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Stress Detection in IT Employees Using CNN

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Abstract - In contemporary society, Stress has emerged as a pervasive issue affecting a majority of individuals. Despite their material prosperity, people often find themselves dissatisfied due to pressures of stress. Stress is a difficult phenomenon that can manifest in emotional, physical, and mental forms. The objective of this project is to be identifying indicators of stress in IT professionals over the application of sophisticated image processing and machine learning methods. This technology represents an improvement over previous approaches for stress detection that didn't account for the subjective experiences of employees or real-time detection. The current model incorporates both periodic and live detection of employee emotions. Automated stress detection serves to mitigate health risks and enhance the well-being of both the IT Company and its employees. By understanding the emotional states of IT professionals, businesses can provide appropriate guidance and achieve better outcomes.

Key Words: Stress, Machine learning and IT professionals.

1. INTRODUCTION

Mental stress has emerged as a significant concern in contemporary times, particularly among the younger generation. The age group that was once deemed carefree is now grappling with a substantial amount of stress. The escalation of stress levels in current times has given rise to a plethora of issues such as suicide, depression, stroke and heart attack. Recently, stress has become an integral part of professional life, especially in today's fiercely competitive economy. In the workplace, an individual has to continuously face several situations, such as work overload, job insecurity, lack of job satisfaction, and the pressure to stay up-to-date. The continuous presence of stress can lead to several negative health effects, such as high blood pressure, lack of sleep, susceptibility to infections, and cardiovascular disease. All these situations result in mental stress, that has evolved the leading cause of many diseases. These negative impacts include affect the employees' health and well-being, but also affect workplace productivity and overall profit.

Figure 1 shows the basic conceptual model of stress. The significance of sleep, physical activity, number of working hours and change in heart rate with regard to stress levels are basic factors which affects the stress level.

Human pressure can result in mental health issues, as well as socio-economic problems, lack of transparency in the workplace, poor working relationships, depression, and in severe cases, even suicidal tendencies. It can leave individuals in a prolonged state of constant concern and fear. In long haul it can influence physical and psychological well necessarily. Therefore, individuals are unsettled regardless of flourishing. The pressure can be brought about by profound, physical, or even mental.

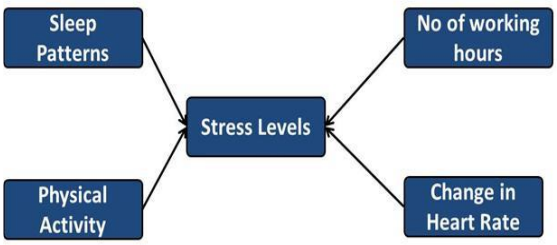

Fig -1: Conceptual model of stress

Stress management systems assume a crucial role in the identification of stress levels that impede the socio-economic functioning. This necessitates the provision of counselling to assist individuals in coping with stress. Although it may not be entirely feasible to entirely evade stress, precautionary measures can aid in mitigating its impact. Presently, only physiological and medical experts are capable of determining whether an individual is experiencing depression or not. an example of conventional methods of identifying stress based on its manifestation. The information technology industry is currently introducing innovative items and technologies into the market, many organizations offer mental health-related programs for their employees. However, the issue remains largely uncontrolled.

Proposed system presents a computer learning, visual processing model aimed at identifying IT employees who are overworked. This model is an improved version of older stress detection systems that has not included live detection or personal counseling. Stress detection methods that don't include real-time monitoring or individual counseling are being updated in this project. A survey is used to collect data on employee's mental stress levels in order to provide effective stress management results. In order to get the most of the employees, this project will look at stress management and ways to create healthy, spontaneous work environment.

2. LITERATURE SURVEY

[1] Utilizing stress level detection blood pressure heart rate for stress management using infrared by N. Widanti, B. Sumanto, P. Rosa and M.F. Miftahudin, proposed work in which stress detector classifies a stressed individual from a normal one by acquiring his/her physiological signals through appropriate sensors include Electrocardiogram (ECG), Galvanic Skin Response (GSR) etc,. These signals are pre-processed to extract the desired features which depict the level of tension in working individuals. Support Vector Machine (SVM) and K-Nearest Neighbors (KNN) are investigated to classify these extracted feature set. The result indicates feature vector with best features having a strong influence in stress identification. An effort is made to determine the best feature set those results in maximum classification accuracy. Proposed techniques are applied on benchmark SWELL-KW dataset and state-of-art results are obtained.

[2] Stress Detection via ML and Processing of Images Techniques by Nisha Raichur, Nidhi Lonakadi and Priyanka Mural, proposed work involves the capture of real-time non-intrusive videos, which are utilized to notice the emotional state of an individual by analysing their facial expressions. Every video frame is analysed to identify the individual's emotion, & the result regarding their anxiety level is made based on consecutive hours of captured video. The employed technique involves training a model and analyzing changes in analyzing features. Theano, a Python framework, is utilized to improve the linear regression model's creation and execution times that serves as the ML algorithm in this study. The experimental results show that, in comparison to other systems, the one that was developed performs well on data across all age clusters to the generic model.

[3] Identifying anxiety based on social network connections by Huijie Lin, JiaJia and JiezhonQiu, in which On social media, a user's stress levels are highly correlated with the ones of their friends. A sizable dataset from real-world online communities has been used to perform a comprehensive examination into the relationship between users' psychological stress and social interactions. An initial set of composed of words, visual, and social qualities associated with stress have been described from a number of angles. A novel hybrid model has since been put forth to use tweet content and interpersonal data for stress detection. This model blends an underlying graph framework with a network of convolutional neural networks. The results of the studies show that the suggested model can improve detection performance in F1 score by 6–9%. Several fascinating occurrences have also been found by analyzing the social interaction data.

[4] Machine learning methods for stress forecasting in working employees] by A.V. Thota, A.Dharun, and U. S. Reddy, where the main goal of this study was to use machine learning methods to analyze trends in stress in working adults and pinpoint the critical variables that have a significant impact on stress levels. Data from the 2017 OSMI psychological wellness survey was used to accomplish this purpose, in particular the responses of those who work in the tech sector. The model was trained using a variety of machine learning

approaches after the data had been cleaned up and prepared. Following that, the models' accuracy was determined and compared, with boosting showing the greatest accuracy among the used models. The key elements that affect stress, such as gender, genealogy, and the likelihood of health benefits at work, were identified using decision trees. These results give industries useful information to focus their efforts on lowering stress and making workplaces more comfortable for workers.

3. ARCHITECTURE

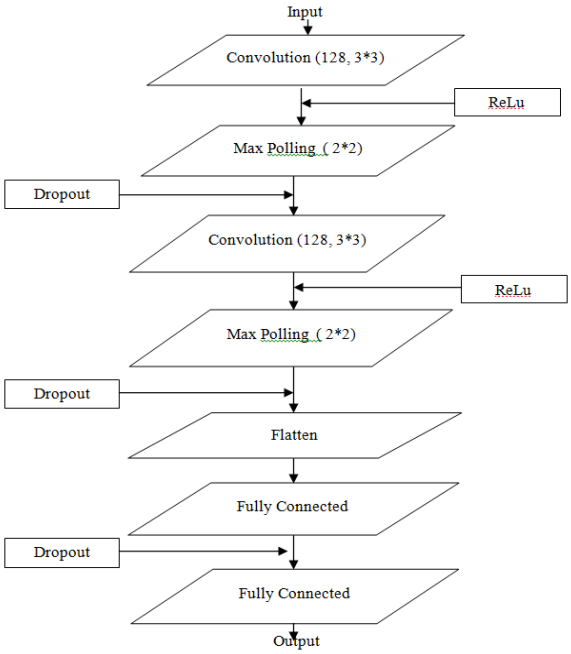

Fig -2: Architecture of Convolutional Neural Network

A neural network architecture called the Convolutional Neural Network as (CNN) has gained widespread usage in the domain of computer vision. The CNN architecture comprises at least one convolutional layer that serves as the initial layer and is in charge of sifting through the supplied image for features. The feature extraction process is accomplished through the application of convolutional filters to the input, which analyze specific regions that the input at a given time before transmitting the output to the subsequent layer. The convolutional layer is main for generating a feature map by utilizing convolutional filters. In order to reduce dimensionality and prevent overfitting, a pooling layer is employed. The most frequently utilized pooling layer is max pooling, which selects the maximum value within the pooling window. This process effectively reduces training time.

4. METHODOLOGY

As the title suggests, here the stress is detected using the facial recognition. The data is accessed & trained in fer2013 dataset. It contains the grey scale images of seven different emotions. The dataset contains 35,887 images. The emotions are Happy, Surprise, Neutral, Fear, Angry, Sad and Disgust. These trained data sets are used for Convolutional Neural Networks. Figure 3 shows Architecture of proposed System.

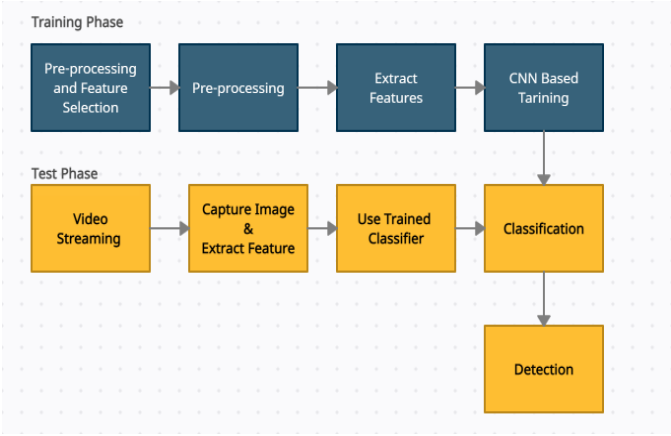

Fig -3: Methodology Steps

Above model used five layers for train the dataset. These layers were implemented using sequential model. The entire training process had completed with 100 epochs an assortment size 64. Adam optimizer necessary to compile the steps. This trained model is then saved in json file. A camera has used to take pictures the near front sight of the person while they are working in front of the computer. Captured video is separated into parts of equivalent length and set of similar number of image frames they are taken from each part correspondingly and are examined using some image processing techniques. The stress detection module scans the image from the extreme left top to record the co-ordinates of the eyebrow and lips. The image detection includes the determining the disparity 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. This is deployed in a web application using Flask framework.

5. RESULTS

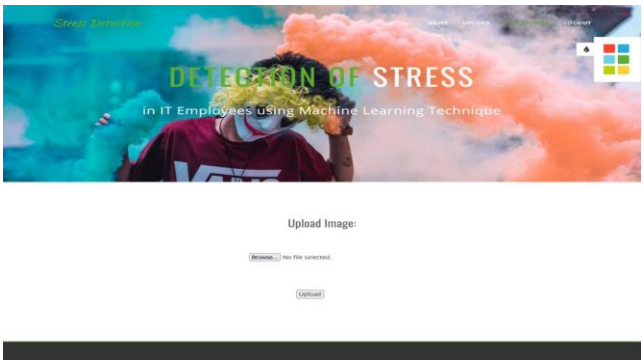

Fig -4: Web application page to upload the image

Figure 4 shows page where user can upload the images. Once successful registration approved by admin. User login and upload any kinds of images.

Fig -5: Result of the uploaded image

The above figure represents the result of the uploaded image by user. Once user has uploads his images. Admin see the result of uploaded images in his login which displays the employees different stress and emotions.

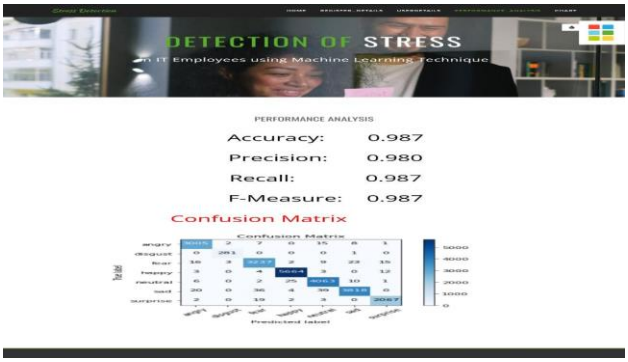

Fig -6: Performance Analysis

Figure 6 represents the efficient of our trained ML model which shows that we got accuracy of 98%. We used confussion matrix along with accuracy, memory, and F-measure to calculate the effectiveness of our model.

6. CONCLUSION

The design of a system has predicted anxiety or stress of the person by uploading images and monitoring captured video in real time. To identify stress, the system combines picture processing & deep learning. To extract features, images were gathered and analyzed. The image is captured from the frames. The user's stress is determined from the acquired photos using machine learning algorithms, which yield more effective results than conventional conversion and image processing techniques. The algorithm processing outputs has used to train the model and test it with the test dataset. Despite of fact that the acquired results are preliminary due to the small number of persons involved or technical information, the key added value of this system is acquired by permitting end-user to correctly recognize ongoing stress in order to decrease future health risk factor.

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