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Mental Health Solutions with AI: Benefits, Implications and Limitations

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Abstract - *In this generation there is there ever increasing and desperate need of mental health support as more and more persons find themselves in struggling through a depressing phase.Traditional methods which are available for mental health support are not always accessible and required modern solution for this.this is where technical aspect fill the gap and fulfill the need of mental health support in today's era,websites,AI driven chatbots,Apps have the potential to provide easy and modified mental health support.Several AI models are trained for the betterment of mental health sector such as Linear Regression Model,Deep Neural Network,Decision Tree.These models aim to provide the collaboration between developer and researchers to ensure that the technology that is being created and used is not only effective but practical and precised manner. Investing resources in digital platform for real time interaction ,screening ,and diagnosis of an individual can offer several cost effective solution and help for the large number of under-served populations an example of this is the AI driven chatbots, that offer promising and convenient scope for delivering therapy remotely and effectively. However, in spite of these promising results in the research phase, these digital solution have often comes with several challenges when it is comes to effective implementation and execution.*

Keywords—Healthcare, Artificial Intelligence, Conversational Agents, Chatbots, Mental Health, Mental Disorder, Neural Network, Deep Learning Models, Robot Therapy, Machine Learning

A. INTRODUCTION

In today's world, Mental disorders have become common, around a billion people live with a mental disorder. Normal methods struggle to face the complexities of mental healthcare. This has created an opportunity for AI to take this field. During the pandemic in 2019 web-based interventions had become prevalent as they offered affordable or sometimes free access to therapy but despite the positive reviews of AI mental services, they have faced many challenges in a real world deployment [1]. Many efforts have been made to face these challenges. One common challenge faced by AI driven chatbots is their lack of ability to understand complex questions. Another challenge is when users ask questions that fall out of the scope [2]. Despite these challenges AI has shown a lot of promise in using unstructured data for mental health applications

From a clinical view, the use of AI in mental health care can lead to intervention in places that still have unmet health needs. The use AI is specially usefull in the detection of mentalhealth concerns early on. Some people have actually preferred the use of AI mentalhealth support to avoid the social stigma associated with mentalhealth disorder. Another reason for users to prefer AI over normal therapists is that they are able to control the pace of the conversation [2]. The use of AI applications in mental healthcare can also provide support to people with mild depression and other nonacute conditions which can help people save time by allowing for an instant therapy session instead of forcing people to get an appointment with a therapist [3]. This also allows mental health professionals to devote their time to the most severe patients. The greatest advantage of AI mental health service is its ability to reach a people that are hard to reach through traditional means.

A common barrier faced in the distribution of AI model for mental healthcare is the reluctance of users to interact with AI models due to their lack of empathy [5]. A solution for these barriers is the

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
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integrations of HCI modelling, HCI (Human-Computer Interaction) referss to the usage of computer technology to facilitate user experience [4]. After extensive research it was found that users preferred a model that spoke like a human than a machine. AI application give a lot of promises for improving mentalhealth supports but these applications carry a lot of ethical concerns. One of these concerns is the misuse of user data, by conversing and interconnecting with the AI model you are technically exposing your weaknesses and problems which can be exploited by malicious user to harm you [3]. Another ethical concern is the algorithms used in the AI model as it is possible for human biases to be built into an algorithm. So, it essential to develop guidelines to make the best use of AI mental health services.

The prespective of mental healthcare lies in expansion of AI techniques that can be implemnted to relive mental disorders, an example of this is the creation of AI driven chatbots which can provide support, offer advice and recommend professionals.

B. HCI: HUMAN COMPUTER INTEGRATION

The integration of Human Computer Interaction (HCI)
into mental health solutions has shown a lot of promise
by allowing the development of user – friendly and
easily adaptable interventions. However, despite these
advantages, there exists many challenges in
integrating HCI into digital well-being solution [4]. In
our current world Artificial Intelligence (AI) offers a way to enhance the prediction, recognising, treating mental health issues and disorders. An example case of this will be AI driven web based and mobile-apps
that focus on providing self help and guided Cognitive
Behavioural Therapy (CBT) [4]. Advancements in HCI
integration are obvious. HCI modelling can provide support in constructing usable applications and addressing injustice in mental healthcare. Using HCI can help incorporate human factors alongside machine interaction and automation [4]. The appearance of the digital therapeutic alliance (DTA) highlights the relevance of HCI in advancing the digital mental health landscape. Tremain et al explorations of the DTA points out the need to comprehend the interaction between AI & human. Despite these advances, the challenges faced by HCI still exist. One of these challenges is the limited number of studies on DTA which impede a complete understanding of how HCI effect the efficiency of

mental healthcare [6]. Another challenge is the deficiency of documents focusing on the assimilation of HCI into digital mental well-being. AI has the ability to revolutionize the mentalhealth support system and as such it is essential the advancement of HCI go hand in hand with the advancements of AI to secure the existence of proper interface which is easily
adaptable and straightforward to use.

C. AI DRIVEN CHATBOT MODELS

AI chatbots have appeared as interactive tools for mentalhealth support which shows a lot of promise in enhancing mental well-being and providing therapy for mentalhealth disorder. They offer many applications in critical situations like a pandemic, when it becomes impossible to venture outside. They also serve a s preventive care tool which can assist in easing mentalhealth disorder before they become disruptive in society. Despite their applications, the implementations of chatbots are difficult due to limited clinical validation and various challenges across specialties. Ultimately, AI chatbots are revolutionary member of the mentalhealth service.

As the name suggests chatbots relies on AI models with deep-learning techniques & machine-learning algorithms to function and perform specific tasks. According to our finding most chatbots use the linear regression models.

Linear-Regression Model: - Linear regression is a machine-learning algorithm that works by finding a linear equation that best describes the correlation of the explanatory variable with the dependent variable [7]. Mathematically, it is represented as: -

$$y = \beta_o + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n + \epsilon$$

Where:
y is the dependent varaiable.
$x_1, x_2, \ldots, x_n$ are the explanatory variables.
$\beta_o, \beta_1, \beta_2, \ldots, \beta_n$ are the parameters of the models.
ϵ is the error term, representing the contrast between the observed and predicted value.

Deep Neural Network: - Deep Neural Networks (DNN) is a machine-learning algorithm that aims to copy the information processing of the human brain. DNN contains many layers with each layer containing a certain collection of units that administer a special functional transformative to the intake. After properly training a neural network, they can achieve a desired result with a high accuracy score [7].

Decision Tree: - Decision tree is a hierarchical machine learning model that is used in decision support by depicting decisions and their potential outcomes [8]. This is a model that utilizes conditional control statements & is non-parametric making It

useful for both regression and classification tasks. The given diagram gives an case of an decision tree:
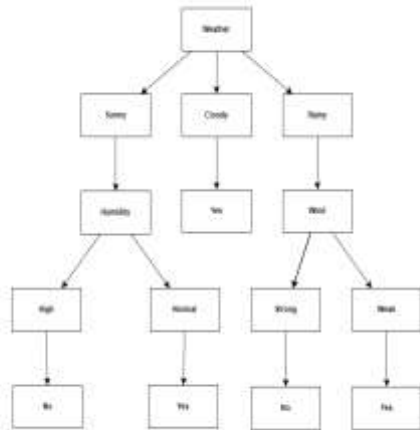
In the above diagram the decision-tree will 1st inquire what is the current weather? If the answer is sunny or rainy then it advances to the consequent part i.e. humidity or wind where it again, checks if there is an strong or weak wind, if there is a weak wind then the user can visit outside. The turnout of the cloudy weather is yes and does not go further because the training-data is always true for the cloudy weather [8].

D. ARTFICIALLY INTELLIGENT ROBOT THERAPY

The mentalhealth of elderly people is an immediate concern because of the rise of depressive conditions & other mentalhealth issue. Traditional methods for reliving these conditions may not always be effective or available. The use of animals in therapy has long been known, researchers have greatly studied the positive effect of animals and pets on human health [10]. Despite these benefits many institutions remain hesitant to incorporate animals and pets due of their potential risks like allergies or infections.

The rising field of robotics presents an alternative for addressing the sensitive & psychological needs of aging people. Researchers have developed a human interactive robot in the shape of animals that bypass the traditional limitations and risks associated with animal interaction [11]. An example of this is Paro, a seal robot that is equipped with therapeutic functions that mimic animal companionship [11]. The introduction of Paro into various settings has yielded positive results, especially in increasing the sensitive & psychological health of aging people. There is a study that was conducted at a health support institution in August 2003 [12]. Approximately 10 people interacted with Paro for 1 hour twice a week

with one or two caregivers managing the interaction with Paro. The results showed that the depression in the participants had been greatly reduced [12]. Interactions among Paro & dementia patients have given great results like reduced symptoms. A neuro surgery clnic conducted a robot therapy session, in which Diagnosi Method of Neuonal Dysfunctiom (DIMENSION) was used to capture each patients EEG before & after 20 minute of the robot therapy. A questionnaire about each patient's reaction of Paro was administered. The results presented that 50 percentage of the patient's condition enhanced after communing with Paro [13].

E. BEFITS OF USING AI IN TECHNIQUES IN MENTAL HEALTH SOLUTIONS

Artificial intelligences (AI) have been employed in a assortment of ways in the late years. For example, prediction algorithms have been evaluated & adopted to identify mentalhealth issue and suicide risk, alongside ways to organize customized treatment regimens. Moreover, therapeutic chatbots offer easily accessible assistance and interference which could be accessed through video games. In order to anticipate, organize, or subgroup a assortment of mental problems & suicidal tendencies, a analysis of AI and mentalhealth identified data sources including electronic well-being records, brain imaging data, mood rating scales, monitoring systems, and social-media platform. Although there is currently no reliable way to forecast specific risks across populations, machine learning automates processes, analyses vast data, and helps mental healthcare providers make decisions about a patient's risk of suicide or mental illness. Quality, accessibility, affordability, convenience, and efficiency of mentalhealth support has all enhanced with the design and implementation of AI technologies. Machine learning offers several benefits, including high accuracy and scalability in predicting mental health disorders. However, its clinical applicability is limited due to its conceptual nature and dearth of empirical evidence. The primary drawbacks are the scarcity of data on model construction and the unreliability of suicide possibility indicator, the vacancy of external evaluation of population studies, the usage of disparate evaluation techniques in cohort studies, and the deficiency of user-centered design procedures that impede HCI [4].

AI engineers are also trying to utilize the intersection of AI & robotics into mental-health clinics. Most relatable example of which is intelligent animal

like robots, which can act as 'companion bots', able to
reply to movement & speech [2]. These companion bots have been implemented as at-home health care assistants. They can help elderly, isolated and depressed patients by catering companionship and having interaction with them.

The main advantages of AI applications are its capability to enhance the geographical access of mental health facilities, where these facilities would be absent without AI. For people staying in inaccessible or local areas where mental-health facilities are scarce, opting for AI build applications is a superior option. Also, people without insurance, low-income, or those who want to avail these facilities at the privacy of their home would prefer the AI applications over traditional methods. Thus, AI technologies may offer new modes of treatment that are better than the traditional methods. Furthermore, the most obvious benefits of a virtual or robotic AI-based therapist are that it is available all the time, remembers everything, and does not criticize or judge a patient, thus providing a more convenient and reliable platform for patients to take help.

Because AI and chatbots might not fully satisfy the wants of vulnerable people or their risks of self-harm, relying on them for therapeutic alliance and triage could place them in danger [5]. Instead, by providing extra professional services and support, chatbots will be a useful addition to human-led mental health systems for people currently enrolled in them. To answer the underlying issues with mental healthcare access, it is imperative to prioritize human-to-human trust and engagement and to remain transparent about the drawbacks of chatbots. In the end, mental healthcare will require developers to accept a balanced approach that combines AI technologies with human empathy and connection to uphold equity, respect, and social inclusion for all people, especially the most vulnerable.

F. ETHICAL CONCERS OF USING AI IN TECHNIQUES IN MENTALHEALTH SOLUTIONS

Various Ethical concerns and challenges are needed to be taken into deliberation, before start using AI tools in actual mental health practice. AI applications or tools which are going to be needed for mentalhealth practice are required to be bound by some ethical guidelines, just like a mentalhealth experts. An AI application can cause harm during the therapy session

and also, in situations when a robot functions in unwanted manner.

AI appliance in mentalhealth must address concerns regarding data security, including the protection of personal health information, potential hacking risks, and unauthorized monitoring. Clear standards are needed to address confidentiality, information privacy, and secure management of data collected by intelligent virtual agents and assistive robots, especially concerning monitoring habits and interactions. As the sphere of data collection expands, particularly with applications incorporating video data, specific privacy protections are crucial to safeguard sensitive information and ensure ethical use.

The rapid evolution of AI in psychiatric and psychological research and analysis has outpaced existing constitutional & virtuous frameworks, posing challenges for regulation and oversight. There's a risk that regulatory gap may only be focused on after harm has occurred. This is specially concerning as embodied AI increasingly enters clinical practice, including through openly accessible therapy chatbots. Professional bodies have not given a comprehensive guide on the implementation of AI into mentalhealth practice or on training future mentalhealth experts to effectively utilize these tools, underscoring the necessity for further proper guidelines specifically addressing the use of AI in mentalhealth support.

Ethical assimilation of AI in mentalhealth care requires addressing concerns about equitable service provision. There's worry that AI might replace existing services, worsening health inequalities. While some see AI as complementary, others stress mixed care models. Implementation suitability depends on local resources; AI can assist where services are lacking but should not replace comprehensive care. Specific challenges arise with AI: ensuring proper response to patient threats and connecting them with services, especially in inaccessible areas. AI must follow ethical guidelines, but operationalizing these for AI, including supervision, remains unclear. As AI evolves, debates on its role in mentalhealth support persist [2].

The slow progress in evaluating digital mentalhealth care has impeded its advancement, particularly in aspect of the COVID-19 epidemic. Decision-making regarding digital mentalhealth care is complex, with the capacity for demand to surpass supply, leading to

dilemmas in resource allocation. Stakeholders must weigh the benefits and drawbacks of digital mentalhealth implementation, considering both patient and physician perspectives. Innovative approaches, such as smartphone apps like Shift Health, aim to address mentalhealth problems among physicians through early intervention and user engagement [4].

However, challenges remain, including barriers to app usage and engagement with clinical researchers. A digital platform for mentalhealth supervision requires innovative design and delivery to promote user engagement and shared decision-making. Techniques to improve resilience, focus on ethical problems, and ensure data security are essential. Input from patients, users, experts, and care-givers are crucial in developing ethical and effective solutions. Emerging proposals, like virtue ethics and micro-ethics, aim to focus on ethical concerns in machine-learning appliances. Overall, there is an requirement for proactive ethical oversight and the formation of shared mental maps to promote beneficence, justice, and patient autonomy during the COVID-19 epidemic.

G. FUTURE SCOPE

This paper discussed about the usage of AI in psychological wellbeing alongside ethical concerns and implications of AI driven chatbots. However, there are various areas that are available for further research. A specific area is the privacy and ethical concern specially in fields like healthcare [14]. Another area to be improved is the user experience, more analysis is needed to be performed to create more interactive design. Studying the chatbots can assist in development of more friendly and interactive designs [14].

There is a want for advancing the natural language understanding. Researchers are required to discover more deep-learning models and techniques that should be adopted to advance the chatbot. Additionally integrating external knowledge and real time data can enhance the chatbots interactions [14].

By deploying AI powered chatbots and studying their impacts on the person or organization can provide great insights which can assist to gauge the perks and limitations of implementing chatbots in different industries [14].

H. CONCLSION

The implementation of AI driven solutions in mentalhealth has given rise to various fields of research. Digital Theraputic Alliance (DTA) is an sample of this as before the rise AI driven chatbots for mentalhealth, it was a considered a under-served topic of research but nowadays it has become a crucial factor in designing a good mentalhealth chatbot. The desperate need for good mentalhealth care has given rise to researchers who spend all their time trying to optimize, improve or find new or old machine-learning algorithms and models. A good example of this would be the Deep-Neural Networks which works by imitating the brain of a human being by creating numerous layers of nodes. This model has gained a large amount of attention nowadays and shows a bunch of promise. The usage of AI driven robots for reliving depression and dementia in elder people has shown a bunch of promise.

An example case of this is the Paro robot, a seal robot that is being tested extensively and shown promising results by proving that the depression in the participant has been greatly reduced. Artificial intelligence offers multiple benefits, including high accuracy in decision-making related to mental-health therapy. By analyzing a large dataset, it can assist in predicting mentalhealth problems and suicide risk. The major benefits of integrating AI tools in mental-health practice is the cost-effectiveness, affordable, easy to accessible and high availability. It could be further enhanced with intersection with various fields such as robotics to provide better services.

For the actual implementation of AI appliances in mentalhealth services, various ethical concerns have to be address. The data security should be of the utmost priority to preserve the secrecy of the person. Other challenges while implementing it includes barrier to app-usage and interaction with researchers. A virtual platform must be informatively design and able to deliver proper user-engagement & shared decision-making.

A compelling need for developing chatbots that have the capability to handle multiple languages exists, if we want to bring about the chatbot in a globalized world. More research that looks into techniques to build cultural sensitive robots should be undertaken. It is crucial for us to create chatbots that are easily trustable to approve for global adoption. Research is being done to assure that the chatbots decisions are more transparent and explainable to the person.

Creating chatbots that can easily give explanations for
their decisions and actions build user trust and acceptance.

Researching for the opportunity of collaborations between chatbots shows plenty of promise for developing a seamless and comprehensive user experience. This can create network of chatbots that can work together to provide its user with more efficient support and help.

AI has the ability to revolutionize the area of mentalhealth. If used correctly it can relive mentalhealth problems before they can cause any permanent damage to a person's psyche. It can also help in lowering the total cases of suicides by alerting the proper authorities if it detects any suicidal tendencies.

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