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MACHINE LEARNING BASED HUMAN STRESS DETECTION

[1]GILAKA GOPIRAJU, [2]A. CHENNA KESHAVA REDDY

[1]PG Scholar, Dept. of MCA, Newton's Institute of Engineering, Guntur, (A.P)

[2]Assistant professor, Dept. of CSE, Newton's Institute of Engineering, Guntur, (A.P)

Abstract: *The major goal of this study is to use vivid Machine Learning and Image Processing methods to identify stress in the human body. Our system is an upgraded version of previous stress detection systems that did not include live detection or personal counselling, but this system includes live detection and periodic analysis of employees, as well as detecting physical and mental stress levels in them and providing proper stress management remedies via a survey form. This study completed in some steps including data collection using closest keywords on Web of Science (WoS) database, design network visualization based on previous data, evaluation of selected research article, and finally conclude the all results. This study mentioned the future direction for the upcoming research in more scientific and significant manner.*

Keywords: *Machine learning, stress detection, support vector machine, web of science.*

I. INTRODUCTION

Stress management systems are necessary for detecting stress levels that affect our socio-economic situation. According to the World Health Organization, stress is a mental health disorder that affects one out of every four people (WHO). Mental and financial troubles, as well as a lack of clarity at work, bad working relationships, despair, and, in extreme situations, death, are all symptoms of human stress. This necessitates the provision of therapy to help stressed people manage their stress. While it is impossible to totally eliminate stress, taking preventative measures may help you cope. Only medical and physiological peoples can now determine whether or not someone is depressor (stressed). A questionnaire

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is one of the most used methods for detecting stress [1]. This technique relies primarily on individual responses; people will be hesitant to communicate whether or not they are worried. Automatically detecting stress lowers the likelihood of health problems and improves society's well-being. This involves the creation of a scientific approach for assessing stress levels in people using physiological markers. Since stress is such a significant societal contribution, a variety of approaches for detecting it have been investigated. It enhances people's quality of life, according to Ghaderi Tal. Stress was assessed using data from respiration, heart rate (HR), face electromyography (EMG), Galvanic skin response (GSR) foot, and GSR hand, with the finding that parameters related to the respiratory process are critical in stress detection [2].

Maria Viqueira et al. present a method for anticipating mental stress that relies only on GSR as a physiological sensor and uses a standalone stress detecting device. Electrocardiograms alone were utilized by David Liu and colleagues to predict stress levels (ECG). The effectiveness of multimodal sensors in detecting stress in working individuals is investigated experimentally. Sensor data from pressure distribution, heart rate, blood volume pulse (BVP), and electro dermal activity is used in this investigation (EDA). In addition, an eye tracker sensor is used, which analyses eye movements in connection with stressors such as the Stroop word test and information regarding pick-up tasks [3].

Nowadays, the IT industry is creating a new standard in the market by introducing new technology and goods. Employee stress levels were also found to set the bar high in this research. Despite the fact that many companies provide mental health benefits to their workers, the problem remains out of control. In this study, we attempt to go further into the topic by attempting to identify stress patterns in working employees in

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businesses. We plan to use image processing and machine learning methods to analyse stress patterns and narrow down the elements that greatly influence stress levels. Machine learning approaches such as KNN classifiers are used to categorise stress. The employee's picture is snapped by the camera, which acts as input, and image processing is employed at the first step for detection. Picture processing is used to improve an image or extract relevant information from it by converting the image to digital form and executing operations on it. By taking a picture from video frames as input and producing an image or attributes related with that image as output.

II. LITERATURE SURVEY

G. Giannakakis et al. [4] Through video-recorded face clues, this research creates a framework for detecting and analyzing stress/anxiety emotional states. Through a range of external and internal stresses, a complete experimental methodology was designed to produce systematic diversity in emotional states (neutral, calm, and stressed/anxious). In order to measure emotion expression more objectively, the study focused mostly on non-voluntary and semi-voluntary facial signals. Eye-related events, mouth activity, head motion characteristics, and heart rate assessed via camera-based photo-plethysmography were also investigated. In each experimental phase, a feature selection technique was used to pick the most robust characteristics, followed by classification algorithms that discriminated between stress/anxiety and neutral states with reference to a relaxed condition. In addition, a ranking transformation based on self-reports was presented to study the relationship between face attributes and a participant's reported stress/anxiety level. Specific facial signals generated from eye, mouth, head, and camera-based cardiac activity acquire excellent accuracy and are acceptable as discriminative markers of stress and anxiety, according to the findings.

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Nisha Raichu et al. [5] Stress is an uncomfortable state of emotional arousal that individuals feel in settings such as sitting in front of a computer for lengthy periods of time. Computers have become a way of life; we spend so much of our time on them that we are more impacted by the ups and downs they create. One cannot totally avoid using computers for work, but one should at least limit his or her use if he or she is concerned about being stressed at a certain moment. Monitoring a person's mental state while working in front of a computer for an extended period of time is critical for their safety. This research uses real-time nonintrusive movies to assess a person's emotional state by analyzing their facial expression. Each video frame contains a distinct feeling, and the stress level is determined in the hours after the video recording. We use a method that enables us to train a model and compare differences in feature prediction. Theano is a Python framework aimed at speeding up the execution and development of the linear regression model, which is employed as a deep learning technique in this case. The results of the experiments reveal that the devised method works effectively with a generic model of all ages.

U. S. Reddy et al.[6] Stress problems are a widespread problem among today's working IT professionals. Employees are more likely to experience stress when their lifestyles and work environments change. Despite the fact that many sectors and corporations provide mental health-related programs and attempt to improve the office environment, the problem remains out of Control. In this research, we will use machine learning approaches to examine stress patterns in working people and to identify the elements that have a significant impact on stress levels. Data from the OSMI mental health survey 2017 answers of working professionals in the IT sector were used to help with this. After proper data cleaning and pre-processing, we used a variety of Machine Learning approaches to train our model. The

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accuracy of the models mentioned above was determined and compared. Among the models used, boosting had the best accuracy. Gender, family history, and the availability of health benefits in the job were found as key characteristics that impact stress using Decision Trees. With these findings, businesses may focus their efforts on reducing stress and providing a more pleasant working environment for their workers.

Tanev et al. [7] The diagnosis of chronic stress is crucial in predicting and lowering the risk of cardiovascular disease. This project is pilot research with the goal of establishing a technique for identifying short-term psychophysiological alterations using HRV properties. The goal of this pilot project is to identify and acquire insight into a collection of characteristics that might be utilized to detect psychophysiological alterations associated with chronic stress. Images, noises, mental activities, and rest were used to evoke four distinct forms of arousal, which were then identified using linear and non-linear HRV characteristics from electrocardiograms (ECG) obtained by the wireless wearable ePatch® recorder. Sample entropy, detrended fluctuation analysis, and normalized high frequency features were used to get the greatest identification rates for the neutral stage (90 percent), acute stress stage (80 percent), and baseline stage (80 percent). It was discovered that standardizing nonlinear HRV variables for each participant was a crucial component in improving classification outcomes.

Zenonos et al. [8] Workplace stress, anxiety, and depression are detrimental to employees' health and productivity, and they are costly. Sensor technologies, such as smartphones and wearables with physiological and movement sensors, have been the focus of recent research in this field. In this paper, we look at the feasibility of deploying such gadgets for mood detection in the workplace. Every two hours, we propose a new mood detection

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framework that can recognize five intensity levels for eight distinct kinds of emotions. We also propose a smartphone app ('Healthy Office') that is meant to promote formal self-reporting and give data for our model. In a small-scale user research, we gather wearable sensing data in an office setting to assess our technology. Our trials have shown encouraging results, enabling us to accurately distinguish different types of emotions.

III. PROBLEM STATEMENT

Image capturing is automated, so it collects photographs whenever a typical behaviour occurs. The detecting of system will be fooled. If the picture is distorted while being captured, the system will provide incorrect findings. Continued picture capture results in massive, useless datasets. Detection will become more time demanding or incorrect as a result of the auto collected picture datasets.

IV. PROPOSED SYSTEM

Machine learning is a basically ability by which computer can learn by self without being especially program. It is the scientific study of statistical model and algorithms that computer system usages to complete a specific duty without using patterns, obvious instructions, and implication as an alternative. It is divided into four parts including supervised, unsupervised, semi supervised, and reinforcement machine learning. The many physiological signals are used in the detection, diagnosis, and prediction of the different diseases like heart diseases, mental disorders, skin disorders, and eye disorders

Lai, Siddiqui and Heyat group's and used physiological signals and different machine learning classifiers to detect sleep disorders. Machine learning methods opened the new way to easily detect, diagnose, predict, and calculate the risk of any diseases. This study provides an outline of the stress and use of machine learning methods in the stress management. Fig. 1 demonstrated the role of machine

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learning in assessing the stress of human

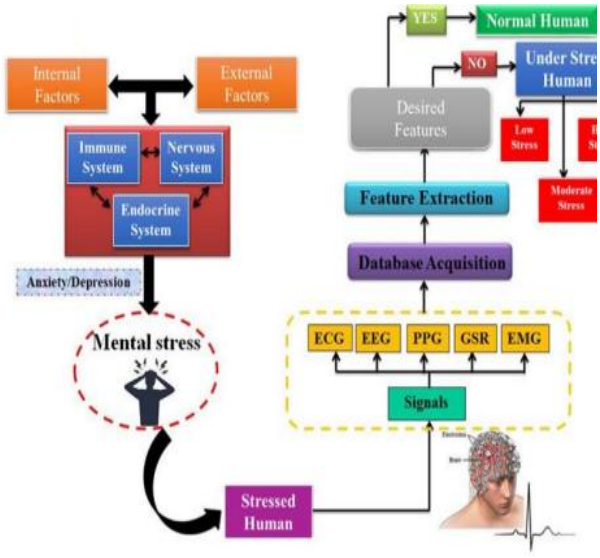

Fig.1 Role of machine learning in stress assessment

V. RESULT AND DISCUSSION.

Table.1 Previously published article based on closest keywords such as stress, machine learning, human and health

Year	Major	Classifier	Objective	Journal Name
2020	PHATE, MI	KNN, RF, SVM	Protection	Analytica Chimica Acta
2020	MEG, EEG wave	SVM	Diagnosis	Scientific Reports
2019	ART	SVM	Treatment	Scientific Reports
2018	Medical features, Demographic features	LR	Prediction	Journal of Anxiety Disorders
2017	T-test, Bhattacharya distance	LR, SVM, NB	Detection	IEE Access

In Table 1, we evaluate the five research articles based on author, year, major, classifier, objective, journal, and publication house. Additionally, the Fig. 2 (a) and Fig. 2 (b) represented the network visualization [31]-[34] and world cloud of this study, respectively. Previously, Zhang et al. [26] used novel Potential of Heat-diffusion for Affinity-based Transition Embedding (PHATE) and Mutual Information (MI) techniques to imagine the data of Raman spectral. They used KNN, RF, and SVM machine learning classifiers for the analysis, effectiveness, and treatment of the oxidative stress. Zhang et al. [27] used EEG and MEG wave to detect the Post Traumatic Stress Disorder (PTSD) using SVM supervised machine learning classification. They used 23 subjects and extracted EEG waves such as theta, gamma, alpha, and beta as a feature extraction and classify the signals using SVM classifier on MEG signals. Dubey et al. [28] studied that Assisted Reproductive Technology (ART) used for the counting of sperm cell and treatment of infertility. They used

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SVM and achieved 91.18 % sensitivity of the system. Papini et al. [29] used hospital and demographic features for the prediction of stress using LR classifier. Subhani et al. [30] extracted Bhattacharya distance as features and discriminate the control and stress group using different classifiers such as LR, SVM, and NB

VI. CONCLUSION

Globally, stress is one of the health epidemics of 21st century. Consequently, it is essential to control and monitor of stress, to prevent the harmful consequences in future. We obtained that SVM would be helpful in the detection and prediction of stress disorder. In addition, several emerging techniques such as unsupervised machine learning, deep learning methods, quantum techniques, and block chain technology can be of great importance to diagnose, and predict the stress with high accuracy.

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