STRESS TRACKING AND RELIEVING SYSTEM

Ms. M.Varalakshmi
Assistant professor, Dept of IT
MGIT.
words.excellence@gmail.com

Pesaru Sreenidhi Reddy
Student(MGIT)
psreenidhi_it201243@mgit.ac.in

Gandu Srijan
Student(MGIT)
gsrijan_it201220@mgit.ac.in

S. Sai Srimanth
Student(MGIT)
ssaisrimanth_it201253@mgit.ac.in

Abstract: Current stress detection systems mostly rely on sensors and survey forms. Sensors are expensive. Survey forms can be inaccurate. To solve these problems.Our system tries to predict stress from face using deep learning. Our system also predicts heart rate using camera.

Keywords: Machine learning, live detection, heart rate, Healthcare routine.

1. INTRODUCTION

Stress is defined as a condition that arises due to pressure situations faced by human sin their day to day lives. Stress affects both the mind and the body. As World Health Organization (WHO) says[1], It is a mental health issue which shows significant affect 25 percent of US citizens.According to Palmer [2], "Stress is defined as a complex psychological and behavioral condition when the person's demands are imbalanced and the way demands are met."Also, the American Institute of Stress found that 80% of workers experience stress in their day-to-day work and need to manageg stress. Stress handling must be given pivotal importance in today's world. As symptoms of stress can be mild to severe and acute to chronic in many cases. It is reported that stress can lead to many health issues like anxiety, panic attacks, migraine, emotional imbalance, gut health issues, physical strain in various parts of the body, skin diseases and blood pressure. The affect of stress and the health issues pertaining to it differ from peer to peer.The conventional method of measuring stress is by employing sensors or questionnaire that can be given to humans. Filling questionnaire can be a biased task, applicants can hide their details due to insecurity or they may not be willing to share their health status to others. There is a need in present order of the day to build a stress tracking and relieving system. To do such, one must keep track of the user health status in the form of various health parameters. These parameters can be measured by using sensors. Various sensors that are available in today's market are GSR, HRV, ECG (Electrocardiogram), EEG and HRV.

GSR: Galvanic skin response is a sensor that Electrical conductance of the skin by measuring the reactions of skin to different situations.

ECG: Electrocardiogram is a high end sensor used to measure electrical signals in the blood to measure pulse.

HRV: Heart rate variability is a sensor which measures the variation of time interval between two consecutive heartbeats .

EEG: Electroencephalogram is a sensor shaped like headset measures the stress by collecting electrical signals of the brain

EMG: Electromyography sensor detects electrical activity from a muscle using conductive pads placed on the skin.

BVP: Blood volume pressure measures the change in circulation of blood due to heart contraction.

All the above mentioned sensors can be used in various combinations to measure stress.
The major drawback with sensors is the assembling of the system and the maintenance that is required for these sensors in order to collect values. On the other hand, using sensor to detect stress for large group of people is equally time consuming process. It requires a lot of effort and expert medical advice to use these sensors. So a more simplified and digital stress detection system is required to detect stress in an effortless manner.

Stress tracking and relieving system is a stress detection and heart rate prediction system which detects stress condition of a human by using Image processing and deep learning techniques and heart rate.

2. LITERATURE SURVEY

[1].“Detection of Stress Using Image Processing and Machine Learning Techniques” Nisha Raichur, Nidhi Lonakadi, Priyanka Mural [3]

In this work, Facial expression is used for stress discovery. The system is non-intrusive and is suitable to run in real- time.

A camera is employed to record a close anterior perspective of an individual as they work in front of the computer. Videotape captured is divided into three section sets of equal number of image frames are uprooted from each section similarly and are analysed. The image analysis includes the computation of the variation in the position of the eyebrow from its mean position. The relegation of eyebrow from its position is calculated by surveying the image for the eyebrow coordinates. still, a determination is made regarding the discovery of stress for a person working at a computer, If an individual constantly exhibits signs of stress during successive time intervals preliminarily delineated.

Image processing contains two phases pixel metamorphosis and double metamorphosis. G(i, j) = α.F(i, j) β is calculated. Two parameters α and β are responsible for brilliance. The pixel values are are compared with a threshold value. If the pixel value is lesser than 1 the double pixel is set to 1 differently 0. Several approaches are applied to prize the discriminational features to learn the pattern of the different features of face. The pixel analysis of the double image scans the image from top left to each row. The image converted to double form is used for the pixel value analysis fashion, which produces the(i, j) equals of the eyebrow are depicted. The relegation computation, calculates the relegation of the eyebrow using eye co-ordinates attained in former way. Deep literacy module is eventually trained using linear regression and gradient decent algorithm. Hence, the system predicts the stress value for the image.

Fig.1. Training Accuracy

These images were processed in order to extract a feature (Eyebrow). The obtained results from image processing with suitable inputs were used to train linear regression model. The model is tested by the testing dataset. The model now predicts the stress condition of the user. Hence, the user can now minimize the health risks in future.

[2]. "Stress detection using machine learning and deep learning" by K.V. Acharyulu, N. Sampath Kumar, K. Paavan Sampath, B. Yaswanth Reddy , G. Guna Sekhar [4]

The system proposes three methods: eye blink detection, eye brow detection and Face emotion recognition. It also calculates the Eye Aspect Ratio (EAR), which is generally a numerical value when the eye is open and tends to zero when the eye closes. Eye aspect ratio generally useful to calculate count of eye blink if the eye aspect ratio raises from 0 to 0) if the value raises from 0 to some value, then eye blink will do definitely based upon designed algorithm. After the successful counting of the number of eye blinks, we take the number of eye blinks per minute and compare it with the normal human eye blinks per minute. Based on the comparison of the values with the threshold value, we determine whether the person is stressed or not.

Eye brow detection: System detects user's eyebrow by capturing a live input image with the OpenCV library and using hyper parameters in the NumPy library we detect the eyebrow's structure. We identify the user's left and right eyebrows and compare them to the average position of the user's eyebrow in normal form. The thicker the brows, the easier the job to detect the eyebrow more efficiently and it leads to detect more accurate results, because the thickness of the eyebrows generally increases the detection rate efficiently. y calculates stress level by measuring the contraction and displacement of the brows from their normal position.

Face emotion detection: Facial emotion recognition generally involves predicting the stress level of the user by considering all eye, eyebrow, and facial structures. This method generally works with the help of a dataset, which produces highly accurate results. This method's output accuracy typically ranges between 68 and 70%

Training, testing, and validation are critical steps in the machine learning workflow. A separate data set is required for each step. As a result, the entire data set is divided into training, validation and testing these will gradually produce the accurate results.

Data set description: the fer2013 data set is used, which contains the huge samples of emotion classifiers, based on the input image provided the developed algorithm produces the best accurate results. The data consists of gray scale images of faces. The expressions on the faces have been classified into one of seven categories (0-Angry. 1 -Disgust. 2-Few, 3-Happy, 4-Sad. 5-Surprise, 6-Neutral). There are a total of 28.709 examples in the training set. The public test set for the leader board has 3.589 examples.

We split the dataset into training and testing data using scikit-train test split() learns function. The test size of 0.2 means that 20% of the data will be used for validation and 80% will be used for training.

Numerous OpenCV and Keras functions were tested during the validation phase. The video frame is initially stored in a video object. By using NumPy, greyscale images are created. This resized image is used to feed the predictor. The maximum argument is printed. The schematic results are highly accurate after successfully training the algorithm and test the output with multiple faces for greater accuracy.

Fig 2

As the stress is the most important factor in human it is detected in three ways are eye blink method detects the blinks of an eye and calculated eyebrow detection of stress and indication of the person is stressed or not stressed.

[3]. "Stress detection using deep learning and IoT" by D. K. Yashaswini , Sachin S. Bhat , Y. S. Sahana , M. S. Shama Adiga , Shashank G. Dhanya[5]

In this work, stress is detected based on the analysis of facial expression and the stress level using the pulse sensor. It makes use of a technique that allows us to train a model and analyze differences in predicting the features. The system uses a deep learning algorithm to achieve the expected results in the areas such as computer vision. A camera is used to capture the frontal view of the person while he/she is working in front of the computer. To detect an individual emotion in a picture frame and the decision on the stress level is captured. The captured image is then analyzed according to the variation in the position of the eyebrow from its mean position. Here, Convolutional Neural Network (CNN), a deep learning algorithm is used for automatic classification of images. It uses two models:

Deep learning: The operated transformations are combinations of linear and nonlinear operations. These transformations are used to represent the data at different levels of abstraction. The popular image processing structure of Deep Learning Models is CNN. It is constructed by three layers: adopted architecture is shown in Figure

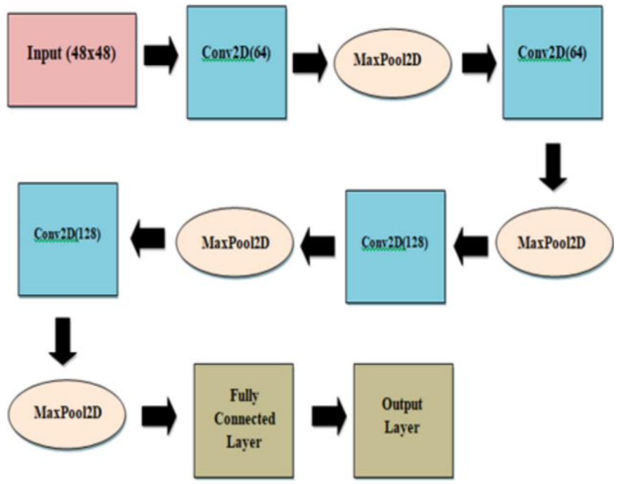

Fig 3

Convolutional Layer: When the input data enters a convolutional layer, the layer convolves each filter throughout the spatial dimensionality of the input which produces a 2D activation map. The scalar product for every value in the Kernel is calculated, as we glide through the input data.

Pooling Layer: Pooling layer mainly intends to reduce the dimensionality of the representation by reducing the number of parameters and also complexity of computation.

Fully Connected Layer: This layer is used to connect every single neuron from one layer to every single neuron in the next layer. The last fully connected layer contains a Soft Max function which classifies the image into different classes using the features generated.

IoT: Components used: The components used in this project are described in the following:

Arduino Mega: It is a microcontroller board which is based on AT mega 2560 micro-controller. It consists of 54 I/O digital pins along with 16 Analog pins. Out of 54 I/O pins, 15 are PWM (Pulse Width Modulation) pins.

Pulse Sensor: This module is used to detect the pulse rate of the body which can be used to find out the heart rate of a person. To count the heart rate, one needs to count the number of pulses in a minute. This is done by calculating the inter beat interval.

Wi-Fi Module: A Wi-Fi module is a self-contained SOC which contains TCP/IP protocol stack which helps to give any micro-controller access to any Wi-Fi network.

Fig 4

Fig 5

[4]. "GSR based generic stress prediction system" By Divyanshu Jaiswal, Debatri Chatterjee, Arpan Pal, Ramesh Kumar Ramakrishnan, Mithun B S [6]

In previous works to this work, GSR based person and task independent stress prediction model giving comparable accuracy across individuals was created. In this work, the size of the training dataset was increased and different set of features were selected through a voting based approach. The training model created improves the classification accuracy reported in . In addition, the model is tested for completely unseen data.

For building the stress prediction model, 4 datasets are used out of which 3 are public datasets, namely, Wearable Stress and Affect Detection (WESAD), S-Test, Affective ROAD and 1 inhouse collected dataset, DS3.

WESAD contains GSR and other physiological signals collected from 15 participants under baseline, amusement and stress conditions.

S-Test contains GSR signals collected from 21 participants.

Affective ROAD data set contains data collected from 13 subjects for rest , city driving and highway driving as stress data.

DS3 data set was collected in author's research lab using Shimmer3 GSR+ device from 15 participants following TSST protocol.

Dataset	Device used	No of subjects	Testing condition	Type of stressor
WESAD	Empatica E4	15	*Stress vs. no-stress, Rest vs. stress vs. amusement*	TSST protocol
S-Test	Empatica E4	21	*Stress vs. no-stress*	Mental arithmetic
AffectiveROAD	Empatica E4	13	*Stress vs. no-stress*	City and highway driving
DS3	Shimmer3 GSR+	15	*Stress vs. no-stress*	TSST protocol

Fig 6

In total, they had 64 participants data for developing the stress prediction model.
To evaluate the performance of our proposed model for completely unseen data, we collected GSR data from 5 test participants selected from our lab using TSST protocol (hence forth referred as Unseen TSST) and DS3.

To train the model, the fluctuation of the GSR reading was taken into consideration for the known data. Different users have different readings on the same GSR scale. The mean GSR value was taken into consideration. Selected GSR signals were filtered using 4Hz low pass FIR filter as most of the useful information is contained within this band. Filtered signals were subdivided into number of non-overlapping windows of duration 30 seconds. A set of time domain, frequency domain and statistical features were calculated on each of these windows. Thus, minimum, maximum and number of peaks of these

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

components were considered as features. The frequency distribution of heart rates are usually studied in various frequency bands called, very low frequency (VLF: 0-0.04 Hz), low frequency (LF: 0.04-0.15 Hz), high frequency (HF: 0.15 - 0.4Hz) of which LF and HF bands are found to be reliable markers of stress level.

Most important features were selected using Maximal Information Coefficient (MIC) algorithm. The training data was subdivided into training and validation sets using 75-25 split. Based on the MIC values, the features were arranged in descending order of magnitudes. Then by selecting top N features, the prediction accuracy, F-score and precision were calculated on the validation set. For testing the binary stress prediction model (i.e. no-stress vs. stress) we used 90-10 split. 10% of the subjects were selected randomly from each data set as the test subjects (refereed as 4DS_10). Training model was created using remaining 90% subjects (refereed as 4DS_90) of each data.

Algorithms like Gradient boosted Trees (GBT), Random forest (RF) and AdaBoost classifiers are tried. Parameter tuning for these classifiers were performed and the model performance was judged through 10-fold cross validation on training data. It is observed that sensitivity was high for GBT classifier, whereas specificity was high for RF and Adaboost. To incorporate the advantages from all 3 classifiers, they adopted Voting approach. Model was evaluated across all the different weight combinations and the combination with maximum F-score were selected as final weights, which were [0.1, 0.3, 0.6] for GBT, RF and Adaboost respectively. observed that Voting2 approach provides a maximum accuracy and hence, we used this classifier for all further evaluations presented in the paper. In Voting2, the weights for the individual classifiers were obtained via grid search over the weight matrix with a resolution of 0.1 interval.

Classifier	Accuracy(%)	Sensitivity	Specificity	F-score
GBT	88.36	**0.88**	0.89	0.89
RF	88.12	0.85	**0.92**	0.89
Adaboost	86.46	0.84	0.89	0.87
Voting1	88.6	0.87	0.90	0.89
Voting2	**89.07**	0.87	**0.92**	**0.90**

Fig 7

After applying the model on unseen data, results are obtained as:

Training	Accuracy(%)	Sensitivity	Specificity	F-score
WESAD	76.9	0.76	0.78	0.80
S-Test	77.7	0.79	0.76	0.81
DS3	89.2	0.84	0.98	0.90
AF	72.3	0.78	0.62	0.78

Fig 8

The proposed model had high accuracy (89%) and f-score (0.86) for a test set created using a combination of participants (considering 90-10 split for each dataset) and different stressors. For completely unseen data, we achieved similar performance. Thus, the proposed model is generic in nature that can be used successfully across participants and activities for monitoring stress in real life scenarios.

Critical analysis: In the above mentioned papers, finding stress condition is the major objective behind them. It can be detected by using various machine learning techniques, deep learning concepts, sensors, IoT devices and simulators. Stress is a condition that needs to be tackled in its early stage. There is also a need for the system to detect and minimize its symptoms by providing users with proper healthcare recommendation/suggestion. So, our system fills this gap of finding the symptom by using similar procedure of the above mentioned concepts as well as suggesting proper healthcare routines to the users. A problem in heart rate can be threat to one’s life. So our system also tries to find heart rate of individual.

3. CONCLUSION

Stress Tracking and Relieving System is built to predict stress in humans by monitoring images and live detection of users. The images and live detection videos are used to detect the stress of the user using machine Learning algorithm to detect stress. And also, heart rate is measured by the system and in addition to the healthcare suggestion is given by our system.

REFERENCES

[1] www.WHO.com

[2] Palmer S 1989 The Health and Safety Practitioner, 8 16-18

[3] Detection of Stress Using Image Processing and Machine Learning Techniques by Nisha Raichur, Nidhi Lonakadi, Priyanka Mural

[4] Stress detection using machine learning and deep learning by K.V. Acharyulu, N. Sampath Kumar, K. Paavan Sampath, B. Yaswanth Reddy, G. Guna Sekhar

[5] D. K. Yashaswini , Sachin S. Bhat , Y. S. Sahana , M.S. Shama Adiga, Shashank G. Dhanya, Stress detection using deep learning and IoT

[6] GSR based generic stress prediction system by Divyanshu Jaiswal, Debatri Chatterjee, Arpan Pal, Ramesh Kumar Ramakrishnan, Mithun B S

[7] Fig 1 from [3]

[8] Fig 2 from [4]

[9] Fig 3 and Fig 4 and Fig 5 from [5]

[10] Fig 6,Fig 7 and Fig 8 from [6]