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# Analysis on Machine Learning Techniques for Stress Detection among Employees

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***Abstract*** **- Mental stress is a common and major issue nowadays especially among working professional, because employees have family commitments with their over workload, target, achievements, etc. Stress tends various health issues like heart attack, stroke, depression, and suicide. Mental stress is not only in employees even normal people also face this problem but the employees has so many stress management techniques to manage the stress like yoga, meditation etc., but still employees suffer from the stress. Stress calculated by the Traditional stress detection method has two types of physiological parameters one is questionnaire format and another one is physiological signals based on Heart rate variability, galvanic skin response, BP, and electrocardiography, etc., Machine learning techniques are applied to analyze and anticipate stress in employees. In this paper, we mainly focus on different machine learning techniques and physiological parameters for stress detection.**
***Keywords:*** **Stress Detection, Physiological Parameters, Machine Learning**

## I. INTRODUCTION

Stress causes mental health problems; nowadays it's common in working employees. Stress or pressure can affect human emotional feelings or physical health. Stress in some people is constructive because it makes them stronger to keep active in their work and it motivates them, and also stress is destructive in another few people because it makes them feel alone, depressed, inactive, mood swings, and it can affect their mental health. Stress problems have been divided into two parts one is a short-term problem like headache, sweating etc., and another one is a long-term problem like changes eating habit in persons, loosing body weight etc., [2]. Stress has three types of common sources first source is social stressor is related to the mental & physical strain, Second source is environment stressor like crowding, traffic block, noise, etc., Third source is physiological stressors can be defined as external & internal condition of a person; from the research, these three stress sources are common in human life [3]. In our country 42.5% of people are suffering from stress or depression. Stress can be measured based on the traditional stress detection method which includes physiological questionnaire examination and physiological sensors. Stress is calculated by using the traditional benchmark like heart rate, pupil diameter, electrocardiography, electromyography, galvanic skin response, foot data and skin galvanic response, etc. stress detection is using Machine Learning classifiers such as LR (logistic regression), KNN (k-nearest neighbor), SVM (support vector machine), DT (decision tree), RF (random forest),NB (naïve bayes), Boosting, & Bagging, BN (bayesian networks). In this study, we mainly focus on mental stress prediction in employees applying ML Techniques& physiological parameters.

## II. EXISTING SYSTEM

Stress detection can use different machine learning techniques and algorithms like K-nearest neighbor, SVM, LR, RF, DT, NB, Multilayer perception, and Deep Neural Network. In this study, we compared between the various ML models to calculate which method gives high accuracy. Through this survey it is noticed that they was used a limited and less amount of data. Compared to the above-mentioned techniques Naïve Bayes, Random Forest, and SVM gives the best accuracy but these techniques have not given much specific and efficient result.

## III. PROPOSED SYSTEM

This paper is concentrating on implementing stress level detection in employees using Artificial Neural Network (ANN) classifiers. Employee's mental health condition are collected through questionnaires using the PSS (Perceived Stress Scale) scale and consider employees physical health condition using their heart rate variation and blood pressure. ANN classifier can train a huge amount of data, and hence we predict it gives a more efficient result.

## IV. RELATED WORK

U Srinivasulu Reddy, Aditya Vivek Thota & ADharun. "Machine Learning Techniques for Stress Prediction in Working Employees", IEEE, 2018 [1]: In this paper, authors developed a system to analyze and predict the risk of mental stress in employees using machine learning methods and the OSMI (open source mental illness) dataset helps to recognize the patterns of mental stress of their employees. They used different models such as LR, KNN, DT, RF, Boosting, & Bagging. They considered various metrics parameters like False Positive Rate, AUC Score, and Precision to calculate the accuracy of their trained model. They mentioned the performance in different trained model KNN gave the highest false-positive rate, but random forest gives good accuracy 75.13%.

Reshma Radheshamjee Baheti and Supriya Kinariwala. "Detection and Analysis of Stress Using Machine Learning Techniques", International Journal of Engineering and Advanced Technology (IJEAT), October 2019 [2]: In this paper, authors explained how to categorize people stressed or relaxed using textual data like tweets conversation, or sentence. Authors used Word Sense Disambiguation (WSD) and N-Gram technique for pre-processing input data and applied Naive Bayes and SVM machine learning algorithms for categorizing and predicting stress by using the text in the document. Authors shows the difference between SVM and NB with & without Word Sense Disambiguation &N gram using the test data and divided into test cases like Support Vector Machine, SVMWSD, SVMN gram, Naïve Bayes, NBWSD, & NBN gram. Overall classification of the test case in precision and Recall SVMWSD/N gram gives the best accuracy of 65%-67%.

Disha Sharma, Nitika Kapoor and Dr. Sandeep Singh Kang. "Stress Prediction of Students using Machine Learning", International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), Jun 2020 [3]: In this paper, authors focused on stress detection under the studies of students like a professional student, UG student, PG student. They analyzed the risk of stress prediction using a machine learning technique. They collected the dataset using the Perceived Stress Scale; it is an instrument used to measure the mental stress pressure level. In this paper, they applied different types of machine learning techniques such as NB, Linear Regression, Bayes Net, multi-layer perception, and the random forest they have calculated their accuracy with the help of different parameters like True Positive, False Positive, ROC, MCC. As a result, Baye's net classifier gives the best accuracy of 88.5965%.

RavinderAhuja, Alisha Banga. "Mental Stress Detection in University Students using Machine Learning Algorithms", International Conference on Pervasive Computing Advances and Applications, 2019 [4]: In this paper, authors concentrated on student mental health, and measuring the stress level of university students, based seven days before the exam throughout the Internet usage by the students. They collected a 206 sample dataset on JIIT Nodia students using the PSS test and applied four Machine Learning approaches that are RF, NB, SVM, and KNN. They also used specificity, sensitivity, and accuracy parameters and enforced 10-fold cross-validation for the little amount of dataset. They found out which is the better classification in the four algorithms, and finally, they said that SVM gives the best accuracy 85.71% compared to other algorithms.

Sandhya P, Mahek Kantesaria. "Prediction of Mental Disorder for Employees in IT Industry", International Journal of Innovative Technology and Exploring Engineering (IJITEE), April 2019 [8]: In this paper, authors considered mental stress on employees in the IT industry and after the prediction of mental stress also told that person need/not a treatment or regular mental stress checkup. Here they have applied ML techniques KNN, LR, RF, DT, bagging and boosting, Neural Network, and they also evaluated the technique by applying the metrics that are TP (true positive), TN (true negative), FP (false positive), FN (false negative), precision, & AUC score. They also showed the differences for the ML Techniques and mentioned which is the best method that suits the dataset, here the Random forest model trained best with the dataset and give the best accuracy of 89.3%.

Disha Sharma, Sumit Chaudhary. "Stress Prediction of Professional Students using Machine learning", International Journal of Engineering and Advanced Technology (IJEAT), June 2020 [9]: In this paper, the authors consider different stress levels and situations of students. Authors used various Machine Learning classifiers such as Baye's Net, LR, NB, and Multilayer Perceptron. They generated a dataset using the student circumstances and their situation with the help of the PSS Scale, and the dataset contains 220 instances with 6 attributes. Here they have used different parameters like TPR (true positive rate), FPR (false positive rate), precision, recall, F –Score, MCC, & mainly Kappa statistic used to measure the performance of ML Techniques. After the calculation and comparison, authors observed Baye's Net classifier gives the best accuracy of 88.3% with different parameters.

B. Padmaja, V. V. Rama Prasad and K. V. N. Sunitha. "A Machine Learning Approach for Stress Detection uses a Wireless Physical Activity Tracker", International Journal of Machine Learning and Computing, February 2018 [11]: In this paper, authors concentrated to detect the mental stress level of a normal person and employees. Collected the datasets using physiological parameters heart rate and they track the person's daily physical activity, sleep patterns, working hours, minutes of lightly and fairly active, the activity of calories, body mass index, movement patterns using FITBIT watch with Smartphone sensor. FITBIT device includes various sensors with this device they collected mental statements. Authors used a logistic regression (LR) model to train the data. As a result, they said the sleeping pattern is not the same for all of the participants, but the increase and decrease of BMI (Body Mass Index), heart rate variation indicate the person's stress levels.

Elena Smets, Pierluigi Casale, Ulf Großekathöfer, Bishal Lamichhane, Walter De Raedt. "Comparison of Machine Learning Techniques for Psycho physiological Stress Detection", Springer International Publishing Switzerland, June 2016 [12]: In this paper, the stress of an optimal computational method for the controlled environment in stress detection. Authors created a laboratory environment for collecting data of physiological records and speech counting task, in the physiological record, they took two parameters that are ECG and GSR (Galvanic Skin Response). They have collected dataset through 20 participants, ten males and ten females, and the age of participants between 40 to 50 years. They applied six

Machine Learning algorithms to train the data such as LR, SVM, DT, RF, and Bayesian Networks (BN). BN is static or dynamic. As a result, Dynamic BN and support vector machines give the best accuracy of 84.6% and 82.7% respectively.

Marife A. Rosales, Argel A. Bandala, Ryan RhayVicerra, Elmer P. Dadios. "Physiological-Based Smart Stress Detector using Machine Learning Algorithms", Nov 2019 (HNICEM) [15]: In this paper, the authors focused on building an intelligent system for stress detection in individuals. Collected datasets through 300 participants between 18 to 25 years, and they considered five Physiological parameters like blood pressure, Heart Rate, GSR, gender, systolic BP. They used a physiological sensor to measure the heart rate, blood pressure, and GSR. They applied machine learning algorithms to train and test the data such as SVM, K-Nearest Neighbor, and Linear Regression. As a result, support vector machine gives the better accuracy of 95.00% - 96.67%.

## V. CONCLUSION

This survey exposes stress detection in employees using ML classifiers like LR, K-NN, support vector machine, Decision Trees, and Random Forest Classifier. We have deliberated about the different ML techniques and various physiological parameters for stress detection. We found that three ML model gives the best accuracy that is Naïve Bayes, Random Forest, and SVM. In this discussion, we observed the comparison between the machine learning models based on different parameters. Among these three algorithms, SVM gave the best accuracy (96.67%) compared to the naive Bayes and Random forest algorithm but SVM train very less amount of data, NB and Random Forest are not much specific, efficient. ANN can train large amount of data and it can be used for more efficient and accurate stress detection in employees.

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