IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 12, December 2024

DOI: 10.17148/IJARCCE.2024.131259

MENTAL HEALTH AMONG ADULTS, CAUSES AND MODELS IN MACHINE LEARNING

Nandana Jayaram[1], Nagavarshini[2], Panchami V Gunaga[3], K R Adithya[4], Anupama K[5]

Department of Computer Science and Engineering, AJIET, Mangaluru, Karnataka, 575006, India[1-4]

*Assistant Professor Department of IoT and Cyber Security Including Blockchain Technology,

AJIET, Mangaluru, Karnataka, 575006, India[5]

Abstract: Mental health disorders, anxiety disorder, depression, and even stress, are seen rising among adults compared to preceding generations. The factors that influence adult mental well-being issues are examined for alternative measures to enhance such adult mental well-being through this review. Recently, in the pursuit of care provision support systems include therapy, counseling, workplace mental health initiative, and internet-based programs. The review also covers barriers which include stigma, cost, and limited access. Conclusion The review concerning the systems concludes advising improvements of the support structures for mental health that are universal, accessible, and user-friendly enough to alleviate the growing concern about adult mental health.

Keywords: Mental Health, Machine learning, Deep learning, KNN, Random Forest, Decision Tree, Naive Bayes, SVM.

I. INTRODUCTION

Mental disorders among adults have become a global concern in which most adults experience anxiety, depression, and stress. According to the World Health Organization, one out of every four people will face mental health problems at some point in their lives, making it an important area of study and intervention. Hence, there is the immense need to explain and acknowledge the need of these support systems because it has a major role in the management and navigation of tasks of overcoming such challenges.

Both formal support systems such as therapy and counselling as well as informal support systems including peer and family support prove helpful. The stigma attached to mental health issues, the financial burden of treatment, and lack of knowledge concerning mental health care includes some of the factors that impede most people's availability of psychological care. However, with increasing technological integration, fresh mechanisms for support, including digital mental health platforms and mobile applications, are being established, making help more accessible to people.

Mental illness has a big impact on emotions and reasoning, even on social contact, and in this regard, it requires protection and assistance. These things can be obtained by early detection. Machine learning is a advanced technique that has enormous possibilities for predicting mental health issues by employing sophisticated statistical techniques to analyze data, leading to personalized insights. This review mainly focuses on summarizing the recent advancement in machine learning applications in mental health pointing out gaps and inviting future research directions [1].

Machine learning (ML) and Natural Language Processing (NLP) can also be used to improve psychological help by analyzing large data quantities to forecast mental health conditions and provide personalized care. Algorithms can recognize patterns in a person's behavior, social media interactions, or health information that may signal stress, depression, or anxiety. ML-driven chatbots and virtual counsellors are equipped to give timely help and advice, while predictive models enable clinicians to make better-informed treatment decisions. The algorithm for the particular model is choosen by seeing the best accuracy. [2] [8]

Analyzing mental health typically requires dealing with complex and multi-dimensional datasets gathered over time. These datasets include various factors such as behavioral patterns, emotional states, and social interactions. To effectively work with these types of data, supervised learning algorithms are the most appropriate and recommended choice. Our goal is to assess and choose the best algorithm from this category to create an effective model for forecasting mental health conditions and offering personalized support.

© IJARCCE This work is licensed under a Creative Commons Attribution 4.0 International License

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 12, December 2024
DOI: 10.17148/IJARCCE.2024.131259

II. MENTAL HEALTH ANALYSIS

A. Issues among Adults and factors affecting

It will depend on a lot on personal factors, and particularly concerning the individual's mental health status. Many factors, such as genetic predisposition, stress-resilience, childhood trauma and general physical health contribute to mental well- being. Even personal stressors such as family dynamics, relationships and lifestyle choices affect mental health. [11]

Parameters as job stress, workload, security and workplace culture are few of the leading causes of mental health obstacles. Demanding more than you can give, not knowing what is expected of you, poor management and insufficient support can lead to burnout or stressed team members with heightened anxiety. Every career stage bears its peculiar set of challenges. Early-career persons usually experience anxiety regarding their chances of doing the job well and retaining it.Mid-level professionals may be engaged in the struggle to work out the balance between work and personal life, while late-career persons generally face the stress about event of retirement and concerns for health. [11]

When structure changes in the work place through reorganization, downsizing, or merging, there is always a sense of uneasiness and anxiety among the employees. All this uncertainty can cause stress, decrease in efficiency of work, and even mental problems. No matter if one has a support system has a great impact on mental stability.

Cultural stigmas, societal pressures, and the general mindset towards mental health can either support or hinder a person in their journey toward healing. In a lot of cultures, mental illness is a highly stigmatized issue and therefore does not get the support or treatment that it needs. Unemployment, debt, or financial insecurity are all causes of stress, anxiety, and depression. Add in some economic down turns, and lack of opportunities, and it makes the situation all the worse. [11]

B. Dataset

The data sets usually come from sites like Kaggle, people share their findings and models for machine learning. Kaggle gives out many datasets for free and they are already processed usually, so they can be modified to fit the demands of a particular project. Datasets are also collected through structured online surveys. [2]

- The first step involves collecting the raw data from different media. These could range from medical records to survey answers to social media conversations to physiological information from wearable technology. This information can be in the form of text (answers to surveys, tweets), numbers (clinical values), and even images (facial expressions, activity graphs). And all these forms will need to be put into some sort of consistent format for machine learning.
- Then the data is preprocessing, eliminating any redundant or meaningless data and pulling out the most valuable information such as severity of symptom, demographic information, behavioral patterns. This way only the really important information is analyzed.
- Next comes indexing, where various pieces of data (depression score, anxiety levels) are assigned tags or so the data can be sorted and used effectively.
- Classification is the final step in refining the dataset. For mental health analysis, classification might involve categorizing the data into groups such as low-risk, moderate-risk, and high-risk for conditions like stress, anxiety, and depression. The final data set may consist issues such as depression, anxiety among students in higher education is a notable element when considering their mental well being during the COVID-19 gave us an accuracy of [99.87%][2]. The highest accuracy of [97%]
  of structured variables such as survey scores (PHQ-9, GAD-7), demographic factors (age, sex), social indicators (loneliness, sleep patterns), and physiological data (heart rate variability, activity level).
- From these data we can develop a machine learning model.

The dataset includes issues like stress, anxiety, depression etc. Considering this, the dataset required for each categories should be collected and analyzed for better results or model. Such an approach will improve the efficiency in forecasting and provide better outcomes.

C. Model

With reference to provided preprocessed dataset, a machine learning model is designed to analyze and predict mental health issues. The process follows a standard supervised learning approach. Or we could use some sort of machine learning algorithm, for increased accuracy. [2]

The steps from dataset to prediction is:

- The initial step is to train the data set that runs through a model which will predict mental health conditions (stress, anxiety, depression, loneliness.

DOI: 10.17148/IJARCCE.2024.131259

- Thenthe data is segmented into a training set and a test set. Than these dataset id trained on the bases of trained data and tested data to gauge the effectiveness of the particular model works.
- Which is to point out that model building is a matter of choosing an appropriate machine learning, such as Support Vector_Machine (SVM), Random Forest, XGBoost, Decision Tree, k-means, Linear Regression, Naive Bayes.
- The model fitting is performed on the training data while the test data is reserved to the success of the model on unseen data.
- Metrics such as accuracy, precision, recall and confusion matrix are used to evaluate the capability of the model regarding the quality of its predictions.

Different algorithms can also permit the classification of risk levels in mental health such as low, moderate and high mental health risk. Also, regression models can be utilized to estimate the intensity of symptoms such as stress or anxiety states [7].

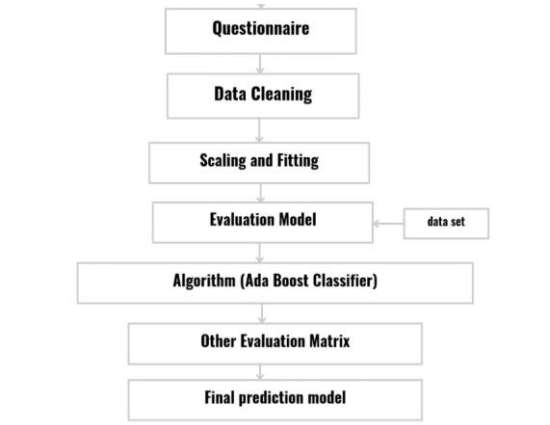

Fig 1. Workflow

III. MACHINE LEARNING ALGORITHMS USED

Machine learning has emerged as a very important technological advancement in assessing mental disorders after evaluating a large range of networks and their datasets. The

- was found in Predicting Posttraumatic Stress Disorder.[1] When using the DASS21 dataset, evidence showed that anxiety was correctly identified 100% within that timeframe by the RF algorithm. When applying the algorithm to the same dataset for the identification of depression and stress, the results were little less for the accuracy 96.55% and accuracy for depression also demonstrated statistical significance high.[8]
- Support Vector Machine (SVM): It is a robust classification method which helps in dividing people, on the basis of survey responses and behavioral data, into high risk, or low risk categories. SVM gave a accuracy of [58.2%] for diagonizing of schizophrenia which was the least among all the other algorithms applied. Since random forest has highest accuracy that was selected. To classify schizophrenia patients the accuracy was found to be [74%] for single nucleotide polymorphism . The datasets provided by National Institute of Health for diagonizing schizophrenia gave an accuracy of [82.68%] which was lesser than other algorithms used. For identifying anxiety and depression in early stage it gave us an accuracy of [95%] for anxiety and [95.8%] for depression. [1] says that the NLP model has better precision recall and F1 score than the SVM model does. That suggests that the SVM model is not as accurate as the NLP-based method that averaged 97.02% accuracy after several tests. [6] It's an technique employed for classification issues and it works by determining the hyperplane that maximally separates the different classes in the feature space. It has been recognized for its effectiveness in predicting depression levels with an accuracy of 88.15% in related studies.[12]
- Naive Bayes: The algorithm is easy to use and quite effective in tasks of text classification, which makes it applicable for use in imn Nuddeulborg. It gave us an accuracy of [66.9%] for diagonizing the schizophrenia.[1]
- XGBoost: A gradient-boosting algorithm that is advanced and depicts significant performance and efficiency. In mental health prediction analysis, XGBoost is bandie about when there is a requirement for high accuracy and for handling complex relationships among features. It is used to adjust mistakes in predicting outcomes targeting, stress, and anxiety levels. It gives us accuracy of [66.3%] for diagonizing the schizophrenia.[1]
- Linear Regression: As per the study, LR achieved the least accuracy amongst the numerous machine learning algorithms examined. More concretely, in comparison to the models RF and NB it had an accuracy of 43.75 percent. In other words, it has to be mentioned that LR was treated in a different context where a more general approach involving several algorithms was taken, but no other accuracy measures for LR were disclosed other SVM, RNN, etc.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 12, December 2024

DOI: 10.17148/IJARCCE.2024.131259

- High Accuracy: The NLP-based prediction mechanism model achieves the result more than 96.7% in the causes of depression, outperforming other models based on NN, preference for algorithms can vary using the data that is accessible and the prediction task. Several among the famous methods used for prediction includes:
- Random Forest: One of a leading basic ensemble-classification algorithm distinctively bagging concept that helps in creating various decision trees aimed at achieving balanced mode or mean prediction outputs.
- It gives an accuracy of [73.7%] for classification of childhood-onset schizophrenia . For diagonizing of schizophrenia it gave us an accuracy of [83.33%] which was greater than the other algorithm used. The datasets given by National Institute of Health for diagonizing schizophrenia it gave an accuracy of [89.33%][1]. Understanding the key predictors of issues such as than its being portrayed as of a lower degree of efficiency.[8]
- Decision tree: According to the literature, Decision Trees are 82% accurate in their detection of mental health, (as seen in Gokten and Uyulan's study). This demonstrates the potential of Decision Trees as a reliable method for classifying mental health conditions, although their performance may vary when assessed against other machine learning algorithms.Decision Trees are typically appraised using various performance indicators, including accuracy, precision, recall, and F1 score. In the Gokten and Uyulan study, the DT model achieved a precision of 0.81 and a recall of 0.80, which further supports its effectiveness in mental health classification tasks.[8] This algorithm is used for its simplicity and interpretability. It helps in making decisions based on the features of the data, allowing for easy visualization of the decision-making process. The paper indicates that Decision Trees have shown good accuracy in predicting stress levels, with an accuracy of 84.44% for stress level prediction in related studies.[12]
- K-Nearest Neighbors (KNN): KNN, a common algorithm used in mental health detection experiments, tends to perform with mixed results depending on the setting and the data set in question. It's easy and versatile enough to be a very useful tool in the machine learning arsenal against mental illness.For example, KNN achieved an impressive 86. 98% accuracy in one study using the fusion modality of audio data.[8]

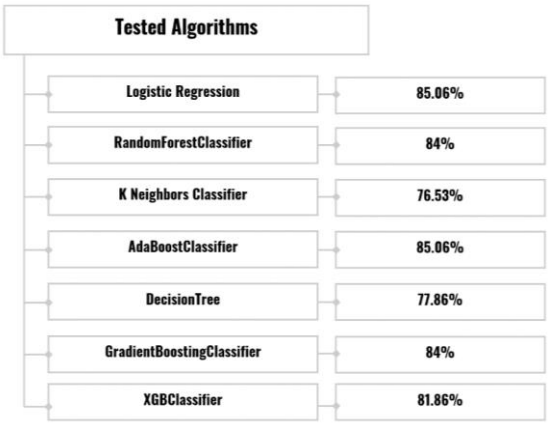

Fig 2. Algorithms and accuracy

IV. NATURAL LANGUAGE PROCESSING

Natural Language Processing: NLP in the Prediction of Depression among College Students The study to predict the depression tendencies in college students cannot be made without NLP. Some points to see how NLP is applied in this study:

- Emotion Analysis: NLP technology is used to identify the emotions of students and perform text content mining. This aids comprehension of the present feeling and thinking of the students which is crucial in forecasting occurrences of depressive behaviours.
- Feature Extraction: In this study, pretrained text has been used to create word embedding vectors. In order to enhance the likelihood of identifying language characteristics related to depression, the vectors have been readjusted to their respective semantic contents. This process will assist in the identification of important features in the language of the students, which may eventually enhance the effectiveness of stress assessment.
- Emotion Dictionary: The emotion dictionary is built by embedding word information based on phonetic characteristics and word concepts. Fine-grained feature representations of words can be produced, which is very important to detect features which are related to depression.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 12, December 2024

DOI: 10.17148/IJARCCE.2024.131259

- Model Development The regression-based predictive model NLP develops is constructed along with depression tendency as a target variable and various other features as input variables and compared against the additional techniques, which incorporate multiple forms such as NN, SVM, RNN, etc.
- High Accuracy: The NLP-based prediction mechanism model achieves the result more than 96.7% in the causes of depression, outperforming other models based on NN, SVM, RNN, and LSTM algorithms with relatively lower accuracy rates.
- Overall Effectiveness: The NLP-based model enhances the accuracy of the predictions and enables quicker analysis. For instance, the NLP model used on a dataset of 3,620 students was analyzed in much less time as compared to other models [8]

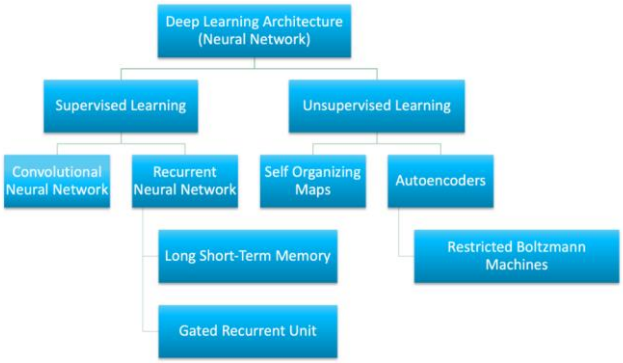

Fig 3.DL algorithms

V. DEEP LEANING ALGORITHM

- Deep learning algorithms have become the new weapon for detecting mental health problems, such as depression. The following section provides a very brief summary of some of the important deep learning algorithms discussed in the paper.
- Deep Q Neural Network (DQN): It is a reinforcement learning algorithm. For decision-making processes, the algorithm can be DQN. Related to mental health, for diagnosis of mental illnesses with robots and for observing various parameters by means of robots, it's highly effective in interactive environment.
- Recurrent Neural Network: RNNs are specifically well-suited for ordered data, as they are well-suited to the analysis of time-series data or text data related to mental health. They can easily pick up on temporal dependencies, which is of relevance in understanding patterns of the symptoms of mental health over time
- CNN: CNNs are more widely applied for image-related processing applications. They can read visual data, like any picture on social media and determine depression or anxiety by keeping track of the signs. The facility of extracting features from any picture makes them more resourceful in this area
- Restricted Boltzmann Machine (RBM): These utilize generative neural network principles, incorporating stochastic elements to are capable of learning probability distributions over input data. They may also be employed for feature extraction and reduction of dimensionality which can assist in recognizing patterns in relation to some mental health conditions.
- Artificial Neural Network (ANN): They represent a network of interconnected nodes or neurons, which learn complex patterns in data. In mental health detection, ANNs can be trained on various datasets to classify different mental health conditions effectively. In a nutshell, DQN, RNN, CNN, RBM, and ANN are deep learning algorithms that allow for different approaches in analyzing and detecting mental health issues. This unique feature enables the investigators to make use of data in diverse modalities such as text and images which improves the efficiency and the precision of mental health diagnosis.[8]

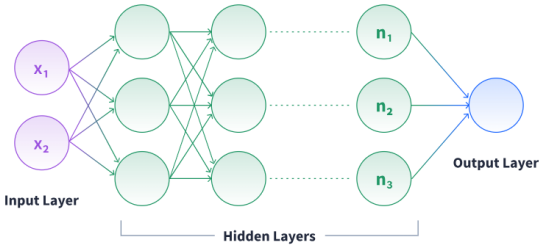

Fig 4. Deep learning

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 12, December 2024
DOI: 10.17148/IJARCCE.2024.131259

Each algorithm offers its own unique benefits. The functionality of these models are engineered to predict possible mental health difficulties that can be assessed with the help of performance assessment measures, such as accuracy, precision, recall, and F1-score.

VI. CONCLUSION

The escalating levels of anxiety, depression, and stress particularly among the adult population has created access to mental health support essential for improving well-being. The literature review papers we examined reveal several formal and informal strategies that individuals typically use to tackle mental health problems. Though these systems are available, impediments such as stigma, cost, and access still act as barriers towards availing care for many people.

To address the discrepancy, machine learning seems a good candidate as it can improve both the scale and granularity of the mental health assistance provided to the patients. SVM, Random Forest, and XGBoost algorithms are suitable for the purpose of finding patterns from enormous data which enables clinicians and individuals to detect mental health disorders at early stages. Location language also enables NLP to capitalize language based feelings fostering mental health prediction further.

Nonetheless, progress is possible. Improvements in these algorithms are crucial for overemphasized in addition to means of reaching out to everyone irrespective of their socioeconomic status should be prioritized in the future. Also, privacy and date security concerns should be dealt with as digital solutions are likely to integrate further into mental healthcare.

Indeed, improvement of machine learning in its application to give better, more accurate and feasible support systems toward this burgeoning population affected by mental health issues is one step closer to sustainability.

REFERENCES

[1]. Mental Health Prediction Using Machine Learning: Taxonomy, Applications, and Challenges Faculty of Computing and Informatics, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia
[2]. Predictive machine learning model for mental health issues in higher education students due to COVID-19 using HADSassessment Reshmy Krishnan Muscat College, Muscat, Oman Shantha Kumari SRMInstitute of Science and Technology, Chennai, India Ali Al Badi Gulf College, Maabelah, Oman, and Shermina Jeba and Menila James Muscat College, Muscat, Oman
[3]. SentiSync: A Robust System for Sentiment Detection and Analyzing the Mental Health Care with ML-Driven Algorithms Sinchana B U1, Thanushree G Hiremath2, Priyanka H V3 UG Students, Department of Information Science and Engineering1,2 Assistant Professor, Department of Information Science and Engineering3 Global Academy of Technology, Bangalore, India
[4]. Harnessing the Power of Hugging Face Transformers for Predicting Mental Health Disorders in Social Networks ALIREZA POURKEYVAN1, RAMIN SAFA 1, ANDALISOROURKHAH 2 1Department of Computer Engineering, Ayandegan Institute of Higher Education, Tonekabon 4681853617, Iran 2Department of Management, Ayandegan Institute of Higher Education, Tonekabon 4681853617, Iran.
[5]. M. M. Qirtas, E. B. White, E. Zafeiridi and D. Pesch, "Personalizing Loneliness Detection Through Behavioral Grouping of Passive Sensing Data From College Students," in IEEE Access, vol. 11, pp. 88841-88851, 2023, doi: 10.1109/ACCESS.2023.3305965.
[6]. He, Zhang. "Prediction mechanism of depression tendency among college students under computer intelligent systems" Journal of Intelligent Systems, vol. 33, no. 1, 2024, pp. 20230209. https://doi.org/10.1515/jisys-2023-0209
[7]. Liu, Nan, Liu, Haihong, and Liu, Haining. 'Mental Health Diagnosis of College Students Based on Facial Recognition and Neural Network'. 1 Jan. 2021 : 7061 – 7072.
[8]. A review and meta-analysis of machine intelligence approaches for mental health issues and depression detection
[9]. SMART Mental Health Project: process evaluation to understand the barriers and facilitators for implementation of multifaceted intervention in rural India
[10]. Prediction of Mental Health Problems Among Children Using Machine Learning Techniques
[11]. Dr. G. Arun Kumar, Mr. K H Shabbeer Basha, Sandesh Pokhrel, Jiwan Chaudhary Tharu, Shyam Lal Kafle, Nabin Shahi Mental Health Prediction of Employees at the Workplace Using Machine Learning
[12]. He, Zhang. "Prediction mechanism of depression tendency among college students under computer intelligent systems" *Journal of Intelligent Systems*, vol. 33, no. 1, 2024, pp. 20230209. https://doi.org/10.1515/jisys-2023-0209