iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VIII **Month of publication:** Aug 2023

DOI: https://doi.org/10.22214/ijraset.2023.55390

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com

Significance of Artificial Intelligence in Mental Health Detection for Overall Development

Gaurav Yadav[1], Mohammad Ubaidullah Bokhari[2]
[1]*Research Scholar,* [2]*Professor, Department of Computer Science Aligarh Muslim University Aligarh, India*

Abstract: ***With the rapid development of human civilization, the capability of the human brain is also increasing with the fast pace of development which is eventually leading to mental health issues varying from young stage students to working professionals. Mental health is the least concerning issue in the life of today's generation when compared to physical health. One of the main concerns about which very few are aware is that mental problems can lead directly to several other physical problems and several terminal diseases. Such cases can affect a person's normal life adversely in various ways from affecting day-to-day routine, the standard of living, and relationship trauma. Early-stage detection is significantly important for the cause but gets delayed due to irresponsible handling or ignorance of the situation, where artificial intelligence can play a vital role. In today's era, everything can be predicted using complex mathematical calculations which can be promptly paced up when integrated with computer science and programming concepts. Numerous pieces of research are being done in the dimension of artificial intelligence and machine learning for early-stage detection of issues related to mental health with optimized accuracy. This can lead directly to the early treatment required with the concerned patient with the help of a counsellor or a psychiatrist if required. This study concluded the implementation of AI for early detection of the mental health issues focuses in dimension of AI and its sub fields such as, machine learning for early-stage detection of issues related to mental health with optimized accuracy. A nation like India is a great way to become a developed nation and implementing AI-based technology will accelerate the developing phase for overall sustainable development.***

Keywords: Mental health, Mental stress detection, Machine learning (ML), virtual counselling, AI.

I. INTRODUCTION

In today's world after the disaster of the COVID-19 pandemic, the revolution towards health concerns knocks over the globe. Society is again turning its focus over one of the most prominent sectors which are related to health. Health is the state of the absence of disease and infirmities by complete physical, mental and social well-being. Among all these three states the one which demands serious attention on it is 'Mental Health.

According to the World Health Organization (WHO)[1], when a person is in a state of mental health, they are aware of their own potential, are able to handle life's challenges and work successfully and fruitfully, and are able to give back to their community. Mental stress also referred to as stress may be defined as one's reaction to any situation which is not significantly manageable by one's ability or out of one's control.

According to P Bobade [2], the majority of people experience stress on a regular basis and at varied times. However, sustained tension or a high level of stress will compromise our safety and interfere with our usual life. The continuation of this state of stress will not only hinder the physical health of a person but the mental health also in the form of inimical effects and terminal diseases such as cardiovascular diseases, high BP, insomnia, depression, suicidal traumas, etc.

Even after several technologies were already been developed in the field of the health sector but yet less attention made to mental stress [3]. The detection of mental health issues at an early stage may avail a person of the opportunity to deal with these terminal diseases. The early detection of mental health issues like stress not only prevents these diseases but also enhances emotional health along with overall social welfare.

Artificial intelligence along with its sub-field machine learning has shown exponential growth in the development of ML models to detect mental stress at an early stage. In this study, we have discussed the role of AI in the field of healthcare specifically on mental health issues detection at an early stage to prevent diseases.

This study covered all the mathematical models of Artificial intelligence which are working in the improvisation of the mental health of the human being. In this study, we will be discussing the related work in the field of mental stress detection followed by the Artificial intelligence approaches in mental health issues detection, results, and discussions of the study, conclusion, and future extension and references.

©IJRASET: All Rights are Reserved

II. RELATED WORK

Researchers have developed various ML models for the early detection of mental stress. There are several approaches used in which Questionnaire, speech recognition, emotion recognition, social media data, and wearable sensors were used to predict the stress. For instance, Kurniawan et.al [4] proposed the stress detection technique using the Galvanic skin response and speech signals; therefore, on the basis of recorded voice and modern sensor technology over the SVM classifier accuracy of 92% was achieved. Sano, A., & Picard, R.W [5] concluded that "75% accuracy of low and high perceived stress recognition using the combination of mobile phone usage and sensor data". Mozoset. al [6] proposed the work on real-time stress detection with wearable physiological and sociometric sensors, which was thought to be a tool for machine learning techniques. Rizwan et.al [7] proposed a system based on the bio-signal by implementing the ML approach and ECG three features signals, supervised machine learning (SVM) method in MATLAB, in this study the data is labeled in the two categories viz stressed and non-stressed. The Gaussian Kernel function produced findings with an accuracy level of 98.6%. Yamini et.al [8] proposed a study on depression detection using sentiment analysis, where the data of social media platform such as Facebook is used for the prediction of mental stress levels using natural language processing. The Depression level of the user is classified into positive, negative or no emotions. Wang et.al [9] proposed a study that offers a smart phonebased stress detection system that is automated and non-intrusive. Seo et.al [10] conclude the study using numerous physiological data, including the electrocardiogram (ECG) and respiration (RESP) signal, proposing a novel stress detection system based on end-to-end deep learning. The study employed arithmetic and Selective attention tasks as stressors, with each stressor being followed by a relaxation exercise, to simulate workplace stress in the tests. Kamra et.al [11] also proposed the cognitive disease prediction model using natural language processing and machine learning techniques by using a variety of neural networks to choose the most effective one for predicting psychiatric disorders. As several pieces of research have already been pursued using the wearable sensor data so in this continuation Gedam, S., & Paul, S [12explores the methods used to recognize stress in relation to sensor devices, including wearable sensors, electrocardiograms (ECG), electroencephalograms (EEG), and photoplethysmography (PPG), as well as in relation to diverse contexts, such as when driving, learning, and working. Nijhawan et.al [13] proposed a study on stress detection using natural language processing and machine 4 learning over social interactions, in which the ML and BERT models were used for sentiment analysis of the tweets data.

III.ROLE OF ARTIFICIAL INTELLIGENCE IN MENTAL HEALTH

Artificial intelligence may be referred to as mimicking behaviour of the humans by machines based on previous experience. The AI works as the expert to teach the machine over the bulk of the data and predicts accurate results. There are several branches of artificial intelligence that are also contributing to the early detection of mental health issues and preventing of diseases. These branches include machine learning, deep learning, neural network, and natural language processing.

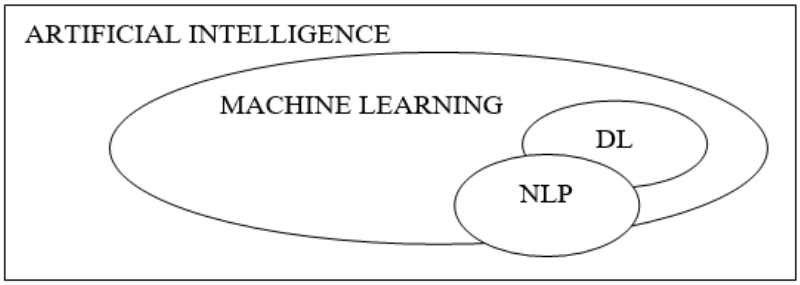


Figure 1 AI and its sub fields

A. Machine Learning

Arthur Samuel first used the phrase "Machine Learning" in 1959. Artificial intelligence's subfield of machine learning provides the ability for the machine to learn from data, analyse the patterns on its own and predict the outcomes with minimal intervention from human activities. The study of machine learning, a subfield of artificial intelligence (AI) and computer science, aims to simulate human learning processes using data and algorithms, gradually increasing the accuracy of the results. Innovative products based on machine learning, like Netflix's recommendation engine and self-driving cars, have been made possible in recent years thanks to technical advancements in storage and processing capacity.ML broadly divides into the following four types namely supervised, unsupervised, semi supervised, and reinforcement learning.

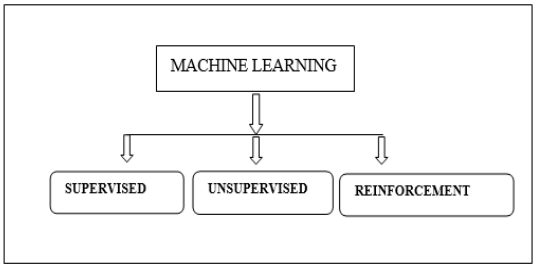


Figure 2 Types of machine learning

1) Supervised Learning

This type of machine learning uses labeled data or datasets to instruct the computer and learn from the experience to predict the outcomes. The pre-trained model will predict the outcome when the new labeled data is input into the machine. This algorithm is widely used in all sectors along with in the health sector to improvise the standard of living of human beings. Stress may also be detected using this approach of machine learning. By using labelled datasets to train algorithms to reliably categorise data or predict outcomes, supervised learning, also known as supervised machine learning, is defined. The weights of the model are adjusted as input data is fed into it until the model is well fitted. To prevent the model from being over fitted or under fitted, this happens as part of the cross-validation procedure. Such as categorising spam in a different folder from your email, supervised learning assists enterprises in resolving a range of real-world issues at scale. Among the techniques used in supervised learning include neural networks, naive bayes, linear regression, logistic regression, random forest, and support vector machines (SVM).

2) Unsupervised Learning

This is the type of machine learning in which unlabelled data or datasets will teach the machine and learn from the experience to predict the outcomes. In this kind of ML, there is no supervisor to train the machine. In this ML type, the algorithm has to learn from observations or experiences and find out its outcomes. When the dataset is supplied into the model, it analyzes and determines patterns on the dataset makes clusters, and split the dataset into those clusters. Unsupervised machine learning, commonly referred to as unsupervised learning, employs machine learning algorithms to evaluate and cluster unlabeled information. Without the assistance of humans, these algorithms identify occult patterns or data clusters. Due to this method's capacity for information discovery, cross-selling tactics, consumer segmentation, picture and pattern recognition, and exploratory data analysis are all made possible. Through the process of dimensionality reduction, it is also utilised to lower the amount of features in a model. Two popular methods for this are principal component analysis (PCA) and singular value decomposition (SVD). Neural networks, k-means clustering, and probabilistic clustering techniques are additional algorithms utilised in unsupervised learning.

3) Reinforcement Learning

It is a learning based on the "Reward and Punishment" method. Problems act as machine agents and utilize the experience from the environment and bring the best outcome. Reinforcement learning in healthcare is attractive, but there are few demerits in the real-world. Although the algorithm isn't trained on sample data, reinforcement machine learning is a machine learning approach that is comparable to supervised learning. By making mistakes along the way, this model learns. The optimal suggestion or strategy will be created for a specific problem by reinforcing a string of good outcomes. Apart from these categories the following technology are also encounter with the early analysis of the mental stress in the employee. Therefore, Machine learning can be used to help people manage stress by providing personalized solutions to identify and address the sources of stress. Machine learning algorithms can be used to analyze data from various sources, such as a person's behaviour, lifestyle, and environment, to identify patterns and correlations that can help people understand their stress levels and develop coping strategies. Additionally, machine learning can be used to create personalized programs that can be tailored to an individual's needs, such as providing reminders or tasks to help them manage their stress levels.

B. Deep Learning & Neural network

In recent years, deep learning has become a popular topic of research, particularly in the area of mental health and stress management. Deep learning algorithms can be used to analyze large amounts of data to identify patterns and trends that can indicate when an individual may be feeling overwhelmed or experiencing an increase in stress.

Deep learning is the kind of machine learning in which the neural network is used with three or more layers. The deep learning cum neural network layer attempt to mimic human brain activity. As the number of layers in the neural network increases, the accuracy of the network improves. Convolutional neural networks (CNN) and artificial neural networks (ANN) are the foundations of the most significant deep learning models (CNN). They get their inspiration from the way real neurons communicate with one another, emulating the name and structure of the human brain. By taking all of these factors into account, the model can suggest interventions that are tailored to the individual and can help improve their overall mental health.

C. Natural Language Processing

The field of artificial intelligence is characterized as natural language processing (NLP), specifically machine learning, and gives machines the capacity to interpret voice and text quite like humans. NLP also makes machines able to auto-interpret and manipulate textual data or spoken words. This will lead to filling the communication gap between machines and humans, which ultimately enhances the interaction of the software with human life development. Mental stress is an important factor that can have a significant impact on our lives. As such, it is important to understand the implications of mental stress on our cognitive and physical health. One way to do this is through the use of natural language processing (NLP) The field of artificial intelligence is characterized as natural language processing (NLP), specifically machine learning, and gives machines the capacity to interpret voice and text quite like humans.

IV. FINDING AND DISCUSSION

One of the most researched subjects in the healthcare industry nowadays is mental health. Additionally, the subject has also received substantial discussion in various physiology publications. The significance of the subject is demonstrated by the fact that physical health is impacted by mental health as well as has long-term implications on mental disease. It is fair to say that the focus of mental health research has shifted throughout time, with one of the most studied topics now being mental stress. It is significant to highlight that the application of clinical research to healthcare and medical practice is included in the analysis and evaluation of the scientific output from this study of bibliometric analysis. Because study findings are rarely presented in a systematic manner and are 6 spread throughout different publications, it is frequently seen that professionals' knowledge of published research is either partial or insufficient. This makes it challenging to evaluate the published scientific data. In order to solve the aforementioned problems, bibliometric analyses frequently serve as a systematic amalgamation of all clinical research conducted on a certain topic or subjective area. An insight that offers a cross-sectional picture of the current status of research efforts on the topic of interest is represented by bibliometric analysis. It is a statistical and quantitative study that seeks to determine the academic influence and features of publications within a certain research topic. This information may be helpful to researchers developing research plans to solve mental health concerns. This study will aid in identifying the standards of the research, innovations, and developments in the field of mental health. Numerous clinical and fundamental research studies have described the possible negative consequences in people caused by mental health conditions, such as stress, asthmatic discomfort, sleeplessness, high blood pressure, depression, and anxiety. In this paper, we perform the bibliographic analysis of the research on identifying mental health problems. There is significant research being done on the early prediction of mental stress and mental health issue in various ways. And the machine learning approach deploys on the dataset for the early detection of mental health issues, is broadly categorized into the following types.

TABLE 1: CATEGORY OF DATASET
1. BIO-SIGNAL DATA.
2. SOCIAL MEDIA DATA (TWITTER, FACEBOOK, ETC).
3. SENSORS DATA VIA SMARTWATCH.
4. TEXT AND VOICE DATA.

We have performed the bibliometric analysis on the most specific studies confined to the above dataset. In this analysis, the study of Kurniawan et.al [3] proposed the stress detection technique using the Galvanic skin response and speech signals; therefore, on the basis of recorded voice and modern sensor technology over the SVM classifier the accuracy of 92% was achieved. The study of Yamini et.al [11] proposed a survey of depression detection using sentiment analysis, where the data of the social media platform such as Facebook is used for the prediction of mental stress levels using natural language processing.

The Depression level of the user is classified into positive, negative, or no emotions. Wang et.al [12] conclude an autonomous and non-intrusive 7 stress detection system based on data from smartphone sensing in the study. Kamra et.al [14] also proposed the cognitive disease prediction model using natural language processing and machine learning techniques by employing several neural networks to determine which is the most effective for diagnosing psychiatric disorders. Nijhawan et.al [16] proposed a study on stress detection in social interactions using natural language processing and machine learning, in which the ML and BERT models were used for sentiment analysis of the tweets data. It may be inferred from this bibliometric study's analysis that there is a lot of research on mental health. However, it is challenging to draw conclusions about the research's trend given that the top five articles which covered all facets of mental health concerns, including the diagnosis, treatment, and impact of the illness on people's mental and physical health.

V. CONCLUSION & FUTURE EXTENSION

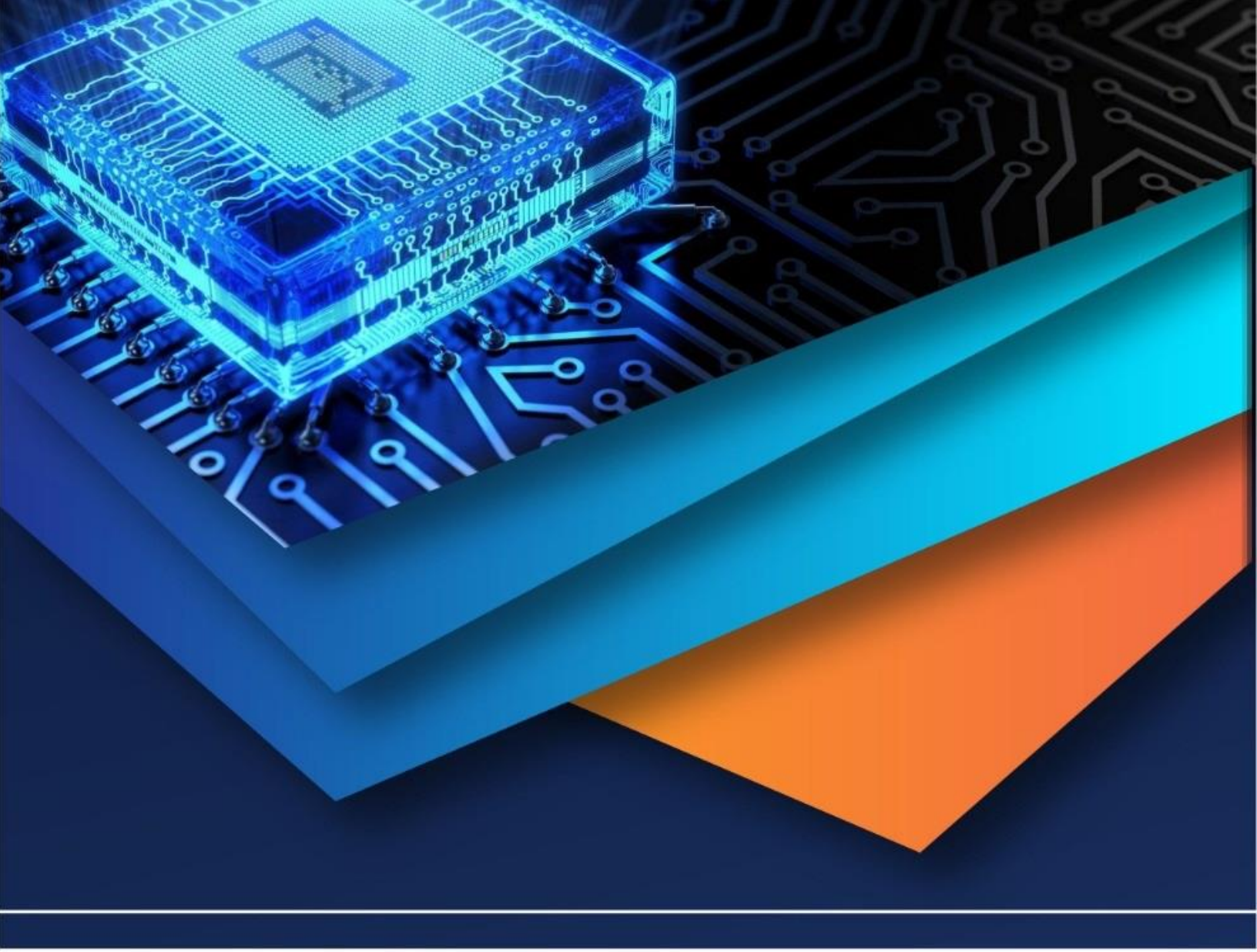
This paper attempted the bibliometric analysis of the most relevant articles on mental health which will aid in the descriptions, contrasts, and visual representations of research output in mental health based on evidence. Additionally, it may be utilized to explain and characterize the performance patterns of the artificial intelligence approach to early detection of mental health issue research. The majority of the publications in mental health are analysed both quantitatively and qualitatively by our bibliometric analysis. Additionally, it offers insights into scientific research, which will help in producing descriptions, contrasts, and visualizations of study findings in mental health that are supported by evidence. It may be used to explain and describe performance patterns as well as the effects of mental health issues. The objective of this study's future extensions is to build a reliable AI model that might employ machine learning to identify mental health issues early on. Using the natural language processing approach of machine learning with the combination of other sub field to predict mental stress may also become an auspicious technique.

REFERENCES

[1] https://wit.edu/student-life/health-wellness/foundational-wellness/brain?cv=1
[2] Bobade, Pramod, and M. Vani. "Stress detection with machine learning and deep learning using multimodal physiological data." 2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA). IEEE, 2020.
[3] Global Organization for Stress on stress facts. http://www.gostress.com/stress-facts. Accessed: 2020-27-02.
[4] Kurniawan, H., Maslov, A. V., &Pechenizkiy, M. (2013, June). Stress detection from speech and galvanic skin response signals. In Proceedings of the 26th IEEE International Symposium on ComputerBased Medical Systems (pp. 209-214). IEEE.
[5] Sano, A., & Picard, R. W. (2013, September). Stress recognition using wearable sensors and mobile phones. In 2013 Humaine association conference on affective computing and intelligent interaction (pp. 671-676). IEEE.
[6] Mozos, O. M., Sandulescu, V., Andrews, S., Ellis, D., Bellotto, N., Dobrescu, R., &Ferrandez, J. M. (2017). Stress detection using wearable physiological and sociometric sensors. International journal of neural systems, 27(02), 1650041.
[7] Rizwan, M. F., Farhad, R., Mashuk, F., Islam, F., & Imam, M. H. (2019, January). Design of a biosignal-based stress detection system using machine learning techniques. In 2019 international conference on robotics, electrical and signal processing techniques (ICREST) (pp. 364-368). IEEE.
[8] Yamini, B., Madhumitha, S. M., &Aruljothi, S. Depression Detection Using Sentiment Analysis.
[9] Wang, F., Wang, Y., Wang, J., Xiong, H., Zhao, J., & Zhang, D. (2019, August). Assessing mental stress based on smartphone sensing data: an empirical study. In 2019 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computing, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People, and Smart City Innovation (SmartWorld/SCALCO- -OM/UIC/ATC/CBDCom/IOP/SCI) (pp. 1031-1038). IEEE.
[10] Seo, W., Kim, N., Kim, S., Lee, C., & Park, S. M. (2019). Deep ECG-respiration network (DeepER net) for recognizing mental stress. Sensors, 19(13), 3021.
[11] Kamra, V., Kumar, P., &Mohammadian, M. (2021, May). Natural Language Processing Enabled Cognitive Disease Prediction Model for Varied Medical Records Implemented over ML Techniques. In 2021 3rd International Conference on Signal Processing and Communication (ICPSC) (pp. 494- 498). IEEE.
[12] Gedam, S., & Paul, S. (2021). A review on mental stress detection using wearable sensors and machine learning techniques. IEEE Access, 9, 84045-84066.
[13] Nijhawan, T., Attigeri, G., &Ananthakrishna, T. (2022). Stress detection using natural language processing and machine learning over social interactions. Journal of Big Data, 9(1), 1- 24
[14] https://www.ibm.com/cloud/learn/neuralnetworks#::text=Neural%20networks%2C%20also%20known%20as,neurons%20signal%20to%20one%20another.
[15] A. H. Yazdavar, M. S. Mahdavinejad, G. Bajaj, K. Thirunarayan, J. Pathak and A. Sheth, "Mental Health Analysis Via Social Media Data," 2018 IEEE International Conference on Healthcare Informatics (ICHI), New York, NY, USA, 2018, pp. 459- 460, doi: 10.1109/ICHI.2018.00102.
[16] Ghaderi A, Frounchi J, Farnam A. Machine learning-based signal processing using physiological signals for stress detection. In 2015 22nd Iranian Conference on Biomedical Engineering (ICBME) 2015 Nov 25 (pp. 93-98). IEEE.
[17] Liu D, Ulrich M. Listen to your heart: stress prediction using consumer heart rate sensors. Online]. Retrieved from the Internet. 2014.
[18] Mumtaz W, Ali SS, Yasin MA, Malik AS. A machine learning framework involving EEGbased functional connectivity to diagnose major depressive disorder (MDD). Medical & biological engineering & computing. 2018 Feb;56 (2):233-46.
[19] Salai M, Vassányi I, Kósa I. Stress detection using low cost heart rate sensors. Journal of healthcare engineering. 2016 Jun; 2016. Padmaja B, Prasad VR, Sunitha KV. A machine learning approach for stress detection using a wireless physical activity tracker. Int. J. Mach. Learn. Comput. 2018 Feb; 8:33-8. 10
[20] Cho, Gyeongcheol, et al. "Review of machine learning algorithms for diagnosing mental illness." Psychiatry investigation 16.4 (2019): 262.
[21] Deshpande, Mandar, and Vignesh Rao. "Depression detection using emotion artificial intelligence." 2017 international conference on intelligent sustainable systems (iciss). IEEE, 2017.

[22] Ahuja, Ravinder&Banga, Alisha. (2019). Mental Stress Detection in University Students using Machine Learning Algorithms. Procedia Computer Science. 152. 349- 353. 10.1016/j.procs.2019.05.007.
[23] Tate, Ashley E., et al. "Predicting mental health problems in adolescence using machine learning techniques." PloS one 15.4 (2020): e0230389.
[24] Rizwan, MdFahim, et al. "Design of a biosignal based stress detection system using machine learning techniques." 2019 international conference on robotics, electrical and signal processing techniques (ICREST). IEEE, 2019.
[25] Padmaja, B., VV Rama Prasad, and K. V. N. Sunitha. "A machine learning approach for stress detection using a wireless physical activity tracker." International Journal of Machine Learning and Computing 8.1 (2018): 33-38.
[26] Lin, Huijie, et al. "Detecting stress based on social interactions in social networks." IEEE Transactions on Knowledge and Data Engineering 29.9 (2017): 1820-1833.
[27] Doan, Son, et al. "Using natural language processing to extract health-related causality from twitter messages." 2018 IEEE International Conference on Healthcare Informatics Workshop (ICHI-W). IEEE, 2018.
[28] Garcia-Ceja, Enrique, VenetOsmani, and Oscar Mayora. "Automatic stress detection in working environments from smartphones' accelerometer data: a first step." IEEE journal of biomedical and health informatics 20.4 (2015): 1053-1060.
[29] Lee, Boon-Giin, and Wan-Young Chung. "Wearable glove-type driver stress detection using a motion sensor." IEEE Transactions on Intelligent Transportation Systems 18.7 (2016): 1835-1844.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)