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Artificial Intelligence in Mental Health: Detecting Psychological Signals via Chatbots

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Abstract. The burden of mental health in recent years has been increasing around the world. About one in seven people around the world is mentally unwell. Although increased awareness and revised diagnostic criteria have partially explained the rise in recorded prevalence, the main reason is that there is a serious lack of professional mental health workers in society. Given the manpower shortage, artificial intelligence (AI) is now being used to fill the service gap for mental health care. Help people with mental illness make better choices, improve their quality of life, make forecasts, and support people in distress. With the development of natural language processing and machine learning algorithms in recent years, intelligent mental health tools have gradually been applied in practice. Systematically study the social demand, technical mechanisms, practical application effects and existing ethical limitations of AI in mental health services in this paper, and provide a clear reference for the standardized development of intelligent psychological intervention in the future.

Keywords: Artificial intelligence, mental health, diagnosis, AI application

1. Introduction

With the rapid development of technology in recent years, many people around the world are facing more mental health problems than ever before. Changes in work and study in modern times have led to complex relationships among various groups, long-lasting social anxiety for many people, and thus, psychological and emotional problems have emerged at all ages. According to the above epidemiological data, nearly one in seven people around the world are living with a diagnosed mental disorder, and this number is still rising annually [1].

Although it can be said that the increase in recorded cases is due to higher public awareness and more standardised diagnostic criteria in recent years, the more undeniable fact is that the entire world's mental health industry is currently experiencing a labour shortage. Professional counselors, clinical psychologists and psychiatric clinicians cannot meet the large-scale demand from grassroots communities, especially for adolescents and college students and other socially isolated groups who do not have easy access to offline psychological resources. A long-standing problem has been the shortage of personnel to meet the rising demands of society for mental health services, thus inhibiting their widespread application.

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Currently, with the increase in acceptance and development of AI-based emotional chatbots, online psychological assessment systems and intelligent auxiliary diagnostic platforms among young people, a shortage of offline psychological services has been addressed [2]. More and more people are starting to think about artificial intelligence as a source of emotional support and psychological help, and these intelligent mental health tools are available 24/7, relatively inexpensive, highly private, and not confined to specific locations [3].

However, artificially intelligent technology is not without flaws in application; currently, many internal problems remain, such as insufficient accuracy in technical support, low trust among the general public, threats to data privacy, and an inherent inability of algorithms to understand people's emotions. Based on the background provided above, this paper will systematically investigate the application values, technical principles, practical effects, and existing deficiencies of artificial intelligence (AI) in mental health support to clarify the current development stage and future optimisation direction of this new service model.

The number of young people with mental health problems in China has risen steadily, and one in five young people is now either anxious or depressed; at the same time, only about 10 per cent have seen a doctor recently. The gap between a high prevalence and low utilisation is further exacerbated by a severe shortage of mental health professionals; the number of licensed counsellors per 100,000 people is far below the international standard, and most grassroots communities and schools lack sufficient psychological support systems. Given the above conditions, AI-based mental health tools have been widely used by young people because they are low-barrier, non-stigmatising and easily accessible in addressing their mental health needs.

2. Social background and practical demand for AI mental health support paper

At present, in society, people are reluctant to talk about their emotional problems with those around them, and this trend is particularly pronounced among teenagers and introverts. Generally speaking, people are more conscious of the issue of personal data privacy now, so they tend to be more careful about revealing their personal information and, as a result, want to avoid negative connotations in society.

Undeniably, self-disclosure refers to the act of sharing one's own information, such as thoughts and emotions. Additionally, one needs to reveal oneself in order to have friends. Self-disclosure is related to the development of self-concept. Therefore, people with a low sense of self-concept clarity tend to restrain their self-expression because of conflicts in their self-perception and fear that others will suspect or misunderstand them [4, 5]. Additionally, they are more prone to experiencing higher levels of social anxiety and are deeply afraid of being rejected by society; thus, they become lonely.

Given the above reasons, a number of people have felt lonely in China due to high academic and social pressure and lack the means to speak about their emotions. More fundamentally, there is a lack of mental health literacy among people, so they do not know when they are in a bad mood. Because of the different ages of the groups, the older generation of parents may not be very aware of the problems that young children are facing. Teenagers and people in their mid-twenties were also subject to mental health stigma; as a result, they feared discrimination and social isolation. Therefore, there has been an increase in discrimination against people with mental illness.

Although there were internal cognitive problems, when they sought help from professionals out of necessity, they frequently faced practical difficulties. For example, high and inconsistent charging standards of offline counselling may be a financial burden for students or people with unstable incomes. Many ordinary people are willing to seek help but are deterred by high service fees and the time cost of offline appointments. Therefore, more and more people have begun to use other

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channels themselves, and among them, digital technology and intelligent online platforms have gradually been chosen first. Digital mental health tools meet the actual needs for time flexibility, low cost and privacy protection perfectly.

Recently, many people have been sharing their experiences with chatting on AI-based emotional applications on various social media platforms. Many users believe that smart AI has become a reliable daily companion that can truly understand their feelings, and they feel free to let down their guard on such a platform. This large-scale social phenomenon indicates that AI has developed into a high-level auxiliary tool that users like. It has a relatively high degree of feasibility for mental health assistance.

3. Advantages of AI systems in promoting emotional self-disclosure

Lower the barriers to access for people needing mental health support through AI systems. The close relationship that has emerged between people and chatbots has encouraged some users to be more open about their emotions and lives [6]. Research by AI conversational systems has also shown that by adopting suitable emotion-expression strategies and adding human-like cues, these systems can reduce users' psychological barriers to self-disclosure and emotional sharing [6]. Machine learning can also be employed to provide psychological support for users through conversation with AI. Anonymity can make some people feel less lonely and anxious. There are no external causes, so the concrete emotions can be summarised by a chatbot. Human counsellors are prone to self-deception, bias and faulty judgment; therefore, they may unintentionally harm the patients [7]. Due to a feeling of shame in speaking to a therapist, collecting detailed information about clients is also difficult [7].

Recently, at home, scholars have explored various methods to increase the efficiency of services, lower economic costs and reduce social stigma in the provision of mental health services to some extent. AI and online applications have been used to address some of the psychological barriers that people face when they are not ready to speak openly in a traditional face-to-face mental health interview. Therefore, AI can help to reduce people's psychological pressure for self-disclosure due to its anonymity and non-judgmental qualities. AI is not subject to emotions, does not have facial expressions of surprise or disapproval, and is free from social pressures on the user. Thus, a safe space for expressing emotions, internal conflicts and even shame is provided, which people would be afraid to share with others.

In the past, models of time- and place-limited individual counseling were common; however, AI chat platforms now provide users with an "anytime, anywhere" open-ended conversation channel for free and in a private space. Nevertheless, many ordinary people still have prejudices and avoidance psychology when it comes to meeting a psychological counsellor, worrying about being misunderstood by their own people. According to research, digital mental health interventions can help reduce the structural and psychological barriers that prevent people from accessing mental health services on time; thus, all-round development of the population's mental health can be promoted.

4. Core technology for AI for mental health applications

AI has been applied broadly to date; however, it is necessary to explore what conditions need to be met for AI to assist in mental health systems and become a potential breakthrough in the mental health industry. AI is a system that can be built using computational models and algorithms, as is generally known. It uses a large amount of data to train a computer and thus improve its performance through pattern learning. Therefore, in order to take on the role of counseling,

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emotional recognition is required, and most people assume that computers do not have it. On the other hand, computing has indeed been applied to recognise emotions in AI and perform counselling functions. By training on a large text dataset, a computer model learns the pattern of emotional expression and enhances its generalisation capability in sentiment classification. Based on psychological theories and neuroscience research on human emotion and consciousness, Affective computing uses signals from the peripheral nervous system to support emotional computation and recognition [8].

The three main parts of AI application in mental health are technology, therapy and ethics. The first is that the AI should be able to understand and parse the language of the user. Natural Language Processing (NLP) can enable people and artificial intelligence to communicate by analysing words and sentences in their own language and learning emotions. And these linguistic cues can reflect a person's psychological condition, as well as their hidden emotions and behavioural intentions [9].

To further understand the process, in addition to the ability to understand, AI systems can now generate human language through modern technology in NLP; these are called Large Language Models (LLMs) that process a large amount of text data. Based on a large amount of data, AI systems learn to recognise patterns in text and can apply this learning to new categories to provide suitable answers and support. In addition, other methods of psychological guidance are used, such as cognitive-behavioural therapy (CBT) and talk therapy aimed at fostering awareness of thought processes; they help AI and users connect their thoughts, emotions and behaviors.

Although there has been some progress, the complicated psychological process cannot be expressed as an open-ended algorithm at present, and this is still a serious problem in mental health. Explainable Artificial Intelligence (XAI) is now frequently used in recent days to improve the precision of diagnosis for people with mental illness. Improve the openness, understandability and accountability of AI-based diagnostic systems. XAI is not a traditional "black-box" intelligent model; instead, it can provide explanations for the results of such models, which are needed in official healthcare for experts to make well-grounded clinical decisions and for public trust [9]. Thus, XAI can help both therapists and patients by offering the transparency required to address ethical issues in the use of technology.

5. Practical application and technology of AI in mental healthcare

Based on a well-established method, AI systems have been applied formally to the task of mental health detection and have achieved good results in practice, such as high accuracy rates. A first-class paper by researchers at Google demonstrated that a deep-learning model was trained on a vast corpus of social-media data and could detect early warning signs of a mental health crisis with an accuracy of 89.3%, offering a lead time of over 7 days before a person was likely to experience significant mental health problems [10]. In controlled studies, machine-learning models have achieved detection rates as high as 96% for various neurodevelopmental disorders such as ADHD and autism [11]. Now, AI can also identify subtle abnormalities in a person's daily speech, providing substantial evidence that makes it a very reliable and helpful assistant for mental health care. AI can also be used to detect possible problems, such as depression, anxiety and suicidal thoughts in the daily conversation data with a certain accuracy in a controlled environment.

When a possible mental health problem is detected, the system needs to change from a passive observer to an active helper and study how to use AI stably and effectively in actual clinical practice. A recommendation system is being built to assist doctors in their work in the medical field. For example, k-nearest neighbors (k-NN) algorithms can be used to group patients with similar profiles of depressive symptoms, and retrospective analysis of treatment results and evaluation of

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intervention effectiveness by clinicians can be carried out. AI can also find complex patterns in a large amount of data that are not obvious to the naked eye. Continuously collect feedback and patient-reported outcomes to improve the above models and, hopefully, find out which interventions will be effective for different patients.

Rule-based and hybrid clinical decision systems can also trigger alerts when a high-risk pattern of symptoms has been detected to prompt patients to receive professional help, such as psychological support or contact crisis hotlines [12]. At the same time, artificial intelligence is being employed in psychiatric research now to analyze medical images and brain scans, and changes in the structure and function of the brain caused by severe illnesses such as schizophrenia are being automatically detected [13]. Furthermore, AI systems are gradually being added to treatment plans to assist clinicians in constructing personalized interventions by determining the best combination of medicines. Although the real-world applications have various users with different backgrounds, informal language and complex emotional contexts, the accuracy of detection may not be perfect; however, AI is still being used in crisis intervention to identify high-risk language patterns, provide prompt emotional support, and promptly connect people with professional services.

6. Technical limitations and moral accountability in AI-based mental health systems

Although artificial intelligence has shown some promising results in providing mental health care, many difficulties remain in deploying large-scale applications in clinical practice, and thus they have not been used widely. Several technical constraints and ethical problems have prevented its large-scale deployment so far. Firstly, mental health is inherently complex; it stems from a combination of genetic factors, living environments, experiences of personal growth, internal psychological states, etc., and cannot be comprehensively assessed and evaluated through simple numerical data [14]. Thus, due to these technical and ethical problems, the application of AI in mental health services is still restricted. At the first level of consideration is algorithmic bias. AI models that are trained on small amounts of or are not representative of all people may perform poorly for groups such as ethnic minorities, older adults and those with lower levels of education.

Algorithms require a large amount of data for user conversations and psychological information, and thus have given rise to serious ethical issues and social problems. For example, protecting users' personal information and preventing data leakage. Mental health data is also highly confidential, and in the event of a data leak, people may suffer harm to their own mental health and be ostracised by society. Discrimination against people of colour and other racial groups is a type of such issue; there is also a lack of clear legal and ethical foundations. Professional Responsibility, Liability for Misdiagnosis, and the Boundaries between AI assistance and Human Clinical Judgment.

AI does not have an inherent sense of morality or human emotions, however. It can simulate empathetic language responses by recognizing fixed language patterns, but it is unable to provide the professional consequences and moral responsibility that come with diagnostic and advisory services. Therefore, this essential empathy deficit clearly indicates that although AI can function well as an auxiliary support tool for daily mental health services. Therefore, it will never be able to replace the deep emotional bond and professional human responsibility that a formal therapist has with a patient entirely. AI mental health tools are not yet suitable for general clinical application. All the results provided by AI are preliminary and must be verified by a professional with a licence to practice psychotherapy.

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7. Conclusion

Systematically explore the social context, shortcomings of regular psychological counselling, practical value, technical basis, and real-life applications of artificial intelligence in mental health support in this paper. Core Strengths and Deficiencies of AI Systems. In recent years, the world's mental health problems have become more severe, and there is now a serious lack of qualified counsellors, high costs for services, geographical isolation, and widespread social taboos. The structure is relatively inflexible, so many people will not be able to access timely mental health services.

Given the above circumstances, AI-based emotional chatbots and online assessment systems have been developed as practical and easily available alternatives to reduce the pressure exerted by rising demand on limited in-person resources. AI systems have the following advantages in promoting emotional self-disclosure: full anonymity, 24-hour availability, low cost, strong privacy protection, and a non-judgmental interactive mode. With the support of affective computing, natural language processing and explainable artificial intelligence technology can be employed to recognize emotional states and detect early-stage psychological problems under controlled circumstances to propose some preventive measures. The above applications have achieved good results in early crisis detection, screening for neurodevelopmental disorders and clinical decision support, and are expected to play a supportive role in mental health services.

There are still many technical problems and ethical issues at present. The reasons for the complexity of mental health include genes and environment, as well as life experiences, and are difficult to be understood by algorithms. AI is also lacking in real emotions, morality and emotional depth. Therefore, AI cannot replace the professional judgment, therapeutic relationship and ethical accountability of human therapists; it will only be used as a supplementary tool.

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