ISSN NO: 9726-001X

Volume 12 Issue 02 2024

JOURNAL OF CURRENT SCIENCE

STRESS DETECTION IN IT PROFESSIONALS USING IMAGE PROCESSING AND MACHINE LEARNING

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ABSTRACT— The primary goal of our study is to identify IT workers who are experiencing stress by using advanced methods in machine learning and image processing. Our system is an improvement over previous stress detection systems that did not include live detection or personal counseling. Instead, our system includes both of these features, as well as periodic analysis of employees to detect levels of physical and mental stress and to provide them with appropriate remedies for stress management through the use of survey forms. The primary goals of our system are stress management, creating a healthy and spontaneous work atmosphere, and optimizing the performance of workers when they are on the clock.

Keywords: Image Processing, Support Vector Machine, Sequential Minimal Optimization.

I. INTRODUCTION

In order to identify the stress levels that are interfering with our socioeconomic way of life, stress management methods are crucial. One in four people experience some kind of mental health issue related to stress, according to the World Health Organization (WHO). Problems with mental and social finances, hazy job goals, strained relationships at work, sadness, and, in extreme circumstances, death, are all outcomes of human stress. As a result, those who are already experiencing stress should have access to counseling services. Although completely avoiding stress is difficult, taking measures to lessen its impact may help. At this time, only trained professionals in the fields of medicine and physiology can diagnose a depressed or stressed individual. Using a questionnaire is one of the more conventional ways to identify stress. People will be hesitant to report whether they are worried or not since this approach is entirely dependent on their responses. Society

ISSN NO: 9726-001X

Volume 12 Issue 02 2024

benefits from automatic stress detection since it reduces the likelihood of health problems. A scientific method that automates the identification of stress levels in people by using physiological signals is necessary in light of this. Since stress detection is a major social contribution that improves people's lifestyles, it is explored in many literatures. Findings from an analysis of stress utilizing data from respiration, heart rate (HR), face electromyography (EMG), galvanic skin response (GSR) in the feet and hands, and GSR in the hands reached the conclusion that respiration-related characteristics play a significant role in stress identification. Using GSR as the only physiological sensor, Maria Viqueira et al. explains how to use independent stress detecting technology for mental stress prediction. An ECG-only stress level prediction study was proposed by David Liu et al. In, the experimental discussion centers on the multimodal sensor's effectiveness in detecting workers' stress. Pressure distribution, heart rate, blood volume pulse, and electro dermal activity (EDA) are some of the sensors that this makes use of. Additionally, a sensor that follows the user's eye movement in response to stimuli like the Stroop word test and data pertaining to pickup tasks is used. The authors of used a suite of non-invasive sensors to measure physiological signals including electrocardiogram (ECG), graphene scintillometry (GSR), electromyography (EMG), and saturation of peripheral oxygen (SpO2). This allowed them to identify subjective stress. Data collected from physiological sensors, including heart rate (HR), electromyography (EMG), and respiration rate (RSR), are used to establish continuous stress levels. By generating ICT-related stressors, it is possible to successfully detect stress using skin conductance level (SCL), heart rate (HR), and facial electromyography (EMG) sensors. Several pattern recognition methods allow for automated stress detection to be done. In order to determine the amount of stress, all of the sensor readings are compared to a stress index. The authors of this study used the Bayesian Network, the J48 algorithm, and the Sequential Minimal Optimization (SMO) algorithm to predict stress levels in 16 people subjected to four different stressors. The stress levels were governed by cardiac statistical characteristics (GSR), HRV (heart rate variability), and the power spectrum components of electrocardiogram (ECG). Anxiety levels may be further detected by extracting characteristics from regularly used physiological signals (e.g., electrocardiogram (ECG), electromyogram (EMG), graphs of

ISSN NO: 9726-001X

Volume 12 Issue 02 2024

signal strength (GSR), blood volume (BVP), etc.) and measuring them with the right sensors. Using the chosen General Regression Neural Network (GRNN) model, it is shown that stress detection is better balanced with smaller clusters. As a consequence, there are several permutations of the sensor signal properties that provide more accurate predictions of the ongoing anxiety level. Low frequency power (LF) (from 0.04 Hz to 0.15 Hz), high frequency power (HF) (from 0.15 Hz to 0.4 Hz), and the ratio of low frequency power to high frequency power are all characteristics of the frequency domain. allows continuous real-time stress detection in, together with temporal domain metrics such as the mean, median, and standard deviation of the cardiac signal. After applying two stressors—the pickup task and the stroop-based word test—to decision tree classification using PLDA, the authors found that stressor-based classification was unsuccessful. Gjoreski et al. developed stress detection classifiers using electrocardiogram (ECG) and heart rate variability (HRV) data in 2016. The GRNN model is used to analyze the ECG features in order to assess the amount of stress. In order to categorize the degree of stress, data on heart rate variability (HRV) and RR intervals (the time between two consecutive Rs) are used. The classification technique that was most often utilized was Support Vector Machine (SVM) because of its strong mathematical foundation and ability to generalize. We found that a linear SVM using ECG frequency data and HRV features outperformed alternative model options when we used it to build models using SVM. We explored several kernels for this purpose. In recent times, the information technology sector has been at the forefront of market innovation, introducing groundbreaking goods and solutions. Employee stress levels are also shown to be elevated in this research. Despite the fact that many companies provide programs to help their workers with mental health, the problem is still out of hand. In this paper, we delve into this issue by attempting to identify patterns of stress in working employees using image processing and machine learning techniques. Our goal is to analyze these patterns and identify the factors that significantly impact stress levels. When it comes to stress classification, machine learning methods such as KNN classifiers are used. At the first level of detection, image processing is used. The camera takes a picture of the employee and uses it as input.

II. LITERATURE SURVEY

Identifying stress and anxiety with video facial cues: This work creates a framework for using video-recorded face signals to identify and analyze emotional states associated with stress. Through a range of internal and external stresses, a comprehensive experimental methodology was developed to cause systematic variability in emotional states (neutral, calm, and stressed/anxious). To evaluate the emotion representation more objectively, the study was primarily focused on non-voluntary and semi-voluntary facial signals [1].Stress Identification Through Image Processing and Machine Learning Methods: This device records a live, non-intrusive video and uses facial expression analysis to determine a person's emotional state. Every video frame is analyzed to identify a distinct emotion, and the stress level is determined within hours of the video being recorded. The method the system uses enables it to train a model and examine variations in feature prediction accuracy. [2].Machine Learning Methods for Stress Prediction in Working Employees: In this study, the system makes use of machine learning methods to assess stress patterns in people in the workforce and to identify the variables that have a significant impact on stress levels. After the necessary data cleaning and preprocessing, we trained our model using a variety of machine learning approaches.[3]].

Machine learning methods for predicting stress in employed workers

Stress-related illnesses are a prevalent concern among today's employed IT workers. Employee stress is more likely to occur as a result of shifting work cultures and lifestyles. Even though a lot of businesses and sectors provide programs connected to mental health and attempt to improve the environment at work, the problem is out of control. In order to identify the elements that significantly influence stress levels, we would want to examine stress patterns in working adults using machine learning approaches. In order to do this, information from working professionals in the IT sector who participated in the 2017 OSMI mental health survey was taken into account. After the necessary data cleaning and preprocessing, we trained our model using a variety of machine learning approaches. The correctness of the aforementioned models was discovered and analyzed in comparison. Out of all the models used, boosting had the best accuracy. Using Decision Trees, it was possible to identify the key variables that affect stress, including gender, family history, and the availability of health benefits at work.

Utilizing physiological cues for customized stress assessment via cluster-based analysis

The advancement of wearable sensors and biosignal processing technology has made it feasible to identify physiological indicators of human stress. However, a significant obstacle to precise and trustworthy stress estimate is the inter-subject variation in stress reactions. In order to account for inter-subject variations, this study suggests a unique cluster-based analytic approach to evaluate subjective stress using physiological data. An index of the State Trait Anxiety Inventory is used to represent the different degrees of stress that human subjects experience throughout a series of task-rest cycles, which is when the physiological data are gathered. Subsequently, two phases of physiological feature analysis are used to generate a quantitative assessment of stress: Using a k-means clustering technique, patients were divided into two groups (clusters) and then the general regression neural network was used to evaluate stress on a cluster-by-cluster basis. Comparing the experimental findings to conventional approaches without clustering, a significant increase in assessment accuracy is seen. The suggested approach is helpful in creating individualized, intelligent solutions for human stress management.

Combinatorial fusion is used to select and combine sensor features for stress recognition.

Identification of stressful driving conditions is a critical matter concerning security, safety, and well-being. Systems and sensors have been installed or made available as wearable technology for drivers. To anticipate symptoms, features are taken from the gathered data and blended. Choosing the feature set that is most relevant to emphasize is the difficult part. In this work, we provide a feature selection technique that takes into account the variety and performance of two characteristics. A combinatorial fusion is then used to merge the chosen feature sets. Additionally, we contrast our findings with those of other combination techniques as k-nearest neighbor (kNN), C4.5, support vector machines, naïve Bayes, and linear discriminant function (LDF).

III. PROPOSED SYSTEM

The graphic below provides an overview of our suggested system.

ISSN NO: 9726-001X

Volume 12 Issue 02 2024

JOURNAL OF CURRENT SCIENCE

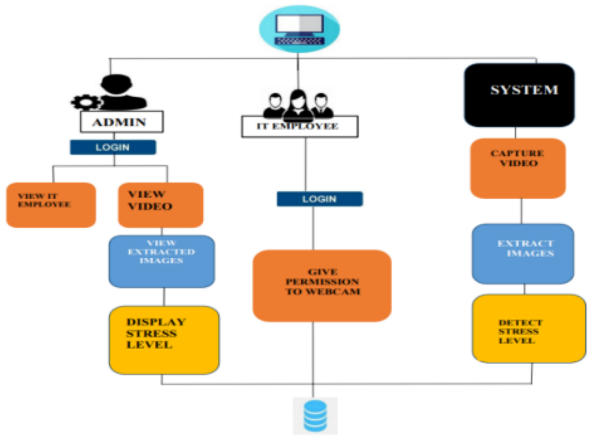

Fig. 1: System Overview

Implementation Modules

Admin

- To access this module, the administrator must provide a valid user name and password. He can carry out a number of tasks after successfully logging in, including viewing people and granting access, identifying stress, and forecasting the outcome.

Users

- In this module, users initially provide their information to register with the system. Following his successful registration, he awaited the administrator's approval. He entered the system using a legitimate username and password after receiving permission from the admin. Once he logs in successfully, he may carry out the following tasks: submit a picture to detect emotions, use a live camera to detect emotions, and forecast the outcome.

Implementation Algorithms

K NN

- One of the most basic machine learning algorithms, based on the supervised learning approach, is K-Nearest Neighbor.
- The K-NN method places the new case in the category most comparable to the existing categories based on the assumption that the new case and data are similar to the examples that are already available.
- The K-NN algorithm classifies a new data point based on similarity after storing all the relevant data. This indicates that the K-NN algorithm can quickly classify newly discovered data into a well-suited category.
- Although the K-NN technique is mostly utilized for classification issues, it may also be employed for regression. aggression

IV. RESULTS

ISSN NO: 9726-001X

Volume 12 Issue 02 2024

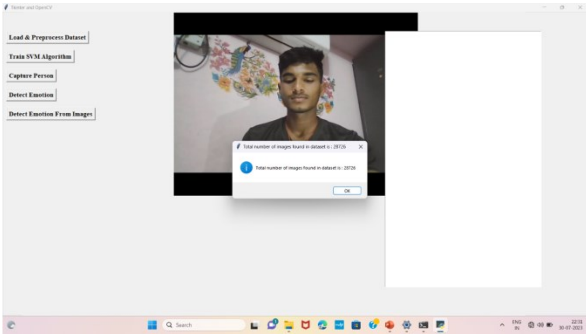

Fig. 2: Load Dataset

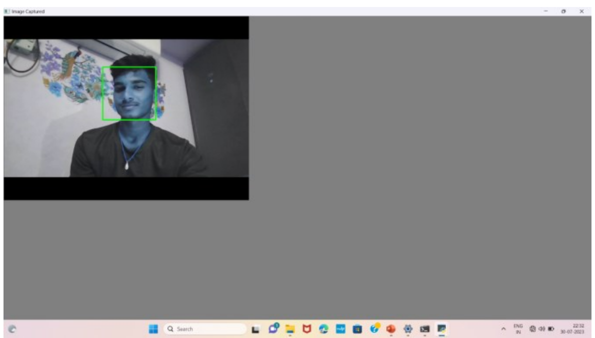

Fig. 3: Capture Image

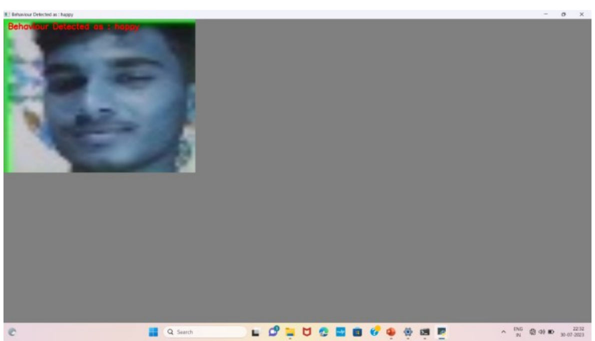

Fig. 4: Finding Emotion

V. CONCLUSION

By tracking photos of verified users, the Stress Detection System is able to anticipate staff stress and maintain system security. Upon the authenticated user's login, the photograph is captured automatically after a certain amount of time. The user's level of stress is ascertained from the acquired photos via the use of common image processing and conversion techniques. Next, the system will use machine learning algorithms to assess the stress levels and provide more effective outcomes.

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