Unveiling Mental Health Disorders Through Machine Learning Technique

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Abstract- *Mental health disorders remain a significant global concern, posing challenges in their identification. Recent years have witnessed substantial progress in the field, driven by advancements in diagnostic techniques and computational methodologies. This abstract provides a succinct overview of the current state of mental health disorder classification and emerging trends. The utilization of machine learning algorithms, leveraging extensive datasets to discern intricate patterns and enhance predictive accuracy, holds the potential to transform the diagnostic process. This project proposes an innovative method for mental health disorder classification through the application of machine learning algorithms. The study utilizes a diverse dataset encompassing various mental health conditions, demographic details, and behavioral patterns. The primary aim is to develop a robust model capable of precisely categorizing individuals into distinct mental health groups based on their unique features. The project specifically addresses a classification problem, distinguishing among Major Depressive Disorder (MDD), Obsessive-Compulsive Disorder (OCC), Anxiety, Post-Traumatic Stress Disorder (PTSD), sleeping disorders, and Loneliness. Various machine learning algorithms, including Logistic Regression and Support Vector Classifier, are employed for mental health disorder classification. Furthermore, the project aims to introduce advanced features to enhance accuracy and broaden its scope.*

Keywords- Mental health disorder, Classification, Logistic Regression, SVC Algorithm.

I. INTRODUCTION

Mental health disorders rank among the leading causes of global disability, affecting an estimated 970 million individuals. Annually, approximately 14.3% of worldwide deaths, equivalent to 8 million people, are linked to mental disorders. Despite the widespread prevalence, access to adequate mental health care is hindered by factors such as insufficient facilities, with nearly 45% of the global population residing in nations where there is less than one clinical psychiatrist per 100,000 mentally ill patients. This limitation, combined with pervasive stigma and prejudice, results in only 15% of affected individuals receiving clinical care.

In response to these challenges, millions of people, often referred to as support seekers, turn to various text-based peer-to-peer support platforms like talklife.co and psychcentral.org to share their emotions and experiences, which are frequently stigmatized. Although well-intentioned, peer supporters on these platforms lack formal training and are often unaware of best practices in therapy. This knowledge gap leads to missed opportunities to provide sound and mutually engaging responses to those seeking support. The conventional approaches to training, such as in-person counselor training, face limitations in scalability when catering to the vast user base of online support platforms. The insufficient support for counseling and online therapies has spurred the exploration of human-computer interfaces, specifically virtual agents (VAs). These virtual agents are designed to detect and respond to users' emotional states effectively. Recent advancements in text mining, natural language processing, and messaging services within major social media companies have paved the way for innovative research in mental health. The aim is to develop automated systems in this domain [6]–[8]. However, the scarcity of high-quality conversational data in the public domain, driven by privacy concerns, poses a significant obstacle to the study and automation of these systems.

II. BACKGROUND STUDY

Malmasi et al. [6] describe their approach for predicting the severity of user posts in a mental health forum, developed to participate in the 2016 Computational Linguistics and Clinical Psychology (CLPsych) Shared Task. The system utilizes a meta-classifier composed of base classifiers that leverage lexical, syntactic, and metadata features. These classifiers are created for both the target posts and their contextual information, encompassing both preceding and subsequent posts. The output from these classifiers is then employed to train the meta-classifier, surpassing the performance of individual classifiers and an ensemble classifier. The success of this meta-classifier leads to

its extension into a Random Forest of meta-classifiers, resulting in further enhancements in classification accuracy. In the competition, their approach achieves competitive results, securing the top rank among a total of 60 submitted entries [6].

Glen Coppersmith and colleagues (Coppersmith et al., 7) point out that conventional mental health studies heavily rely on information gathered through direct interaction with healthcare professionals. While recent research has successfully utilized social media data to explore depression, there is a scarcity of evaluations concerning other mental health conditions. The focus of their study is post-traumatic stress disorder (PTSD), a prevalent and severe condition affecting millions globally, particularly prevalent among military veterans. The authors introduce an innovative approach to develop a PTSD classifier for social media by employing straightforward searches of publicly available Twitter data. This method significantly reduces the cost of training data compared to previous methodologies. The authors showcase the effectiveness of their approach by analyzing linguistic differences between individuals with PTSD and randomly selected individuals, creating classifiers to distinguish between these two groups. Additionally, they apply their classifiers to identify heightened rates of PTSD in and around U.S. military bases [7].

According to Satvik Gurjar et al [11], mental health issues have emerged as a significant concern in 21st-century healthcare, primarily attributable to a lack of awareness among the general population. The objective of this paper is to raise awareness among individuals regarding potential mental health issues such as depression, anxiety, PTSD, and insomnia by employing machine learning techniques. To implement these algorithms, a diverse set of data was gathered from individuals spanning various ages, professions, genders, and lifestyles. This data was acquired through a survey form containing questions commonly utilized by psychologists to gain a comprehensive understanding of their patients' issues [11].

III. PROBLEM DEFINITION

Creating models and systems for classifying individuals based on their mental health status and predicting the likelihood of specific mental disorders is crucial for organizing and forecasting mental health conditions. This plays a pivotal role in the field of mental healthcare by enabling early intervention, tailoring treatment strategies, and optimizing resource allocation. Establishing a robust system to group individuals into specific mental health categories, considering symptoms, behavior, and other relevant criteria, can significantly improve personalized mental healthcare, facilitate timely intervention, and ultimately enhance mental health outcomes. The successful implementation of such a system aims to diminish the stigma associated with mental health disorders while simultaneously boosting the efficiency of mental health care and treatment.

IV. PROPOSED MODEL

This study focused on utilizing machine learning algorithms to predict mental disorders by leveraging data to build models capable of forecasting mental health outcomes. Logistic Regression and Support Vector Classifier, three pivotal ML algorithms, were employed in the prediction process. The Kaggle dataset, which includes measurements of pollutants in different environments, was used as the basis for training and evaluating the effectiveness of the models.

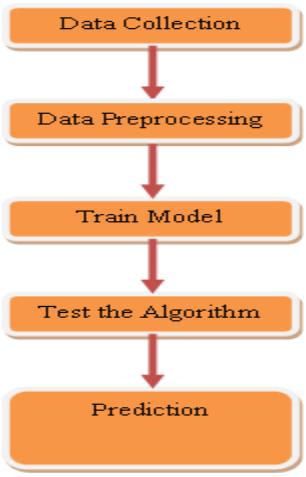

Figure 1: Proposed architecture

V. RESULTS AND DISCUSSION

The focal point of this research is the Results and Discussion section, where the study's discoveries are unveiled and thoroughly examined. This section reveals crucial facts, patterns, and insights that emerged from an in-depth investigation. The subsequent discussion interprets these findings within the context of existing literature, theoretical frameworks, and the overall goals of the study.

Belonging to the category of supervised learning algorithms, Logistic Regression (LR) is employed to address classification problems. This model is designed to handle binary variables, such as 0 and 1 or yes and no. Logistic regression utilizes a sigmoid function, also known as the logistic function, which involves a sophisticated cost function in its operations.

The Support Vector Classifier (SVC) is a notable algorithm employed for both regression and classification purposes. Its objective is to establish an optimal line or decision boundary capable of partitioning n-dimensional space into classes, facilitating the accurate categorization of new data points in the future. This optimal decision boundary is referred to as a hyperplane. SVC identifies the crucial points or vectors at the extremes that contribute to the creation of this hyperplane. These pivotal instances are termed support vectors, hence the algorithm is named Support Vector Classifier.

To ensure high accuracy in the model, it was imperative to thoroughly clean and preprocess the data until it was suitably fitted. Python libraries such as NumPy, pandas, and matplotlib were instrumental in this process. To optimize our results, we subjected each of our datasets to multiple machine learning algorithms, including Logistic regression (LR), Support Vector Classifier (SVC), and LR. The outcomes of these algorithms yielded accuracies of 76%, 97%, etc., respectively. We selected the algorithm that provided the true and highest accuracy for our system. Additionally, we explored hyperparameter fine-tuning to assess if further improvements in accuracy could be achieved.

Algorithm	**Accuracy**	**Precision**	**Recall**	**F-measure**
LR	97%	97%	97%	97%
SVC	76%	73%	76%	72%

Table.1

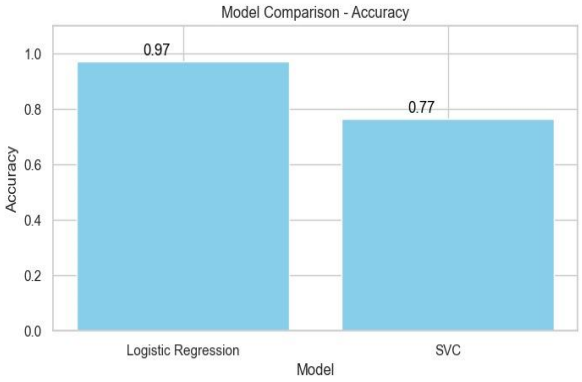

Figure 2: Algorithm comparison

VI. CONCLUSION

In our research, we harnessed the capabilities of Random Forest, a robust machine learning technique, to tackle the vital task of categorizing and predicting mental disorders. The Kaggle dataset, containing comprehensive information on mental health conditions, served as the foundational source for training and evaluating our models. Logistic regression exhibited several merits in this context, including robustness, interpretability, and the ability to handle intricate, non-linear associations within the data. Throughout our experiments, Logistic regression consistently demonstrated high accuracy in effectively classifying individuals into distinct mental health categories. The algorithm's resilience was evident in its adept handling of diverse datasets characterized by varying features and complexities.

In contrast to existing methods, our suggested Logistic regression (LR) approach surpassed them in terms of accuracy (97%), precision (97%), and F-measure (97%). The interpretability of the Logistic regression proved pivotal in identifying key factors contributing to the classification of mental disorders. This newfound knowledge serves as a valuable asset for mental health providers, enabling targeted intervention and personalized treatment planning. It is essential to acknowledge that the success of the Logistic regression model relies on the quality and representativeness of the training data. Ensuring the model's ability to generalize necessitates addressing biases within the dataset and promoting diversity.

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