Stress detection using social interactions

Dr. C. Punitha Devi[#1], Dr. T. Vigneshwari[;#2],
B. Jeevitha[#3], D. Suganthi[#4], A. Venniammal[#5],

Information Technology, Sri Manakula Vinayagar Engineering College
[1]punithadevi@smvec.ac.in
[2]vigneshwarirt@gmail.com
[3]bjeevitha21@gmail.com
[4]sugidhana1505@gmail.com
[5]venniammala@gmail.com

Abstract—**Nowadays mental stress is a major issue, especially among youngsters. Increase in stress leads to many problems like depression, suicide, heart attack and stroke. A manageable amount of stress is healthy and can motivate a person; however, a large amount of continuous stress or hardy stress can be harmful. For this reason, the detection of mental stress, and its prediction has become a significant area of research. In recent years Social media have received more attention and popularity. People use social media for sharing their routine activities, and interacting with friends. Therefore, public and private opinion about a wide variety of subjects are expressed and spread continually via numerous social media. In this paper, we are calculating mental stress of a person through their interaction like post, chat, and comment on social media using machine learning. Our objective is to detect type of stress and its state in earlier stage. Based on the result of the stress prediction graph, we send the notificationto a particular person.Then proposed a factor graph model combined with support vector machine to grasp tweet content, and social interaction information for the stress detection.**

Keywords—**Stress detection, Machine learning, Chronic stress, Acute stress, Risk level.**

I.   INTRODUCTION

Our current lifestyle is becoming more comfortable, and highly technological. Along with the comfort that technology has brought, it also promotesunhealthy lifestyle habits such as negative eating habits, less exercise and lack of sleep. These habits can negatively impact a person's life. Stress describes the tension level caused by daily demands as well as many other factors such as family, work, and social problems. There are two types of stress depending on which stress occurs, and these types are: chronic stress andacute stress. Whereas chronic stress stays for a long period, acute stress disappears quickly.So, it is very important to detect stress timely for proactive cares [7]. Nowadays, people can get all the information about another person via social networking sites and applications, and user's mobile device contains all the necessary information about the user's current situations in the form of snaps or chats with his/her close friends. So, stress level of the user risk closely related to the text or media shared among friends. As the social media data timely reflect the user's real-life states and emotions in a timely manner, it offers new opportunities for representing, measuring, modelling users stress state using the classifications in machine learning.

II.   LITERATURE SURVEY

This section, summarize some approaches to detecting stress level. These approaches vary according to the methodology used. This survey can be classified into two categories. They are a manual approach and systematic approach. The study on these approaches help us to analyse the challenges in detecting stress level. This study will also make us understand the level of accuracy attained in the reviewed techniques.This study can be broadly divided into 2 types, they are manual approach and system based approach.

II. A. *Manual Approach:*

Some available approaches depend on the use of questionnaires, which are often not accurate because of individual differences.

a.   Questionnaires:

There is a long-standing theory asserting the existence of a cancer-prone personality, the main contributing traits being inability to express emotions and consequent suppression of such emotions, and inability to cope with stress, leading to the feelings of hopelessness, helplessness, and giving up. Thus, this stress questionnaire or personality questionnaire can predict cancer mortality in original healthy pro bands with 80% accuracy [1][3][9].

The information, or data obtained through these questionnaires are insufficient and are not accurate this may lead to irrelevant result. To overcome those difficulties system based approaches were designed.

II. B. *System Based Approach:*

This approach uses both sensors and learning algorithms to analyse the state of stress for an individual user. So, it is again classified into two types. They are sensor-based approach and machine learning based approach.

i. *Sensor-based approach:*

It includes the use of measuring devices such as mobile, remote, or wearable sensing devices [2][4][5][8] to collect physiologicalsignals suchas electrocardiogram(ECG) and electrodermal activity (EDA).

a. *Wearable Sensors and Mobile Phones:*

Wrist device is used to detect stress events. Accelerometer data was used by the average recognition classifier to recognize users' activities and distinguishes between stress, and other situations that cause similar physiological arousal.

 A web application was developed to collect laboratory data. The author extracted 27 features from the collected signals while 10 of them with the highest mutual information was used to train KNN classifier [1][4]. The accuracy of stress prediction is 89.8%.

It consists of two electrodes, skin conductance sensor, 3-axis accelerometer, blue-tooth, and a micro-controller to analyse the collected skin conductance. The electrodes pass small electrical current to the skin. The collected data is sent to a smart-phone through Bluetooth to show the user his stress level [4]. Moreover, the data are uploaded to the web so that doctors can use these data for a better treatment. The authors used logistic regression to predict the probability of stress state of the subject.

b. *A finger-shaped tactile sensor with a machine learning:*

A fingertip-shaped tactile sensor system is used to measure forces and vibrations using the same sensor. A fully integrated stress sensorASIC[4]is a simple design and assembly of the tactile fingertip. It quantifiablymeasures forces, use machine learning to extract abstract information out of the raw sensor data.

Evicting complex signal processing, this processing scheme for sensor-to-information is fast and can have a small footprint. The results show that the system can classify the direction of applied forces with 99.8% accuracy [10].The combination of the stress sensor array and the machine learning approach allows detecting slip and tangential force direction simultaneously.

c. *ECG sensor and galvanic skin response:*

The brain signals of the thirty subjects are recorded while they are solving five mathematical question sets with increasing complexity. Assuming the subjects undergo through five different stress levels i.e. 'Relaxed', 'Less stressed', 'Moderately Stressed', 'Highly Stressed' and 'Alarmingly Stressed' while solving these question sets.The EEG data is processed and features are extracted [1][5]. Then apply the forward neural network for classifying the stress level in human brain.

Prepare a new question set consisting of easy as well as complex numerical questions for testing purpose. Then record the EEG data [1][4] of a subject while solving this question set and extract six feature values from the processed EEG data of the subject. These data are fed to the designed feed forward neural network [6].The neural network predicts the stress level, and the predicted stress level indicated in the 'Stress Indicating' circuit. They obtained efficiency of our developed stress detection mechanism is 91%.

ii. Machine learning based approach:

In the machine learning domain, computers learnfrom experience by using computational methods to learn information from data without being explicitly programmed or dependency on a predefined equation.

The machine relies on two learning techniques to learn information; unsupervised and supervised learning.

In unsupervised learning, the machine finds a pattern in the input data, where the input data is not labelled. An example\\technique of this type is clustering [11][14][15], which analyses input data and finds the hidden patterns and groups the similar classes.

In supervised learning, the machine develops and trains the predictive model by using labelled data to predict future output by learning from a known set of input and output data.

Two techniques are used in this type of machine learning approach; the regression technique, which is used to predict future continuous values; and the classification technique, to predict discrete, categorical values such as determining whether the text is stressed or not.

Selecting an optimal machine learning algorithm to train the model is not a simple task; thus, many cases use trial and error as a method to obtain the optimal algorithm. Developing the machine learning algorithm starts by cleaning the data and applying various preprocessing steps that enhance the data [7][12][13].

a. Convolution neural network Algorithm:

The depression of users is closely linked to that of their social media friends and the use of a large-scale dataset from real-world social platforms to systematically study the association between user stress and social interactions [6][7].

First, identify a set of textual, visual and social attributes related to stress from different aspects, and then propose a new hybrid model-a factor graph model[6] coupled with Convolutional Neural Network to exploit tweet content and social interaction knowledge for stress detection.Experimental results show that the model proposed in F1-score can increase the detection efficiency by 6-9 percent.

By further analysing the data on social interaction, some interesting anomalies are discovered, i.e. the number of social structures with minimal relations (i.e., no delta links) of stressed users is about 14% higher than that of non-stressed users, indicating that the social structure of stressed user friends tends to be less linked and less complex than that of non-stressed users [7].

b. Sentimental analysis using classification algorithm:

Analysing the twitter posts about electronic products like mobiles, laptops etc. using Machine Learning approach [7].The impact of domain information in sentiment classification can be established by doing sentiment analysis in a particular domain.

There by present a new feature vector for classifying [8][10] the tweets as positive, negative and extract peoples' opinion about products. The impact of domain information in sentiment classification can be established by doing sentiment analysis in a particular domain.

TABLE I

PARAMETER ANALYSIS FOR STRESS DETECTION

Reference No	Input Type		Categorize Stress/non-Stress	Type of stress	Risk level	Predict	Identify
	Questionnaire / sensor	Text / comments					
[1]	✓	X	✓	X	X	X	✓
[2]	✓	X	✓	X	X	✓	X
[3]	✓	X	X	X	X	X	✓
[4]	✓	X	✓	X	X	X	✓
[5]	✓	X	✓	X	X	✓	X
[6]	X	✓	✓	X	X	✓	X

✓ - Parameters that are achieved in the reference.

x - Parameters that are not achieved in the reference.

The above table concludes that the majority of the work was based on sensors or questionnaire, this may lead tounreliable data. They had not given a priority to the text related data. Text based input did not give an irrelevant data. Since all the tabulated references failed to classify the type of stress. It needs an approach to calculate the level of the stress and its types, in addition with stress prediction and identification.

The below tabulation describes the methods by which all those parameters were implemented and describes the technologies involved in order to detect the stress and depict their accuracy based on the algorithm used and sensor used.

TABLE II
COMPARISON OF REVIEWED STRESS DETECTION

Reference	Methodology	Concept	Accuracy
[1]	Questionnaire or online quiz	Predicting of death from cancer using stress analysis.	80% efficient
[2]	Questionnaire using Electro encephalogram signals and KNN algorithm.	Based on the theory of " More complex problem leads to more stress on brain", it classifies the mathematical problem of questionnaires into to the stress level.	91% accuracy
[3]	ECG sensor, galvanic skin response	Based on the answer given by the user to the physician it classifies the stress level using KNN and SVM	Signal accuracy 92.75%
[4]	Fingertip shaped tactile sensor.	It receives the external vibration as input based on the learning it classifies stress using Random forest.	Slip and static impulse produce 99.6% accuracy.
[5]	EEG (Electroencephalography) device and 3classifier (LR Classifier SVM Classifier NB Classifier)	Device fetch the brain electrical signals produce the output as Delta, Theta, Alpha, Beta, Gamma and Mu bands. Then classifier classify the stressed tweet.	Identify the stress level to an accuracy of 96.4%
[6]	Convolutional neural network and factor graph model.	Classify stressed, non-stressed tweet and total comments for weekly user interactions.	9% efficiency in f1-score and 91% accuracy in CNN.

This survey(table II) describes the prediction methods that use sensors, Mathematical questionnaire [1] and signals. The main drawbacks of these approaches were need of external devices and psychiatrist [2][5]. It concludes that, there is a lack in prediction of stress level and its types. Our approach is mainly concentrating on people working in an IT sector. Based on the recent survey, people are working in an IT sectors were facing a lot of issues due to the stress, which may lead to many disorders like bipolar disorder, traumatic stress disorder. Based on that risk level, SVM classifies the stress into two categories, acute and chronic. It is important to detect these stresses and their level in an earlier stage.

III.   LIMITATIONS

o   Wearable Sensor: It barely read signals from the user when they feel stressed. Sensor are not cheap and its size vary according to the individual user. The battery capacity is limited.

o   Questionnaire: One major disadvantage of questionnaire is the possibility of low response rate. It can dramatically lower their confidence in the result. Finally, questionnaire is simply not suited for some people. For example, a return survey to a group of poorly educated people might not work because of reading skills problems.

o   Improper classification:The above mentioned approaches classify the stress as stressed and non-stressed type or positive and negative comment. But stress may vary accordance with time, they can be of short and long term stress. Hence these methodologies failed to classify the stress type.

IV.   CONCLUSION

In today's world, where mainly the youngster and almost all of the population is suffering from surmounting stress, be it because of peer pressure, work load or other domestic tensions; it is very crucial to have a reality check about how stress edapers on really. It is because of this reason the timely detection and prevention of stress is a dire need [8]. We have come up with this project which assists people in scrutinizing the problem of stress. This work will be very beneficial for those who are not so comfortable in opening up about their problems to others. It will help these people get a reality check and may prompt them to reach out and get medical help, just based on their social interactions.There are a variety of machine learning algorithms that are suitable for stress detection. Among them are support vector machines (SVM) and logistic regression (LR) [6][7], all of which are used in the approaches that will be discussed in this paper. Thus, the machine learning concepts helps to analyse the Stress level and its types. The main characteristic of this system is to make accurate and fast-oriented implementation in detecting stress when compared with the previous approaches.

V.   REFERENCES

[1] Detection of Stress in Human Brain *Prithwijit Mukherjee | Anisha Halder Roy* 2019 Second International Conference   on Advanced Computational and Communication Paradigms (ICACCP) *Year: 2019 | Conference Paper.*

[2] A Fingertip Shaped Tactile Sensor with Machine-Learning-Based Sensor-To Information   *Kuehn | Yiannos Manoli* 2019 20th International Conference on Solid-State Sensors, Actuators and Microsystems & Eurosensors XXXIII (TRANSDUCERS & EUROSENSORS XXXIII) *Year: 2019 | Conference Paper.*

[3] The prediction of death from cancer by means of personality/stress questionnaire: too good to be true*? H. J. EYSENCK* University of London, perceptual and motor skills, *1990, 71, 216-218.*

[4]A system to detect mental   stress   using   machine   learning   and   mobile   development   *Chandrasekar   Vuppalapati | Mohamad   S khan | NishaRaghu | PriyankaVeluru | Suma   Khursheed* 2018 International   Conference   on   Machine   Learning   and   Cybernetics   (ICMLC) *Year:2018 | Volume:1 | Conference Paper.*

[5] Stress detection in working people *Sri Ramprakash.S, Prasanna Vadana. D, O.V. Ramana murthy* ,7th international conference on advances in computing & communication *ICACC 2017.*

[6]Detecting Stress Based on Social Interactions in Social *Networks   Huijie   Lin | Jia   Jia | Jiezhong   Qiu |Yong   feng | Guangyao   Shen | Lexing   Xie | Jie Tang | Ling Feng | Tat-Seng Chua* IEEE Transactions on Knowledge and Data Engineering *Year: 2017 | Volume: 29, Issue: 9 | Journal Article*

[7]Machine Learning Approaches to Automatic Stress Detection: A Review *Sami Elzeiny | Marwa Qaraqe* 2018 IEEE/ACS 15th International Conference on Computer Systems and Applications (AICCSA) *Year: 2018 | Conference Paper*

[8] Daily stress recognition from mobile phone data, weather conditions and individual traits. *Andrey Bogomolov, Bruno Lepri, Michela Ferron, Fabio Pianesi, and Alex Pentland.* In ACM International Conference on Multimedia, pages 477–486, *2014.*

[9] Detection of mental stress due to oral academic examination via ultra-short term HRV analysis. *R. Castaldo, W. Xu. P. Melilo, L. Peechia, L. Santamaria* 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). *Year:2016 | Conference paper.*

[10] Detecting emotions in social media *Yichen Wang and Aditya Pal* Proceeding of the Twenty-Fourth International joint conference on Artificial Intelligence *(IJCAT 2015).*

[11] Twisty: A multilingual twitter stylometry corpus for gender and personality profiling.*Ben Verhoeven, Walter Daelemans, and Barbara Plank*. In Proceedings of the Tenth International Conference on Language Resources and Evaluation LREC, pages 1632–1637, *2016*

[12] Retrieval evaluation with incomplete information.*Chris Buckley and Ellen M Voorhees*. In Proceedings of the 27th annual international ACM SIGIR conference on Research and development in information retrieval, pages 25–32, *2004*.

[13] Semantic concept discovery for large-scale zero-shot event detection.*Xiaojun Chang, Yi Yang, Alexander G Hauptmann, Eric P Xing, and Yao-Liang Yu*. In Proceedings of International Joint Conference on Artificial Intelligence, pages 2234–2240, *2015*.

[14] Mental stress detection in university students using machine learning algorithms. *Ravinder Ahuja, Alisha Banga*. International Conference on Pervasive Computing Advances and Applications-*PerCAA 2019*.

[15] Detection of stress using image processing and machine learning Techniques. *Nisha Raichur, Nidhi Lonakadi, Priyanka Mural*. International Journal of Engineering and Technology (IJET) - *2017*.