Journal for Re Attach Therapy and Developmental Diversities
eISSN: 2589-7799
2023 August; 6 (9s2): 643-651

Use of AI And IOT's to Improve Mental Health Treatment

[1]Faisal K Alkholifi, [2]Subrahmanya Bhat, [3]Ruth G. Luciano [4]Sohaib Alam, [5]Dr. Khushbu Agarwal

[1]Department of Pharmacology, College of Pharmacy
Prince Sattam Bin Abdulaziz University, Al Kharj, Saudi Arabiaf.alkholifi@psau.edu.sa,

[2]Swami Vivekanand Vidyaprasarak Mandal's College of Commerce, Bori-Ponda, Goa, India skmbhat@yahoo.co.in,

[3]Associate Professor, College of Information and Communications Technology
Nueva Ecija University of Science and Technology, Nueva Ecija, Philippines
ORCID ID: 0000-0001-8532-6971
rcgluciano@gmail.com,

[4]Department of English, College of Sciences and Humanities in Al-Kharj, Prince Sattam bin Abdulaziz University, Kingdom of Saudi Arabias.alam@psau.edu.sa

[5]Pacific Institute of Management, Pacific Academy of Higher Education & Research University, Udaipur, India
khushbu.agarwal6@gmail.com,
*Corresponding Author: Sohaib Alam: s.alam@psau.edu.sa

Received: 15- June -2023
Revised: 20- July -2023
Accepted: 22- August -2023

ABSTRACT

Medical health is a crucial issue in medical treatments and care that needs quick attention and can considerably profit from technological advancements. We believe that IoT developmental breakthroughs can have a significant impact on mental healthcare as well as how we live our daily routines. By incorporating proposed initiatives and methods of data acquisition, selection, transmission, computation, and protection, this article suggests a human-centred approach that makes use of the newest IoT wearable technologies and a securely encrypted cloud computing algorithm that may assist in enhancing the detection and treatment of mental healthcare patients. If done properly, with more in-depth study on mental health, we can anticipate seeing tremendous advancements in the very near future in the techniques used to treat and diagnose people with mental illnesses. Our focus is on developing a human-centred approach that can be turned into an engaging app with functional characteristics that can recommend various treatment options based on the condition of the patient and evidence obtained from Big Data sources using IoT sources, all while maintaining the highest level of security protection for sensitive information.

Keywords: *IoT, Human Centred Model, Mental Health*

1. INTRODUCTION

The digital age is a fascinating, dynamic, and challenging place to live. Our lives have altered as a result of the rapid development of digital technology and its impact on how we live. Everything has evolved from how it was approximately ten years ago, including the way we buy food, engage with others, and perform and communicate.

All facets of our life are changing as a result of information technology and its use. It is growing more commonplace as it becomes more detailed and complicated. The emergence and advancement of the Internet of Things (IoT) is the most recent example of this in digital technology.

This study concentrates on how the IoT might advance, progress, and improve the field of healthcare, particularly mental health. The adoption of IoT technologies can be advantageous in several critical sectors, including healthcare systems and services. The development of clever and original remedies for treatment and protracted care is being accelerated by the application of artificial intelligence (AI) and machine learning (ML). In the suggested method below, we suggest using wearable technology to collect data from patients, using short-range and long-range interaction to transmit data from IoT devices to a central, secure cloud, and using AI and ML to perform data to produce new, perceptive understanding and alert systems for all concerned stakeholders. The human-centred interface design with an emphasis on responsive real-time monitoring, communication, and the

provision of medical aid throughout the complete system, moreover, forms the fundamental element of our concept.

In the field of healthcare, it's crucial to continuously follow and keep track of patients' states using a variety of tools in order to address their varied ailments and disorders. In other terms, facts are necessary for doctors to recommend a course of treatment. IoT can play a big role in this situation by integrating the many assessments and reading-monitoring devices with the ability to link to the internet and digitise all data. Additionally, as more Big Data is produced, more effective, quicker, and good preventive and diagnostic procedures can be used to provide good healthcare.

There are several research that investigates various facets of IoT in healthcare and offer various approaches and remedies [1].

IoT can assist persons with impairments to increase their participation and integration in the internet age, according to research by Sohaib et al. It suggests a structure for online retailers that can lower obstacles for customers with exceptionalities by integrating various IoT-enabled smartphone technologies that increase their accessibility to and interaction in the e-commerce arena [2].

Another research explores the usage of a microcontroller to interface with sensors that measure patients' body temperatures and heartbeats and provide that data for real-time monitoring to doctors and healthcare professionals. By decreasing the frequency of hospital visits and diagnostic tests, they emphasise how the usage of IoT in this manner can also aid in lowering healthcare expenses [3].

In studies on IoT and health, it is discussed how to integrate IoT-embedded devices and the cloud layer in an eHealth ecosystem made up of an IoT infrastructure driven by fog computing to enable frictionless communication among patients and doctors.

IoT and digital technologies, in particular, can be very important for mental healthcare because figuring out reasons and treatments depends heavily on patient history. According to research, utilising online interventions, having unrestricted access in the present, and communicating via voice and video are now feasible and can result in improvement [4].

The development of online clinics, blended therapies, and digital examinations and tutoring, which are now feasible and are the following obvious step in mental healthcare, is stressed in the research of digital technology and its effect on psychological treatment [5].

IoT will be essential to assist in performing the periodic evaluation, diagnosis, and prognosis needed and providing both innovative and sustainable solutions, complementing ML and AI. Since the data in issue all pertains to confidential patient data, it is crucial to highlight that when this data has been gathered and transported from various devices and locations, full security must be maintained by encryption algorithms and hardware care as well.

We assume that an engaging and tailored human-centred scheme can substantially aid in the treatment of the mental health patients concerned and that this research's goal is to propose a creative model specifically for mental healthcare.

1.1 RESEARCH PROBLEM

The COVID-19 problem and the ensuing social isolation emphasized the need for precise and accurate diagnostics and therapies to be given from a safe location in order to stop the infection and transmission of the disease. In many cases of mental and neurological illnesses, virtual reality mixed with IoT and AI technology appears to be a trustworthy substitute for traditional physical and mental evaluation and treatment. These cutting-edge methods can accurately identify the earliest symptoms of mental diseases. To overcome the gap between these freshly flourishing techniques and mental health care, prudence and additional work are needed.

1.2 RESEARCH OBJECTIVES

Using Intelligent Diagnosis, Real-time Monitoring, Data Capture and Management, and Smart Medication to completely revamp the existing model. This will help us to surpass human limits and provide us with a comprehensive perspective on the enormous population.

2. LITERATURE REVIEW

Today AI and ML in specific have been employed in the creation of prediction, diagnosis, and therapeutic methods for mental health care as a result of the emergence of digital experiences of mental health. In order to improve user experience and improve individualised mental health care, AI has been applied to digital treatments, especially online and smartphone apps. Recent sources of plentiful data allow for the development of prediction and diagnostic algorithms for mental health disorders using data-driven AI techniques. For attitudinal or mental health implications, it is possible to extract a human's "digital exhaust," or the information obtained from their frequent interactions with social networks and private digital devices [6]. With the advent of strong computer-based natural language processing, language—long seen as a gateway into the human mind—can now be statistically processed as data and used to predict mental health. Additionally, cognitive entities for potential treatment can be created using natural language processing.

IoT is becoming a more important study field in the entire health industry as well as in specialised fields like Mental Health. This report's major goal is to present an overview of the literature-based scientific studies that focus on the key IoT products and services for mental health disorders. The academic sources used to conduct the review include Google Scholar, IEEE Xplore, PubMed, Science Direct, and Web of Science, with the most recent 10 years, from 2008 to the now, taken into consideration as the time of issuance. The most intriguing papers were chosen using a variety of search parameters, such as "IoT AND (Application OR Service) AND Mental Health." IoT-based services and applications for mental health were observed in a number of 49 papers, 21 of which have been deemed to be pertinent works in the field. More than 54% of the retrieved papers display the applications created for tracking people who have mental problems using sensors and networked 7]. With regard to tracking, welfare interventions, and the provision of warning and information services, the adoption of modern IoT technologies in the healthcare sector has several advantages.

IoT offers new healthcare options to improve the safety and quality of life of individuals with mental health conditions. To solve this specific research need, this paper examines how IoT might be used to achieve this goal. This study positions the deployment and uptake of IoT applications in Dutch mental healthcare through a survey of the literature and seven instances with semi-constructed interviews. An exploratory, interpretative, and primarily qualitative multiple case research is presented in this study [8]. The findings suggest that IoT adoption in mental healthcare is incredibly low due in large part to concerns about privacy, security, awareness of new technology, and resistance from conventional medical experts.

Given the conviction in its impact on a person's mood and general optimism, we suggest an IoT to improve the experience of individual gardening as a treatment option for mental-health patients. Beyond a variety of sensors, the suggested (IoT) prototype constantly detects and tracks the condition of an indoor plant. With created alerts via channels over the cloud in real-time, the user is informed of the plant's demands for water, sunlight, etc. As a result, we were able to construct a humanistic healing scenario in which the user may easily "speak" to its plant using a smartphone [9].

Furthermore, ML has had excellent performance in the healthcare industry when combined with the IoT. However, certain places are still without advancing technologies. One of the conditions for which there hasn't been a complete cure is a mental disease. The biggest problem is determining whether a person has a mental disorder in the first place. Psychologists work one-on-one with clients to conduct assessments and administer therapy. However, there is some confusion over the course of action. Even while psychologists provide their patients a variety of medications, such as antidepressants, sleeping aids, etc., the drugs haven't been able to completely treat or eliminate the illness. An individual may be dealing with a particular scenario for a number of

reasons, including environment, job stress, relatives, etc. Utilising the collected dataset, we will be able to forecast such illnesses in the human body and determine what the individual is going through [10].

To carry out daily tasks effectively and to lead a happy life, one needs to be in better mental health. However, it is generally disregarded by the large majority of individuals from all spheres of society, regardless of their social status or degree of education. Some of the causes of ignorance include the scarcity of qualified experts, the lack of concern shown by society for those who are dealing with mental health issues, the high cost of therapy, etc. Innovation, including social media and IoT - enabled gadgets, is present in all facets of society and is employed to address these problems. These aids medical personnel in intrusive and ongoing remote patient monitoring. However, the usage of social media with IoT comes with its own set of difficulties, including big data, knowledge representation, heterogeneity, and NLP [11]. This article contributes to the various perspectives on mental healthcare that concentrate on the use of technology, as well as the risks and rewards of using social data in the field.

The fast-paced workplace and new work arrangements have increased hazards for mental health, particularly work-related stress and burnout. In office environments, mental health becomes a crucial component of occupational safety and health. Consequently, through focused health interventions, companies seek to enhance employees' well-being and safety at work. IoT technology is increasingly employed for these things. Furthermore, confidentiality problems accompany its deployment in the workplace [12]. Our goal in this research is to present a meta-synthesis of the IoT solutions that are now available for promoting employees' mental health in work environments. We categorise current research into use cases with potential implementation strategies. We go over the primary issues arising from privacy worries throughout the IoT data lifecycle. By highlighting the potential for an interconnected workplace to enhance occupational health, we assist in the creation of the workplace of the future.

3. RESEARCH METHODOLOGY

This study suggests the use of several state-of-the-art and cutting-edge IoT technologies that are now accessible and being developed in order to support the mental healthcare sector in coping with and resolving mental health illnesses (Fig.3.1). How human-centred interaction (HCI) can be applied to mental health technology is covered in a number of study projects. HCI will be included in the treatment process, which will not only aid in cost-savings but will also offer more detailed and precise data to provide better and more individualised treatment solutions.

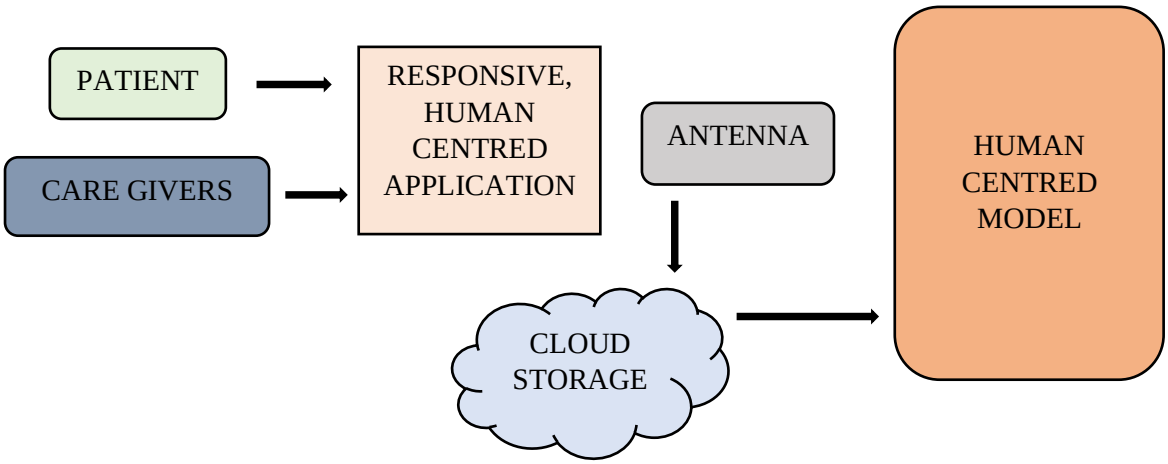

Fig.3.1. Human centred model

This human-centred strategy is unique in that it employs technology to help patients, doctors, and carers come up with creative solutions for coping with and resolving mental illnesses. In regards to self-help, urgent care, medical guidance and management, and assistance from family members, the theory suggests an innovative alternative.

Hospitals, schools, and other organisations frequently utilise the symptom checklist 90 scales to assess the psychological symptoms of individuals. The scale's validity and dependability for different symptoms are good. Users over the age of 18 are eligible to take the test. There are 100 total items on the scale, which has 12 factors. Interpersonal sensitivity factor, melancholy, solicitude, aggression, mental disorder, fear, psychopathic, and others are among the factors on the scale. Based on the degree of the symptoms, the scale's items are classified into five categories: i) none, ii) mild, iii) moderate, iv) quite serious and v) severe, which correlate to the respondents' experiences throughout time.

974 younger adults and 254 older adults in Saudi Arabia were used to gathering data, with insufficient findings being eliminated. There were 40 questions in the survey, and it took 32 minutes to complete.

There is a specific proportionate association between the results for each factor and the subjects' measure of mental health. The scale test score increases when the degree of mental health decreases. The SCL-90 is typically used because, as contrasted to alternative scales, it includes further test elements and can represent a deeper symptom experience, encompassing personal behaviour, affection, mood, awareness, envisioning, interpersonal interaction, diet, sleep, and lifestyles.

4. RESULTS AND DISCUSSION

The correlation between CNN's number of repetitions and the method's validity is provided here based on the prior information.

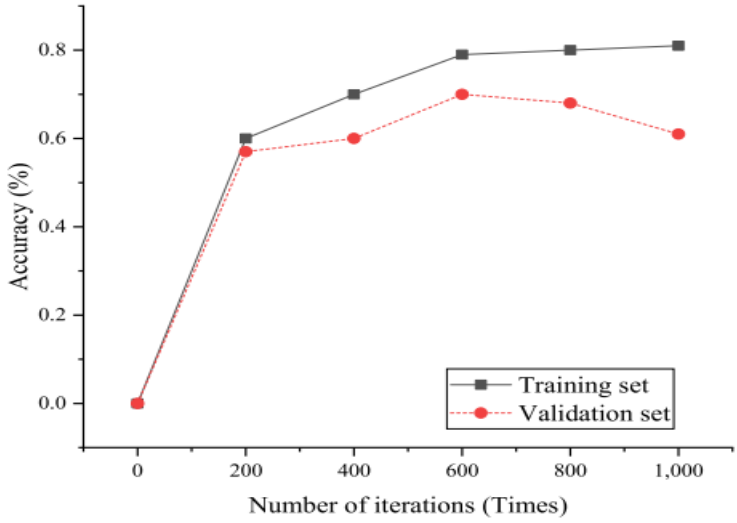

Fig.4.1. Calculation of method repetition times

According to Fig. 4.1, when the training set's amount of iterations is minimal, the precision consistency among the training and the verification set is greater, and the method's precision is limited. Conversely, when the training set's amount of iterations is greater, the precision of the training set method will rise, but the distance among the precision of the verification and the training set method will widen. The model is currently overfitted. Consequently, 500 model iterations are required to maintain the correlation among model accuracy and overfitting.

According to the calculation findings in Figure 5, the CNN model and Flagged F1 both perform better in regards to the nongreen F1 index when contrasted to the FastText method. This demonstrates how the CNN method has progressed in distinguishing between healthy and unhealthy samples. The CNN model outperforms the FastText model on Urgent F1 by a factor of 0.11. The CNN model outperforms the FastText model in terms of recognition performance for each model category; the CNN model's accuracy for the entire sample has achieved 0.62, which

is 0.03 greater than the FastText model's accuracy of 0.52. In conclusion, the CNN model performs better in assessing and providing a prior warning of mental condition.

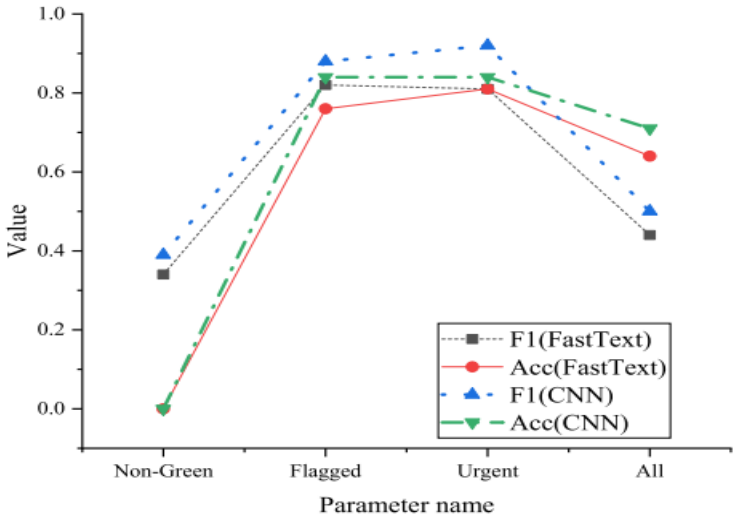

Fig.4.2. Correlation of the outcomes of several methods' calculations

According to Fig. 4.3, big data network mental health treatment considerably improves people's mental health compared to traditional treatment. These are the specifics of the performance. There are 160 people with minor mental illnesses among those receiving traditional treatment, 90 of who are men and 70 of whom are women. Around 32 pupils exhibit moderate mental illness, including 11 female and 21 male people. Every grade has essentially the same mental condition. The number of people with mild mental states considerably rises after receiving mental education via the big data network, reaching 180 individuals. There are now 12 more pupils overall with mild mental conditions—eight males and four females. There is a considerable drop in the number of pupils with intermediate mental health, from 20 to 16, a reduction of 12. It demonstrates that this mental health strategy is workable, and the development of campus networks among the people is what led to this change. As a result of online psychological forums and mutual assistance, people can now address their psychological conundrums and issues in a variety of ways.

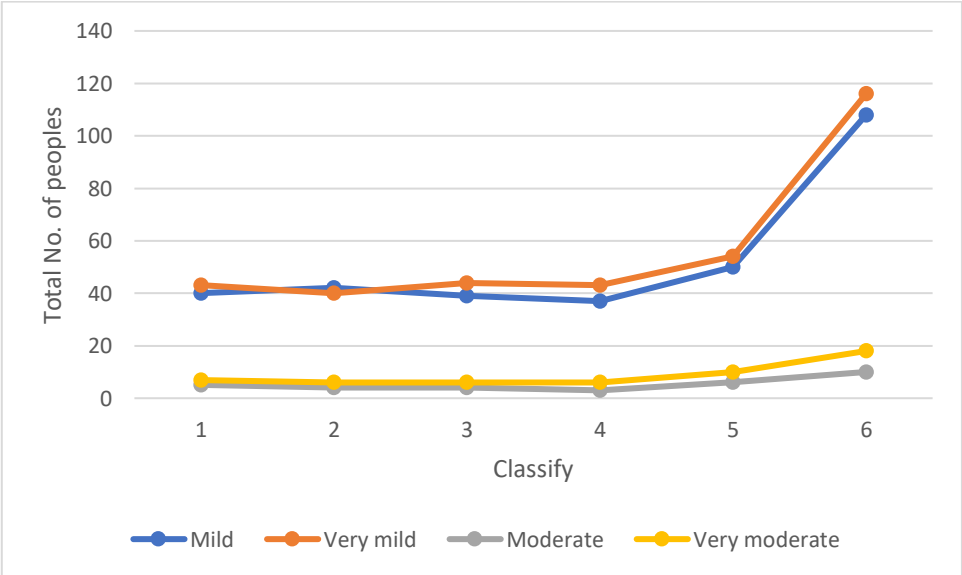

Fig.4.3 People's mental health symptom distribution curve

According to Fig. 4.4, the researched peoples' mental health can be categorised into 3 states: mental health, subhealth, and major mental health disorders. The percentage of pupils with mental health is 150 against the backdrop of conventional mental health education. There are 70 women and 80 men among them, making up 52.4% and 69.9% of the entire male and female populations, respectively. Senior peoples are significantly more likely to have mental health issues than junior people; 64 people, or 29.4% of all people, had subhealth mental states. There are roughly the same numbers of subhealth people in each grade, with female people with mental subhealth making up 29.7% of the overall number of female people and male people with mental subhealth making up 36.9% of the entire number of male people. There are 6 people that have major mental health issues or 3.8% of the entire sample size. Males with major mental health issues make up 2.4% of the overall male population, while girls with the same issues make up 2.15% of the whole female population. The proportion of kids with major mental health conditions across grades is not significantly different.

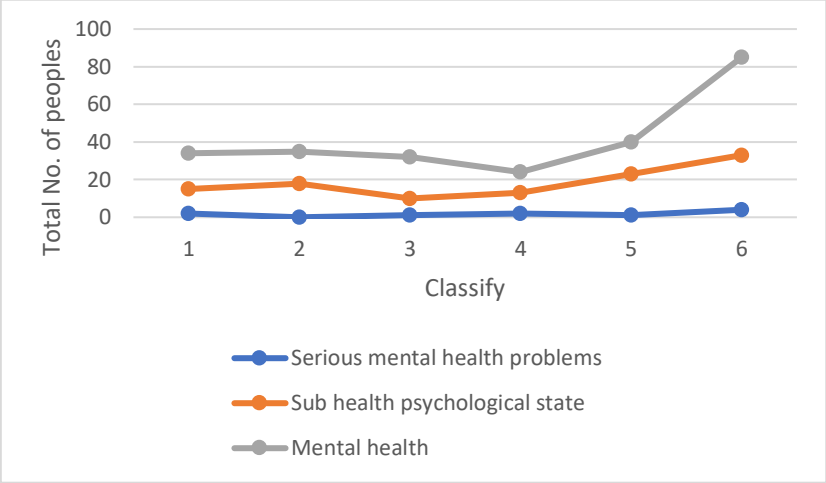

Fig.4.4. People's mental health in conventional mental health

According to Fig. 4.5, peoples' mental health is good under the big data mental network than it is under the conventional mental health system. There are 40 kids that take part in the big data network who have normal mental health, a 16.7% rise from the previous year. The number of females with mental health rises by 12, while the number of males increases by 6, while there is a 13 percent decline in the number of mental subhealth (females have 5, and males have 7), and a 2 percent drop in the total of people with severe mental issues (male 2, and female 1). It demonstrates that the big data mental health treatment network is helpful in enhancing peoples' mental health.

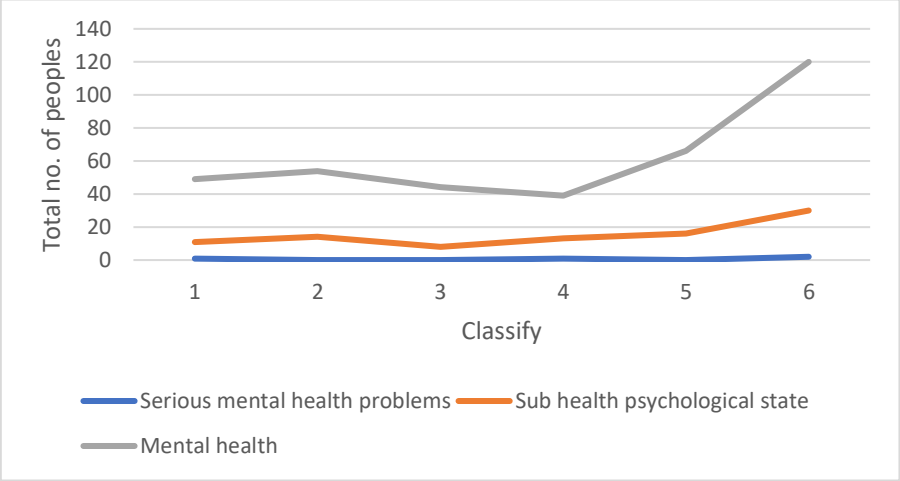

Fig.4.5. Mental health state of people under the mental health treatment under big data network

5. CONCLUSION

In various countries and for a variety of reasons, big data are being employed in the study of mental health. We have provided examples of some of the many useful uses of data science in the study of mental health from this viewpoint.

We talked about many sorts of mental illnesses and viable, acceptable solutions to improve mental healthcare facilities. Nowadays, the frequency of detailed examinations cannot keep up with the digital mental health transformation, and it is obvious that clinical organizations must catch up. Different intelligent healthcare systems and tools have been produced that lower the mortality rate of mental illness and prevent the patient from getting involved in any unlawful activity through early warning.

The various prediction techniques are examined in this work. In order to anticipate future data, a variety of ML methods are frequently used to train data. Prominent ML methods include the random forest model, Naive Bayes, and k-mean clustering. Social media is one of the finest places to obtain data since user moods can provide insight into psychological behaviour. The effect of numerous data science advancements on the intelligent healthcare system is taken into account in this research. It is determined that rather than using expensive gadgets, there is a demand for a low-cost method of predicting intellectual status. For the stored and active tweets available through the application programme interface, Twitter data is used (API). In the long term, a low-cost method to identify depression in selected patients will be to integrate the twitter API with Python, then perform sentimental analysis of the patient's "posts," "liked pages," "following pages," and "comments."

ACKNOWLEDGEMENTS

Funding

"This study is supported via funding from Prince Sattam bin Abdulaziz University project number (PSAU/2023/R/1444)"

Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Declaration of Conflicts of Interests

Authors declare that they have no conflict of interest.

Consent for Publication

All authors read and aware of publishing the manuscript in Journal for ReAttach Therapy and Developmental Diversities

Data Availability Statement

The database generated and /or analysed during the current study are not publicly available due to privacy, but are available from the corresponding author on reasonable request.

Declarations

Author(s) declare that all works are original and this manuscript has not been published in any other journal.

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