AdaBoost through its paces: A total of 160 thousand characteristics may be used for facial recognition. However, not every detail is equally crucial. Therefore, the AdaBoost method is utilised to narrow down the characteristics to those that will aid in facial recognition.

D. Outcomes

The dashboard of a web app typically consists of two sections: employee management and report generation. Information about workers' feelings is organised chronologically and shown in Manage Employee. The Manage Report summarises the number of times each emotion was expressed by each employee during a certain time period. Employers may use this data to better support their workers by responding to their emotional needs. The RtEEd system's control panel is shown in Figure 3. Employee emotions sensed by the RtEED system are shown and dated in Figure 4. The RtEED system's assessed emotion and the accompanying picture were shown to the employee as seen in Figure 5. Figure 6 shows the employee receiving a text message asking about his or her mood.

ISSN: 2366-1313

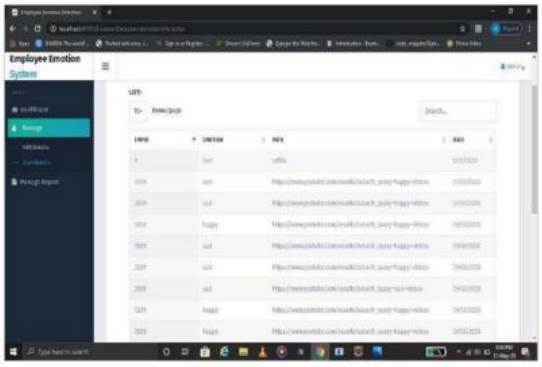

Figure 4. List of detected emotions of employees with date

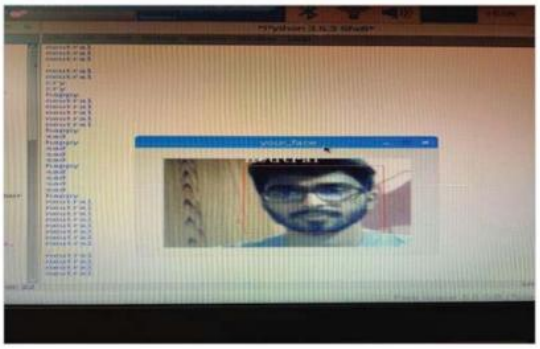

Figure 5. Sample output of emotion detection system

Figure 6. SMS sent to respective employee

Each part of an image is analysed in terms of the features chosen by the AdaBoost algorithm to create a cascade of classifiers. Every subregion is subject to cascading since each feature is added in succession. It is unnecessary to compare a subregion to the other features if it does not share a match with the chosen feature. This means that the face's subregion does not match.

Third, pre-process the picture to the specified dimensions; in this case, the image will be cropped to the specified dimensions before being sent as input to the Sobel channel technique for edge detection.

Find the optimal point in the picture where the model and the acquired image are a good match by utilising Active Shape Model (ASM).

To choose a few crucial best-match points in an employee's photograph in order to determine their emotional state, the Ada Boost algorithm is utilised.

There are six basic emotions to choose from, and whatever one is identified will be among them.

Sixth, show the identified feelings: Concerned parties will get messages informing them of the feelings that have been identified.

V Conclusion

Today, many companies place a premium on being able to read their employees' emotions to ensure long-term success. In this research, we propose the RtEED system to use machine learning methods to identify an employee's emotions in real

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time. Using a camera in real time for a certain time period, cropping the picture, and precisely identifying an employee's emotional state are all examples of the RtEED system's efficacy. In order to help the company, make smarter choices for the health and happiness of its staff.

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