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Cognitive Health Analysis

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ABSTRACT: Undoubtedly, a person's emotions, intellect and ability to communicate with others are all affected by mental illness, which is a health issue. These problems have demonstrated that mental illness has major societal repercussions and necessitates novel approaches to prevention and intervention. A crucial technique for implementing these measures is early mental health detection. The rise in mental health issues and the demand for high-quality medical care have prompted research into the use of machine learning in mental health issues. One of the most recent generations of AI technology, deep learning (DL), has proven to perform better in a variety of real-world applications, from computer vision to healthcare. This work aims to review the literature on DL algorithm uses in outcome research on mental health. By recognising mental health symptoms and risk factors, predicting the course of diseases, customizing and optimizing treatments, and understanding patterns of human behavior, ML approaches may open up new avenues. Despite the potential uses of ML in the field of mental health, this is a relatively new field of study and creating practical ML-enabled applications is fraught with numerous intricate, interrelated difficulties. In discussing our findings, (i) we consider the current state-of-the-art of machine learning (ML) work for mental health (ii) offer specific recommendations for a stronger integration of human-centered and multi-disciplinary approaches in research and development and (iii) invite more thought into the potentially extensive personal, social and ethical implications that ML models and interventions can have, if they are to find widespread, successful adoption in real-world mental health.

I. INTRODUCTION

A person's mental health is determined by both their current state of mind and how they are interacting with the world around them. A person's level of mental health acts as a gauge for how to treat their illnesses effectively. It is crucial to monitor the mental health characteristics of various groups in order to anticipate any health-related anomalies. There are working adults, college students, and high school students living in the neighborhood. It is essential to assess the mental health of various categories at various points in time in order to prevent major sickness Some of the most serious mental health conditions, like chronic illnesses, bipolar disorder, and schizophrenia, develop gradually over time and have early-stage signs that can be identified. Such disorders might be prevented or better managed. If anomalous mental states are identified early on in the disease's progression, additional attention and therapy can be given. Although there are screening test solutions, they are not practical for large populations due to time and financial constraints.

II. LITERATURE SURVEY

Stress, depression, and other psychological health conditions have grown quite widespread among the general public in today's fast-paced environment[1]. Five distinct machine learning algorithms were used to predict the occurrence of anxiety, sadness, and stress on five different severity levels. This study has used the Depression, Anxiety and Stress Scale questionnaire to identify signs of stress, anxiety, and depression (DASS 21). Google forms were used to collect data from a total of 348 participants, and five machine learning algorithms, d.Decision Tree (DT), Random Forest Tree (RFT), Naive Bayes, Support Vector Machine (SVM), and K-Nearest Neighbor were used, in which in which Bayes turned out to have the best accuracy. To calculate the accuracy and error rates, precision, recall and specificity in each confusion matrix these equations were used.

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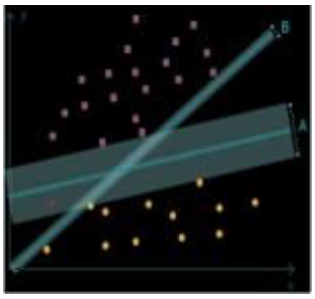

Fig.1 Support Vector Machine Representation

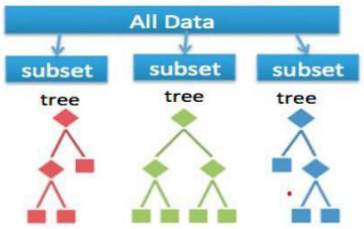

Fig.2 Random Forest

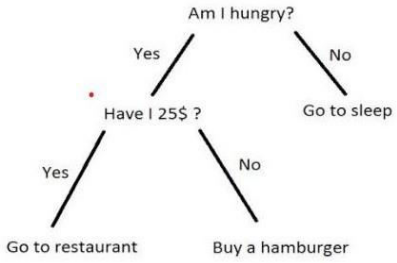

Fig.3 Decision Tree Example

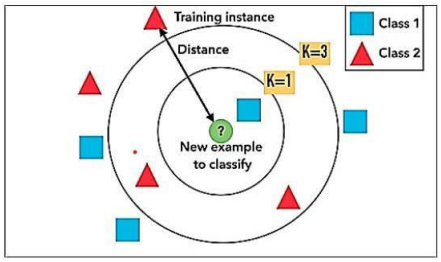

Fig.4 K-nearest neighbor representation

In Fig.1 Support Vector Machine Representation is shown.In Fig.2 Random Forest is shown. Similarly in Fig.3 Decision Tree Example is shown. In Fig. 4 K-nearest neighbor representation is shown. These are the figures for the classification algorithms that were used which includes SVM(Support Vector Machine),Random Forest,Decision Tree and K-nearest neighbor.

These are the values of different measures for different classification methods.

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Table 1: Different measures for different classification methods

Classifier	Mentalillness	Accuracy	ErrorRate	Precision	Recall	Specificity	F1 Score
Decision	Anxiety	0.733	0.267	0.458	0.532	0.923	0.492
Tree	Depression	0.778	0.222	0.731	0.714	0.909	0.723
	Stress	0.628	0.372	0.599	0.585	0.9	0.592
Random	Anxiety	0.714	0.286	0.431	0.51	0.919	0.47
Forest	Depression	0.798	0.202	0.881	0.678	0.91	0.766
	Stress	0.723	0.277	0.731	0.692	0.928	0.711
Naive	Anxiety	0.733	0.267	0.459	0.542	0.924	0.497
Bayes	Depression	0.855	0.145	0.822	0.85	0.917	0.836
	Stress	0.742	0.258	0.548	0.568	0.934	0.558
Support	Anxiety	0.678	0.322	0.403	0.504	0.914	0.448
Vector	Depression	0.803	0.197	0.82	0.716	0.908	0.765
Machine	Stress	0.667	0.333	0.672	0.631	0.921	0.651
K Nearest	Anxiety	0.698	0.302	0.449	0.53	0.913	0.527
Neighbour	Depression	0.721	0.279	0.75	0.634	0.892	0.687
	Stress	0.714	0.286	0.719	0.682	0.921	0.7

Table 1 shows the accuracy, error rate, precision, recall, specificity and f1 score of each classobtained by the different algorithms.

A possible block diagram for predicting anxiety, depression, and stress using machine learningalgorithms could include the following steps:

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1. Data Collection: Collecting data from various sources such as electronic health records, social media posts and surveys.
2. Data Preprocessing: Cleaning, organizing, and formatting the data to make it suitable for the machine learning algorithms.
3. Feature Extraction: Extracting relevant features from the data, such as keywords and sentiment, that can be used to predict mental health outcomes.
4. Model Selection and Training: Choosing an appropriate machine learning algorithm and training it on the preprocessed data.
5. Evaluation and Validation: Testing the performance of the model on a separate dataset and determining its accuracy in predicting mental health outcomes.
6. Deployment: Deploying the trained model in a clinical or real-world setting to predict mental health outcomes in individuals.
7. Monitoring: Continuously monitoring the performance of the deployed model and making necessary adjustments to improve its accuracy.

It's important to note that this is just one example of a possible block diagram and that the specific steps and details may vary depending on the specific application and dataset.

Equations:

$$P(A|B) = \frac{P(B|A) * P(A)}{P(B)}$$

Where,
p(A | B) = this is posterior
p(A) = this is the prior i.e. what you believed before you saw the evidence p(B|A) = this the likelihood of seeing that evidence if your hypothesis is correctp(B) = this is the normalizing of that evidence under any circumstances

Authors have divided these relevant articles into four groups: social media data-based risk assessment for mental illness, genetic and genomic data analysis for understanding mental health conditions, vocal and visual expression data analysis for disease detection, and clinical data-based diagnosis and prognosis and have demonstrated the usefulness of DL in enhancing the identification and management of patients with mental health issues[2]. It is crucial to assess a person's mental health and keep a close check on it.Using a deep learning feature extraction technology like phrase embedding and integrating it with traditional machine learning algorithms, they have analyzed people's mental health from their social media posting and behavioral traits[3]. They have created and extracted structural and behavioral elements from twitter data to model userbehavior since social networks serve as a true mirror of a person's activity.

Stress, worry and today's fast-paced lifestyles have had significant psychological consequences on people's minds all around the world over time.a generic paradigm for diagnosing depression that includes data extraction, pre-processing, ML classifier training, detection classification and performance evaluation[4]. From their review,SVM has been found to be the most popular classifier for diagnosing depression among the research that has been examined since it does well with unstructured and high-dimensional data. It shows the comparison of classification models used for a depression diagnosis. It is shown that with the expansion of data sets relevant to depression and the development of machine learning, it may be possible to create intelligent systems that can recognise signs of depression in written content[5]. a practical method for locating texts representing one's own self-reported depressive symptoms using recurrent neural networks (RNNs) based on long short-term memory (LSTM).Therefore, the depression prediction approachcan be used to help create better technology for mental health care, including intelligent chatbots.
This study suggests using a variety of machine learning techniques, including logistic regression, support vector machines, decision trees, naive bayes classifiers, and K-nearest neighbor classifiers, to determine the mental health of a target population[6]. Unsupervised learning techniques were first used to the responses collected from the target group for the questionnaire that was created. The labels that were obtained through clustering were verified.This study offers a perceptive grasp of the analysis of mental health among various target groups. The article provides an overview of current machine learning (ML) research on psycho-socially related mental health issues from the computing and human computer interaction (HCI) field[7]. They believed that in order for ML models and interventions to be widely and successfully adopted in real-world mental health contexts, it is important to (i)reflect on the state-of-the-art of ML work

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for mental health, (ii) offer specific suggestions for a stronger integration of human-centered and multi-disciplinary approaches in research and development, and (iii) invite more consideration of the potentially extensive personal, social, and ethical implications that ML models and interventions can have.hey have addressed existing strategies and potential stages toward establishing ML systems that are efficient and implementable for mental health care in an effort to determine the future direction ofthe study.
To identify people with mental disorders, multi-class models were trained using traditional machine learning, deep learning, and transfer learning[8]. By automating the detection process and alerting the appropriate authorities about people who need emergency assistance, this effort will benefit the public health system. This study handles the mental illness problem as a multi-class classification problem. It classifies it into one of the six following mental disorder classes: – ADHD, Anxiety, Bipolar, Depression, PTSD or None i.e. No mental illness. By adjusting key hyperparameters and training on more data, the cutting-edge language model RoBERTa (Robustly Optimized BERT Pre Training Approach) outperforms BERT. It forms the basis of our proposed solution and outperforms BERT on a number of tasks. Machine learning algorithms were used to forecast levels of stress, anxiety, and depression[9]. Data from employed and unemployed people from various cultures and communities were gathered using the Depression, Anxiety, and Stress Scale questionnaire in order to apply these algorithms. Five different machine learning algorithms each predicted the occurrence of anxiety, depression, and stress on five different severity levels. Classes were found to be imbalanced in the confusion matrix after using the various methods. The addition of the f1 score measure enabled the best accuracy model among the five used algorithms to be found. Data were collected from a total of 348 participants via Google forms and subsequently classified using five machine learning algorithms – namely Decision Tree, Random Forest Tree, Naïve Bayes, Support Vector Machine and KNN.

The current system requires doctors to manually collect patient data before spending days studying the characteristics to determine the patient's mental state[10]. A new strategy known as a semi- automated system is introduced. This system will identify the patient's psychological disorder. By contrasting the patient's mental health with the DSM-IV-TR, fourth edition revision, this is accomplished. In order to construct a semi-automated system, they are using genetic algorithms, classification, and machine learning techniques. The system will not be fully automated unless it can accurately identify patients with mental illnesses in accordance with the required standards.Social media platforms and their users have a close relationship, and as a result, these platforms on many levels reflect the users' personal lives[11]. Convolutional neural networks (CNNs) and recurrent neural networks, two of the most widely used deep learning methods in the field of natural language processing, were used to achieve the main goal of detecting depression. They provided a method for word-embedding task optimization. We conducted a comparative analysis of some of the popular deep learning models for user-level depression detection from tweets. Models with optimized embeddings were able to keep up performance while maintaining generalisation. Used hierarchical attention networks in experiments to try and predict Reddit users' mental health status.By creating patterns for finding self-reported diagnoses of nine different mental diseases, the users were located[12]. The authors had to choose the control group for each of the nine circumstances because there wasn't a precise mapping available. A Hierarchical Attention Network (HAN) is modified by the authors for use in classifying social media users. A HAN is made up of a sentence encoder, a sentence-level attention layer, a word-level attention layer, and a word-level attention layer.

Developing an automatic recognition system can aid in symptom early detection and provide information on the biological markers for diagnosis[13]. However, it is a difficult task because it necessitates considering indicators from various modalities, such as facial expressions, gestures, acoustic features, and verbal content. To solve this problem, we suggest a general-purpose multimodal deep learning framework in which various modalities, such as acoustic, visual, and textual features, are processed separately while taking into account cross-modality correlation. A Multimodal Deep Denoising Autoencoder (multiDDAE) is specifically made to obtain multimodal representations of audio-visual features, which are then encoded using Fisher Vectors to yield session-level descriptors. In the textual modality, a Paragraph Vector (PV) is proposed to embed interview transcripts into document representations that capture indicators of mental disorders. **A**ttempt to identify an individual's probable mental illnesses from their social media postings[14]. The following six mental health-related subreddits were used by the authors to compile post data: r/depression, r/anxiety, r/bipolar, r/BPD,r/schizophrenia, and r/autism. Each of these subreddits is considered to be linked to a certain disease. Each title was combined with the matching post after the data had been gathered. The Authors then deleted all extra punctuation and blank spaces from each post. Each of the subreddits is classified using one of the six binary classification models the authors constructed. The dataset was split into training (80%) and testing (20%) sets by the authors.Convolutional neural network (CNN) and XGBoost were then used.

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III. PROPOSED METHODOLOGY

A person's Cognitive health is determined by both their current state of mind and how they are interacting with the world around them. Mental illness is brought on by anomalies in the brain's chemistry.In our project we will be using technologies such as Reactjs, Nodejs, Mongodb, python, flask and various algorithms in order to process our data.We will be using Reactjs for our frontend, MongoDb in order to store the user's data and we will be using bcrypt package in order to encrypt the password for authentication purposes.There will be 2 models to predict the cognitive health and after analyzing the user data a score will be predicted to the user on their email and whatsapp and based on that they can work accordingly.

IV. CONCLUSION

Every organ in the body, including the mind, is controlled by it, making it one of the body's most powerful organs. Our bodies' ability to function as a whole is impacted by our thoughts' instability. Being both physically and emotionally fit is the key to success in all areas of life. People need to be aware of how mental illness affects them and understand how important it is to maintain their mental health in the same way that they maintain their physical health. The two categories of health are indistinguishable from one another. And when both are in harmony, we can only say that someone is completely well and in good health. Therefore, it is imperative that everyone strive for a balance between their bodily and mental well-being and seek the appropriate assistance when either of them falters.

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