

A SURVEY ON HEALTH CARE USING MACHINE LEARNING TECHNIQUES

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Abstract

Mental healthcare is highly prevalent and has a significant impact on a person's physical health. To provide the best care to the patient at the right time, early detection is essential. The use of Machine Learning tools also assists future research areas, diagnosis, treatment and prognosis. In this study, we have discussed different machine learning tools for mental health. It provides an overview and highlights the various methods for predicting mental disorders. The purpose is to emphasize the importance of Artificial Intelligence in health and of Machine Learning techniques. By using machine learning, the massive amount of data can be used to identify patterns, define symptoms, and provide personalized treatments and optimize therapies.

Keywords: Personality Disorders, Artificial Intelligence, Machine Learning, Deep Learning

I. INTRODUCTION

Physical fitness isn't the only way to stay fit. Mental fitness is just as important. Mental health is an indicator of well-being of an individual. We should have a strong and healthy mind to handle the opportunities and challenges that life presents without getting disillusioned or overburdened by it. Personality disorders can pose a threat to mental health. Personality disorder is an enduring pattern of maladaptive coping skills. Since the teenagers are on their development trajectory, the assessment of enduring patterns is often misconstrued as development. Currently, the world is battling with the covid-19 pandemic, which has adversely affected the mental health of millions of

people. In contrast to the number of people suffering from mental health issues in the country, WHO reports that there is a dearth of psychiatrists and psychologists. WHO says that about 7.5 per cent Indians are affected by some mental disorder and forecasts that approximately 20 percent of India will suffer from mental health issues. There are 56 million Indians suffering from depression and another 38 million distressed by anxiety disorders, according to the statistics. Hence access to high quality mental care in a timely way is extremely difficult.

Psychologists rely heavily on psychological testing and psychotherapy to treat the symptoms of the person. In this regard by using artificial intelligence in mental health care, psychologists' job can be improved or done away with the assistance of artificial intelligence. The growing field of 'Predictive analytics in mental health' is gaining momentum, with many turning to use machine learning for aiding in the initial clinical decision-making. There are many techniques available to determine and predict personality disorders in human behaviour.

The remainder part of the paper is organized as follows:

Section II contains the background of the study. Section III present the personality and different types of Personality disorders. It also describes the role of Artificial intelligence in physical and mental health care. It also explores the deep learning techniques used in various aspects of health domain. Section IV throws light on different machine learning approaches used in healthcare followed by conclusion in section V.

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II. MOTIVATION

The study aims to identify the affected individual among the large population of people suffering from personality disorders and the personality traits. It is very important to identify the people with personality disorders since they need special attention and care in order to be mentally fit. Early adulthood is a critical time to better understand personality disorders. An early diagnosis of personality disorder in an adult would assist in providing the necessary help at the right time.

The Key contributions of this papers are as follows:

- (i) This paper presents the state-of-the-art of Personality disorders and how it affects the mental health of an individual.
- (ii) This work focuses on the research on role of adopting machine learning in health domain.
- (iii) This paper explores the role of AI in healthcare.
- (iv) This study examines the various deep learning techniques used in physical as well as the mental health care.

III. TYPES OF PERSONALITY DISORDERS

A. Personality Disorders

According to ICD-10, personality disorder is a 'severe disturbance in the characterological constitution and behavioral tendencies of the individual, usually involving several areas of the personality and nearly always associated with considerable personal and social disruption'. Evidence from empirical research into personality variation suggests that personality disorders could be conceptualized as extremes of normal multivariate trait distributions [1]. Personality disorders are associated with impairment in social and occupational functioning, overall disability, suicide attempts and premature mortality.

B. Types of Personality Disorders

The roots of the various types of personality disorders

can be attributed to the three different sources of concepts and assessment that contribute to the current classification, such as clinical psychiatry, psychodynamic theory and psychological trait theory and empirical research. Currently the most authoritative reference for diagnostic guidelines in psychiatry is American Psychiatric Association's Diagnostic and Statistical Manual, fourth edition DSM-IV [2].

According to DSM-V there are ten types of Personality Disorders. These ten personality disorders are classified into three clusters such as A, B and C based on the similar characteristics, features and symptoms. Cluster A is characterized by odd or eccentric features. This category of Personality disorders is difficult to be diagnosed and managed. These personality disorders are bundled together in this cluster because share the personality traits that resemble certain features of psychotic disorders. Cluster B is characterized by the appearance of a kind of dramatic, emotional or erratic behavior pattern. Cluster C appears to be anxious or fearful. This study underlines some types personality disorders traits become evident by early adulthood and it increases its risk for the development of anxiety disorders by middle adulthood. It is necessary that the scheme be reliable and valid before it can be used to differentiate personality disorders. Studies show there is a need for further progress in assessing personality disorders. A person is diagnosed with a personality disorder based on the traits that cause him or her to behave in socially dysfunctional ways, and these are often varied from the way individuals in a particular culture perceive, feel, think and relate to others. The assumption is that an individual with a personality disorder will resist treatment. The individual diagnosed with personality disorders have been noted to see the world as being 'out of line' rather than themselves being out of 'sync' with the world around them. Because of this, they are typically perceived by others as self-centered, which makes forming and maintaining relationships challenging.

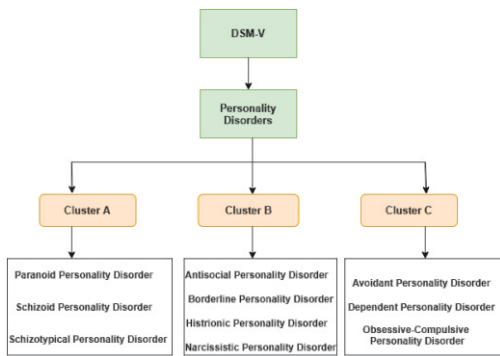


Fig. 1. Types of Personality Disorders

Personality disorders are one of the most controversial fields of mental disorders. Psychiatrists have re-examined the reliability of personality disorders and found that their diagnostic reliability is extremely low. There are no widely accepted treatments for personality disorders and their long-term effects are usually not known. The empirical studies of personality disorders have expanded since the introduction of DSM-II in 1980. With the advent of diagnostic criteria for mental disorders, diagnosis has become more accurate. It can be used in conjunction with structured psychiatric interviews. Most personality disorders are in the early phase of construct validation. There are several psychological test and behavioral indicators that can be used to assess construct validity. One of another important sources of external validation is biological markers.

C. Role of AI

Mental health care can be strengthened by incorporating artificial intelligence for detecting and predicting mental health issues. AI can yield stronger findings and validate the larger samples over a longer duration [2]. Many students struggle with personality disorders, which adversely affect their academic and social lives. This is an affliction that affects one out of three students. As solution a mental health chat-bot is used to overcome the problems faced by students and also provided personal mental health coaching if needed. Intelligent systems can be used to overcome the challenges for behavioral and mental health. With the advent of AI in

health domain such as mobile health apps and wearable fitness trackers, we can overcome the limitation of offline consultations [3].

D. Importance of Machine Learning Techniques in Health

Artificial Intelligence includes machine learning. Machine Learning allows the computer to learn a humongous amount of data without having to explicitly program it. Different machine learning algorithms can be applied to these data and learn from it to make better decisions. After analyzing the data collected by the devices or tools, it makes a prediction. The main goal of the machine learning techniques is to make predictions on new data and thereby enhance the performance. Some of the limitations of the machine learning is that it depends on the data that may be noisy and incomplete. All these can lead to erroneous predictions. But when carefully dealt the ML can maximize its performance [4].

A number of critical disease models such as neurology, cardiology, cardiovascular disorders, discovering the factors of heart disease, and diabetes research use machine learning models. The advancement of Machine Learning is also beneficial for Mental Health care. A wide range of ML models includes those used for various mental disorders such as depression, autism spectrum disorder, personality disorder, schizophrenia, and bipolar disorders. As a result, ML models are instrumental in making new discoveries regarding people's emotional state and mental health.

A wide range of physical diseases, as well as mental health disorders, can be predicted and identified using machine learning algorithms [5]. This study evaluates the criminal behavior by evaluating face images for personality traits [6]. There are different variables and factors that should be considered to define the criminal nature of an individual. Personality traits or psychological factors is ubiquitous

among them. Machine Learning techniques can be used to predict personality traits and human behavior. By incorporating Machine Learning techniques into a more comprehensive construct validation framework, we can expand the applications of Machine Learning to personality assessment [7].

In mental healthcare, it may be used not only as a tool for predictive problems, but also as part of a quantitative toolkit to aid both research and practice. Machine Learning techniques and Natural Language Processing serve as an additional tool to derive new insights and useful information that can assist in treating the patients with caution. This technique has the capability to be used for prognosis, monitoring the issues and delivering the treatment [7]. ML models and NLP models create semiautomated systems can be more cost-effective and time-efficient than traditional methods. It aims to improve the specificity of diagnosis, knowledge of psychophysiology, speed of diagnosis and more accurate estimations of disease severity.

[8] investigates the feasibility of predicting depression using digital biomarkers quantified from a smartphone dataset. This data collected from the smartphones helps to understand the details about depression. The findings of this study proves that behavioral markers gathered from smartphone data sets can be used to predict the depression score.

E. Deep Learning Techniques used in Health domain

Deep Learning techniques are the newest breakthrough in AL and ML. It provides a new paradigm to effectively draw insights and knowledge from the complex data. DL techniques has gained notable traction in recent years especially in the domain of healthcare. Using nonclinical and clinical data, these techniques are used to predict diseases, which have yielded promising results so far.

In [9] Deep Learning techniques along with neural network can be used in order to study mental health conditions and abnormal behavior pattern on a large scale. The main problem identified and addressed in this paper is the problem of automated classification of contents related to mental health on social media platform.

In [10] author analyze the mental health of individuals with deep learning algorithm which is combined it with the traditional machine learning algorithms to enhance the performance of the model. Deep Learning models have emerged as a novice way of constructing meaning representation from unstructured data. In this study the deep learning algorithm used in categorizing personality traits. Different ML algorithms used in this study are Deep Neural Network (DNN), Convolutional Neural Network (CNN), Recurrent Neural Network (RNN). In spite of these different techniques, the two othermany methods are Long Short Time Memory (LSTM) and CNN.

IV. PROMINENT MACHINE LEARNING TECHNIQUES USED IN PREDICTING DISEASES

Table I. Summary of the papers reviewed in this study

Ref	Year	Method	Purpose of Study	Techniques used
[3]	2021	Qualitatively	The analysis of the human behavioral parameter that can be used to prediction of diseases.	Convolutional Neural Network Approach
[4]	2021	Qualitatively	Predicting the Mental Health of an individual	Conditional random fields, Decision Trees, Support Vector Machine, Random Forest and Neural Networks
[5]	2019	Qualitatively	Synthesis the application domains of ML in mental health	Clustering, Latent Dirichlet allocation, Neural networks, Decision Trees, Support Vector Machine
[6]	2016	Qualitatively	Identifying the Personality traits from a face image	ANN, SVM and Deep Learning
[7]	2018	Qualitatively	Personality assessment by incorporating comprehensive construct validation framework using ML approaches.	Linear Regression
[8]	2021	Qualitatively	Predicting depression by detecting changes in behavior patterns using digital biomarkers and ML models	Random Forest, Support vector Machine, K-nearest neighbor, Logistic Regression.
[9]	2019	Qualitatively	Identifying the antisocial behavior using machine learning techniques and Natural Language Processing	ML and NLP
[10]	2018	Qualitatively	Analyzing the mental health based on social media posting and behavioral features	Ensemble, Gradient boosting, Random Forest, K-Neighbors, Logistic Regression
[11]	2021	Qualitatively	A model has been developed to predict the suicidal thoughts and behavior among college students.	Logistic Regression, Naïve Bayes
[12] [13]	2020	Qualitatively	Predicting the antisocial personality disorder based on Electroencephalographic data	Random Forest
[14]	2021	Qualitatively	Identifying the bipolar disorder using online mental health questionnaire and Blood marker data with the help of Machine learning algorithm	Machine Learning, Extreme Gradient Boosting and Nested Cross - validation
[15]	2019	Qualitatively	Detecting Mental Health issues using speech signal	CNN

Ref	Year	Method	Purpose of Study	Techniques used
[16] [17]	2021	Qualitatively	Role of Machine learning in prediction task	Supervised Machine Learning
[18]	2020	Qualitatively	Predicting Mental illness from social media content	Deep Learning Techniques
[19]	2017	Qualitatively	Predicting the Psychological state using the data collected from smartphone	Neural network models
[20]	2020	Qualitatively	Predicting the suicidal behavior in a targeted population including antisocial personality disorder and borderline personality disorder.	Logistic Regression, Linear Regression, Random Forest, Decision Tree, Neural Network
[21]	2021	Qualitatively	This study focuses on the machine learning methods and NLP techniques used in mental health clinical practice	SVM, K-Means, Random Forest, Decision Tree, Logistic Regression, Naïve Bayes, Neural network
[22]	2016	Qualitatively	An intelligent health care system to diagnose the heart disease	Decision Tree, Ensemble of ANN and SVM, Naïve Bayes, Neural network
[23]	2020	Qualitatively	Predicting the mental health problems in adolescence	Logistic Regression, Random Forest, SVM, Neural network

V. DISCUSSION

The papers presented in the previous sections are related to diagnosing and predicting both physical and mental health diseases that used many machine learning algorithms. Table I. presents a summary of twenty-three previous works done in this regard. Major algorithms used in these works are Logistic regression, Linear regression, K-Means, Decision tree, Random Forest, Support vector machine and ensemble model. Different disease categories are predicted using these machine learning algorithms using standard datasets. After reviewing and analyzing many papers certain conclusions are drawn. SVM algorithm was used widely and this algorithm provides the effective and most accurate predictions in health domain. In addition to SVM, the other algorithms that are widely used are Random Forest, Decision Tree, Naïve Bayes algorithms that generated better results.

Neural networks are less used technique but they provide better results with great precision. The unsupervised learning is an unattractive technique for researchers. These techniques provide very low accuracy in predicting the mental health disorders in the cases studied. the accuracy of an algorithm used depends on the feature selection parameters and also on the size of the dataset. The results of the ensemble model are better than depending on a single machine learning model.

VI. CONCLUSION

To conclude, we would like to bring to light the machine learning approach which could be an impressive technique with its capability to process humongous amount of data. Various mental health issues were discussed as well as possible solutions. Systems and devices that are intelligent

and connected to the health domain can be used to make early predictions.

This work examines many ML algorithms used in predicting several diseases. The advancement and its impact on the intelligent healthcare system are also highlighted. As a result of the study conducted, we would like to develop a framework for assessing the personality traits using ML models. In addition to previously unexplored data, machine learning algorithms can be used to analyze patterns in daily behaviors of patients, which are typically inaccessible to physicians. This very fact has led many researchers to opt for a paradigm shift in disease prediction. It can be considered as a complementary tool in every step of health care. The data collected from social media, smartphones, and websites are also widely used to predict mental health. Identifying people at risk for behavioral disorders such as anxiety, depression, schizophrenia, and personality disorders through this data is essential. It is therefore appropriate to consider machine learning as a method to support both physical and mental health care.

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