

Mental Health Prediction using Machine Learning

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Abstract: *Humanity has always struggled with mental health issues. Since the fifth century BC, there have been historical references to mental disease. However, the issue is increasingly prevalent in the current society. Out of India's whole population, 130 million individuals may be affected by a mental disease, according to official statistics. Our broken healthcare system and the lack of proper government assistance for this problem are the major causes of the large number of persons who suffer from mental illness.*

Keywords: Mental Health

I. INTRODUCTION

Humanity has always struggled with mental health issues. Since the fifth century BC, there have been historical references to mental disease. However, the issue is increasingly prevalent in the current society. Out of India's whole population, 130 million individuals may be affected by a mental disease, according to official statistics. Our broken healthcare system and the lack of proper government assistance for this problem are the major causes of the large number of persons who suffer from mental illness. In India, the subject of mental health is still taboo, therefore only 8 to 10 percent of individuals are able to receive therapy for their issues, while the remainder go unrecognised, which may be a contributing factor to India's high suicide rate. Nearly 35% of patients who seek medical attention may have depression, post-traumatic stress disorder (Ptd), anxiety, sleeplessness, bipolar disorder, etc., according to doctors. The inability to afford solutions is yet another significant aspect that fuels the issue. A sizable portion of India's population lives in poverty; they lack access to adequate housing, food, water, medicine, etc. For many, finding effective therapy for mental illness remains a pipe dream. Treatment is expensive, even for the highest 10% of the population. In comparison to Argentina, which is the world leader in this field and has 106 psychologists per 100,000 people, India has 0.75 psychologists and psychiatrists for every 100,000 people, according to data from the World Health Organisation. To overcome this potential epidemic of mental illness, the government has to take some strong and necessary steps towards healthcare, providing a sufficient budget towards mental health. To diagnose a patient's problem, the doctor may ask the patient to fill out a questionnaire. The nature of these questions could be situational and objective. In our paper we are trying to predict the following problems.

- **Depression** is an emotional disorder that makes it challenging for the sufferer to carry out daily tasks. Depression can be identified when a person experiences persistent melancholy and hopelessness.
- **Anxiety** is defined as a nervousness-like feeling coupled with an excessive worry about the future. In particularly severe cases, it can also result in shortness of breath and a fast heartbeat.
- **Post-traumatic** stress disorder (PTSD) is a psychiatric condition marked by an inability to get better after having experienced or seen a scary incident.
- **Insomnia** is a common sleep disorder that makes it difficult for a person to fall asleep, stay asleep, or keep them from waking up early and going back to sleep.

A relatively new area that has attracted a lot of attention recently is the use of machine learning to predict mental health. Despite decades of study into the idea of utilising data-driven methods to forecast mental health outcomes, the development of machine learning and improvements in data analytics have made it possible for academics and therapists to create prediction models that are more precise and dependable.

II. WORK FLOW OF SYSTEM

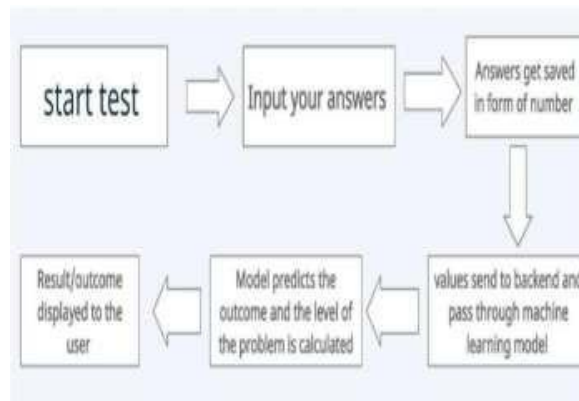


Fig: Data Flow Diagram

Machine learning algorithms like support vector machines, neural networks, and ensemble approaches were used to larger and more complex datasets in mental health research as technology and computing capacities improved. These algorithms were able to more accurately forecast the consequences of mental health by analysing large volumes of data, including genetic data, electronic health records (EHRs), social media data, and other digital biomarkers.

Early diagnosis and treatment of mental health illnesses has been one of the major advances in machine learning-based mental health prediction. Researchers have developed models It uses behavioural, physiological, and self-report data patterns to find early symptoms of mental health issues including sadness and anxiety. For instance, digital biomarkers like typing habits, facial expressions, and voice patterns have been analysed by machine learning algorithms to anticipate the development of mental health disorders before they completely appear. Suicide risk prediction has been a subject of research in another field of mental health forecasting. By examining a variety of risk indicators, such as historical data on suicidal thoughts, prior suicide attempts, psychiatric diagnoses, social support networks, and other contextual factors, machine learning models have been constructed to predict suicidal behaviour. When it comes to detecting those who are at a high risk of suicide and enabling prompt treatments, these models have demonstrated encouraging outcomes.

III. TECHNOLOGIES

Machine learning may be used to predict mental health utilising a variety of different technologies. These technologies could consist of:

- **Electronic Health Records (EHRs):** An individual's medical and mental history is recorded in an electronic health record (EHR). EHR data may be analysed by machine learning algorithms to find trends and indicators of mental health disorders. For instance, depending on a patient's medical history, use of medications, and other pertinent criteria, algorithms may be trained on sizable EHR datasets to forecast the risk that the patient would experience depression or schizophrenia.
- **Wearable Technology:** Wearable technology, including smartwatches, fitness trackers, and biosensors, may gather information on a variety of physiological factors, including heart rate, sleep patterns, and physical activity, which can be used to forecast mental health. These data streams may be analysed by machine learning algorithms to find patterns or anomalies that can point to changes in mental health state. Changes in sleep patterns or heart rate variability, for instance, might be signs of stress or worry.
- **Social Media and Digital Footprints:** Social media sites and other digital footprints, including text messages or internet search histories, may offer a plethora of information that can be used to forecast mental health. These data sources may be analysed by machine learning algorithms to look for linguistic, emotive, social, and behavioural trends that can indicate the presence of mental health issues. For instance, alterations in language usage, the frequency of social contacts, or participation in online forums discussing mental health issues may be signs of alterations in mental health status.

The study of interpreting and processing human language is the focus of the area of natural language processing (NLP), a branch of machine learning. For the purpose of predicting mental health, NLP techniques may be used to analyse text data from sources including clinical notes, patient interviews, and social media posts. For instance, it is possible to forecast mental health outcomes or spot early warning signals of mental health issues by using sentiment analysis, topic modelling, and language-based characteristics.

Mobile Apps and Digital Interventions Mobile apps and other digital tools that forecast mental health, including chatbots or virtual reality programmes, can gather information on user behaviour, emotions, and reactions to interventions. These data may be examined by machine learning algorithms to find trends and indicators of outcomes related to mental health. To anticipate changes in mental health status, for instance, app usage habits, self-reported moods, or reactions to therapeutic therapies might be employed.

Brain Imaging: Electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) are two brain imaging methods that can offer information on brain connections and activity that can be used to predict mental health. Brain imaging data may be analysed by machine learning algorithms to find biomarkers or patterns of brain activity that may be related to mental health issues. For instance, alterations in the brain's activity in specific areas may be a sign of depression or other mental health conditions. These are only a few examples of the technologies that may be applied to machine learning-based mental health prediction. The particular study or clinical environment, as well as the accessibility of data, will determine the technology to be used.

IV. METHODOLOGY

The planning step is followed by the searching and analysis phases in this review work. The discussion of the discovered pertinent papers will then be emphasised and condensed in this article. To wrap up this review study, the findings will be discussed.

For this review study, many goals or research issues have been identified and examined. In order to help the clinical practise, we'd want to start by summarising the most recent research on machine learning techniques for forecasting mental health issues. In addition, the types of machine learning algorithms that have been extensively used to this subject will be identified in this review study. Additionally, we aim to identify potential future research directions or possibilities that might fully realise the promise of machine learning techniques in the mental health sectors. The sources of the database used to compile the research papers and articles are identified for the planning stage. This review paper has highlighted the journals and conferences that are relevant to the research, including International Conference on Computational Intelligence and Data Science, Journal of Psychiatric Research, and International Conference on Advanced Engineering, Science, Management and Technology.

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V. DESIGN

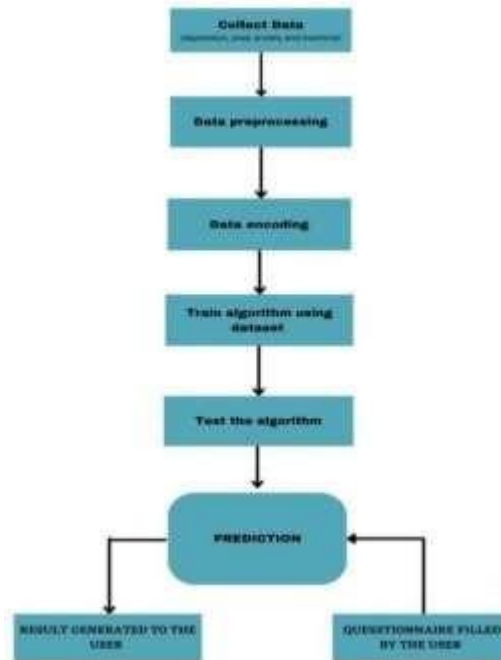


Fig Design photogram

The World Health Organisation (WHO) provides regional status updates on various obstacles to diagnosing mental health issues and urges scientists to have the scientific knowledge necessary to solve the problem of mental health. Due to technological advancements, there are now several methods for predicting one's mental health. The amount of research in the area of mental health has expanded recently, which has helped to spread knowledge and publications about the various aspects of mental health that can be used to solve a variety of issues. The process of identifying mental health issues is not simple and cannot be completed in a short amount of time. The diagnosis will often start with a particular interview complete with inquiries regarding symptoms, medical history, and physical examination.

In addition, psychological exams and diagnostic tools can be used to identify a person's mental health issues. Numerous studies have been conducted to look into and analyse facial motions to detect certain mental illnesses. Information on appropriate methods to lessen mental health issues has increased as a result of increased study in the field of mental health. The particular causes of mental diseases, however, remain unknown and ambiguous.

VI. MACHINE LEARNING AND DATA MINING

The administration and processing of data has completely developed into a hot issue in computer science nowadays. Knowledge finding in databases is known as data mining, which is discovering useful patterns and relationships in large volumes of data. Within the medical field, data mining techniques are increasingly applied for tasks such as text expression, drug design, and genomics.

The two types of data mining approaches are supervised learning and unsupervised learning. Through the group's data, it establishes the object's similarity and finds patterns for unsupervised learning. Clustering, association, summarising, and sequence finding can all be done using it. When the data set is unlabeled, unsupervised learning is especially helpful in assisting with automatically identifying the data structure by learning inherent from input data.

Data mining is, in summary, an essential tool for computer science. Through data mining, the complexity of the amassed data sets may be quickly and effectively resolved. Additionally, data mining may benefit numerous parties by improving outcomes and providing answers to their difficult challenges. Machine learning is an application of artificial intelligence (AI), which implements systems with the capability to learn and improve from experience without being explicitly programmed. Machine learning has offered essential advantages to a wide range of areas such as speech recognition.

VII. RESULTS

In order to achieve high accuracy with the model the data needs to be properly cleaned and preprocessed until it is well fitted. To do this we used python libraries like NumPy, pandas and matplotlib.

In order to get the best result for our work we had to pass each of our datasets through multiple ML algorithms like logistic regression, SVM, random forest, k-neighbors etc. Example: - for anxiety, we ran the above-mentioned algorithms and achieved accuracy of 97.27%, 94%, 81%, 80% etc. respectively. Same was the case for the other three diseases which had different levels of accuracy. For our system we chose the algorithm which gave us the true and highest accuracy. We also tried to finetune the hyperparameter to check if the accuracy could be increased more.

VIII. CONCLUSION

Many different techniques and algorithms had been introduced and proposed to test and solve the mental health problems. There are still many solutions that can be refined. In addition, there are still many problems to be discovered and tested using a wide variety of settings in machine learning for the mental health domain.

As classifying the mental health data is generally a very challenging problem, the features used in the machine learning algorithms will significantly affect the performance of the classification. The existing studies and research show that machine learning can be a useful tool in helping understand psychiatric disorders. Besides that, it may also help distinguish and classify the mental health problems among patients for further treatment. Newer approaches that use data that arise from the integration of various sensor modalities present in technologically advanced devices have proven to be a convenient resource to recognize the mood state and responses from patients among others.

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and machine learning algorithms. They also discuss the challenges and limitations of predicting mental health outcomes and highlight the need for further research in this area.