Real-time Stress Detection using CNN

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Abstract: Stress is common in everyday life states of emotional strain that play a crucial role in the person's subjective quality of life. It has become an increasing serious problem in the current society.

The main motive of this paper is to detect stress of a person whose stress levels should be continuously monitored in order to provide healthy work environment.It can be mainly used in IT industry, as the software professionals work is too hectic and their stress levels must be controlled.Here, a system is proposed which captures the live video and based on the frame it detects whether a person is stressed or not by capturing the eyebrow and lip movements of the person who is working in front of the camera. It is done using Convolutional Neural Networks (CNN) on fer2013 dataset. After predicting stressed or not stressed it calculates the stress levels. This model is deployed in a web application using flask.

Keywords: Keras, OpenCV, Convolutional Neural Networks(CNN) , Tensorflow, Facial Expression

I. INTRODUCTION

Stress is most common problem is everyone's life these days. It causes physical and mental health problems. Stress is our body's response to pressure. It is a pressurized feeling. Many different situations or life eventscan cause stress. Everybody deals with stress differently. Theirability to cope with it depends on their genetic, early life events, personality, and social andeconomic circumstances. However, too much stress can cause negative effects leading to depression.As World Health Organization (WHO) says, Stress may be a psychological state drawback moving the lifetime of one in four voters. Human stress results in mental furthermore as socio-fiscal issues, lack of transparency in work, poor operating relationship, depression and eventually commitment of suicide in severe cases. It caneven leave them in a permanent stage of constant worry and fear.Inlong term it can affect physical and mental health very badly. This is whypeople are not happy despite prosperity. The stress can be caused by either emotional, physical or even mental.

One can divide stress into two types, Short-term and the other Long-term or chronic stress. Short-term stress is situational as soon as the situation changes, the stress is gone or over. Long-term stress is a long-term problem. That's why it is dangerous. Sometimes chronic stress is mostly hereditary or genes related also. It can make to end

anyone's life. Excessive stress leads one to death. Accepting stress is the first step to lead stress-free happy life. It is very important to detect and manage stress before it turns acute easy remedies are available at an affordable cost.

Research has been going on, since long to detect stress or stressed people. A lot of literature is available to study stress detection. There are traditional as well as scientific methods to detect people under stress.
A) Questionnaire: Psychiatrist provides a big questionnaire and based on the answers, they decide whether one is under stress or not. This method has its own limitations and drawbacks because many times the answers are not factual. Sometimes some of the questions in the questionnaire are not appropriate.
B) The other method is the sensor measuring method. The limitation of this method is, it is time-consuming and a bit expensive.

Stress management systems play a major role to notice the stress levels that disrupts our socio-economic mode. This demands counselling to be provided for the stressed people cope up against stress. Stress turning away is not possible however preventive actions helps to beat the stress. Currently, solely medical and physiological consultants will verify whether or not one is beneath depressed state (stressed) or not. one in every of the normal methodology to notice stress is predicated on

form.Nowadays as IT industries are setting a new peek in the market by bringing new technologies and products in the market. In this study, the stress levels in employees are also noticed to raise the bar high. Though there are many organizations who provide mental health related schemes for their employees but the issue is far from control.

Effects of stress on human face:
An issue of great interest is the correspondence between information reflected in and conveyed by the human face and the person's concurrent emotional experience. Darwin argued that facial expressions are universal, i.e. most emotions are expressed in the same way on the human face regardless of race or culture. There are several recent studies reporting findings that facial signs and expressions can provide insights into the analysis and classification of stress.The main manifestations of stress on the human face involve the eye brow movements and the lip movements.

Stress is detected by taking input as a picture from video frames and output is also image or characteristics related to that image. Image process primarily includes the subsequent 3 steps:
• Importing the image via image acquisition tools.
• Analysing and manipulating the image.
• Output within which result's altered image or report that's supported image analysis.

II.LITERATURE REVIEW

Maintaining a stress-free workplace must be given a prime importance for greater productivity and well-being of the employees. Several steps can be taken to help working professionals cope up with stress for mental well-being like counselling assistance, career guidance, stress management sessions, and health awareness programs. Early identification of employees who will be needing such a help will improve the chances of such measures being successful.

A. *Traditional Methods of Stress/Relaxation Measurement:*
Stress has been traditionally measured by some indicative parameters such as heartrates, galvanic skin response, pupil diameter and another method are Questionnaires that help to find a person prone to stress, some life events also helps to detect stress. But, these traditional methods require continuous observation or assessments or some

expensive sensors and also have to believe that the person is sharing correct answers of his or her mindset. And also not lying to make a better image in front of psychiatrists. There is a relationship between personality and psychological stress of a person.[1]

There's also a method where it conducts a study of stress, mobile usage as well as data which is captured from sensors. This study is based on different observations. It makes the use of an Android application.The Stress Collector (TSC) to collect the stress data. After installing the application on an Android mobile using (.apk) file, it continuously runs in the background to collect the mobile usage and sensor data periodically. It describes significant correlations among stress and smartphone data, and it performs better than the back reported levels. It helps to encourage for further investigations on stress prediction using smartphones. This methodrequires continuous observation or assessments or some expensive sensors.

III.OBJECTIVE

The general objective of the study is to propose a reliable, convenient and accurate detection system. The study has the following specific objectives:
- To predict stress in a person by the eyebrow and lip movements calculated by monitoring.
- To analyze the stress levels in the person.
- To classify whether the person is suffering from high stress or low stress based on the stress level calculated.

IV.METHODOLOGY

As the title suggests, here the stress is detected using the facial recognition.The dataset used for training is fer2013 dataset. It contains the greyscale images of seven different emotions.The dataset has 35,887 images. The emotions are Happy, Angry, Sad, Disgust, Surprise, Fear and Neutral.
The dataset is trained using Convolutional Neural Networks. Here five convolutional layers are used to train the dataset. These layers were implemented using Sequential Model. The entire training process had completed with 100 epochs with a batch size of 64. Adam optimizer is used to compile the model. The trained model is then saved in json file.
A camera is used to capture the near front sight of the person while they are working in front of the computer.

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Captured video is divided into sections of equivalent length and set of similar number of image frames are extracted from each part correspondingly and are examined using some image processing techniques. The stress detection module scans the binary image from the extreme left top to record the co-ordinates of the eyebrow and lips. The image detection includes the calculation of the variation in the place of the eyebrow and lip movements from its mean position. The displacement of eyebrow from its place is considered by examining the image for the eyebrow co-ordinates.The displacement of lips from its place is considered by examining the image for the lip co-ordinates. Emotion is detected for that particular frame. Emotions like Scared, Sad and Angry are classified as Stressed. Remaining emotions are classified as not stressed. The stress value is calculated from eyebrow and lip distance using some mathematical calculation like normalisation. The integrated decision of individual frames eventually determines the level of stress involved.If the stress level is more than 0.65 it is labelled as High Stress along with its level, else it is Low Stress along with its level. This is deployed in a web application using Flask framework.

Image Pre-processing: $G(i, j) = \alpha \cdot F(i, j) + \beta$, $\alpha > 0$ and β are called as gain and bias parameters, these are used to bright and contrast the image. Here $G(i, j)$ is output image pixel and $F(i, j)$ is input image pixel.[2]

Pixel transformation: Pixel transformation is a technique used in image processing to obtain pixel values. This transformation is used to make image generic and diverse. The image is converted into Gray scale image that is a colour image is converted into black and white or in shades of grey. Threshold of the image is found which is used to convert grey scale image into binary form, If the pixel value is greater than threshold pixel value is set to 1 otherwise 0.

Convolutional Neural Networks: A convolutional neural network is class of deep neural network, most commonly applied to analyze visual imagery.A convolutional neural network consists of an input layer, hidden layers and an output layer.

*Sequential model:*The sequential is used to create models layer-by-layer. It is appropriate for a plain stack of layers.Each layer has exactly one input tensor and one output tensor.Sequence modeling is the process of generating a sequence of values by analyzing a series of input values. These input values could be time series data

where a specific variable, say the demand for a particular product, varies over a period of time. The output could be the prediction of demand for consequent periods.
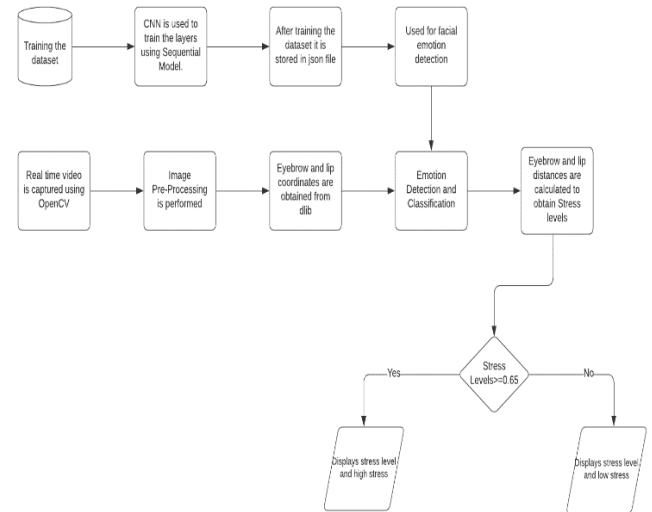

Figure 1: Flowchart of the system.

V.RESULTS
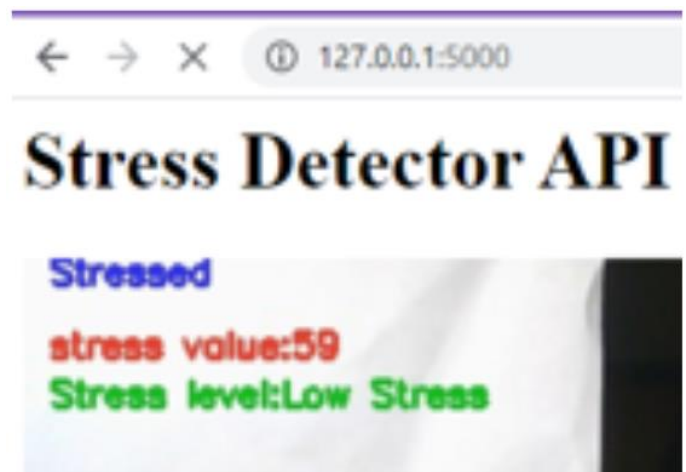Below are the results obtained after implementation:
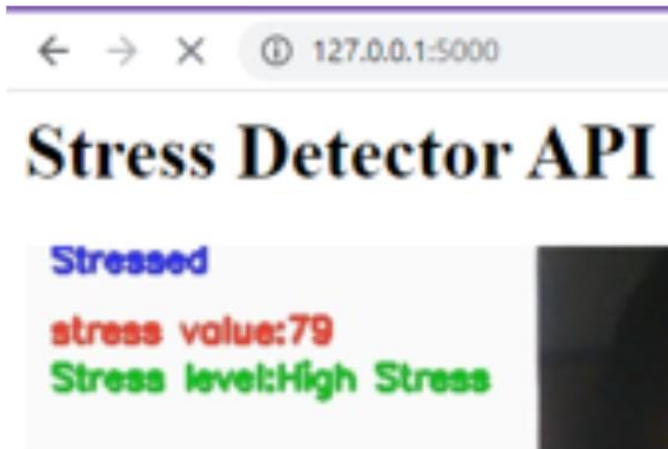

Figure 2: Low Stress

Figure 3: High Stress

VI.CONCLUSIONAND FUTURE SCOPE OF WORK

This System is designed to predict stress in the person by monitoring captured video. The image is captured from the frames. The captured images are used to detect the stress of the user based on some standard conversion and image processing mechanisms. Then the system will analyze the stress levels by calculating eyebrow and lip movements using Machine Learning algorithms which generates the results that are more efficient.

The stress report of the particular person along with suggestions to manage the stress can be sent to the person. This could be carried out as further work.

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