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Analysis of the application of facial expression recognition in psychotherapy

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Abstract. People's psychological problems are increasing with the increasing influence of COVID-19. Psychological problems can greatly affect our daily lives, so we must take this problem seriously. Traditional psychotherapy has many disadvantages. To address these shortcomings, a new technology that combines artificial intelligence is gradually emerging in the psychotherapy industry. Use image recognition in artificial intelligence to help consultants do this job better. This article discusses how technologies in artificial intelligence such as facial expression recognition, chatbots, and other technologies can improve these shortcomings and presents hypotheses about the future of psychotherapy and artificial intelligence based on relevant The results show that although facial expression recognition has broad prospects, there are still many problems, such as fewer micro expression data sets and insufficient training models for model generalization ability.

Keywords: Psychotherapy, Facial Expression Recognition, Natural Language Processing.

1. Introduction

The world is changeable. In the grim situation of a global outbreak, the public is also faced with more psychological challenges. The mental health of people is not optimistic. Depression, procrastination, anxiety disorders, obsessive-compulsive disorders, and other psychological problems are becoming more common [1]. A 2018 survey showed that about 41.1 percent of clients with depressive disorders in China were comorbid with other mental disorders, including 29.8 percent with comorbid anxiety disorder, 13.1 percent with comorbid substance use disorder, and 77 percent with comorbid impulse control disorder. The results showed that most clients with depressive disorders had significant social impairment, and the utilization of health services was very low, and clients rarely received adequate treatment [2]. At the same time, in traditional psychological counseling, there are still problems such as insufficient professional level of consultants, lack of attention to clients, and clients' refusal or avoidance of consulting due to consulting price and "face" issues [3, 4]. Under the influence of COVID-19 and the above problems, online counseling has gradually gained the upper hand and become the dominant way of psychological counseling. In the current rapid development of artificial intelligence technology, artificial intelligence technology has been combined with psychological counseling technology, that is, artificial intelligence robots or dialogue systems are used to provide psychological help and support for visitors. Psychological counseling provides professional psychological counseling services for visitors through in-depth learning of artificial intelligence

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technology, learning a lot of professional knowledge and experience of consultants. However, the existing psychological counseling methods combined with artificial intelligence generally can only communicate with clients in text, and compared with traditional psychological counseling, clients' emotions cannot be directly observed. To let people with psychological problems get better treatment effects, as well as allow psychological counseling and artificial intelligence further development, this paper uses the literature research method to propose the idea of using facial expression recognition technology to assist online consultation.

2. Problems in psychotherapy

2.1. Problems of the psychological counseling industry

There are two main issues concerning the counselor in psychotherapy. The first is the quality of counselors. The main problems are the unevenness of the staff, the varying levels of professional work, and the lack of awareness of the professional nature of counseling and therapy work, including the lack of attention to ethics and standard procedures, the lack of attention to basic training and practical skills, the lack of attention to scientific research on the efficacy of therapy, and the lack of attention to the feedback mechanism for evaluating professional work [3]. In addition to this, most counseling is very expensive. According to the authoritative data of the United States, the cost of psychological treatment that people can afford every month accounts for 1/12 of their monthly expenses in the whole world. For example, in China, the price range for psychological counseling ranges from RMB 400 to RMB 1,500, and the cost of a month of counseling is RMB 1,600 for one session per week at the minimum rate, which translates to RMB 2,927 per month in 2021 when China’s annual per capita income is RMB 35,128[5]. In other words, the cost of normal counseling alone is up to 54.6% of monthly per capita income, and the high cost reduces people’s willingness to undergo psychotherapy.

2.2. Problems of the clients in psychotherapy

There are two reasons for clients. The first is because there is a great deal of prejudice against mental illness. In China, for example, the specific manifestations of Chinese stigma are determined by the cultural significance embedded in Confucianism, the pejorative etiological beliefs about mental illness, and the centrality of 'face'[4]. One of the core principles of Confucianism is that every member of society must abide by the moral requirements of society in order to achieve harmony between the individual and society. People with mental illness may not be able to fully meet these requirements, leading others to question their moral status [4]. The second point is that some clients do not trust their counselors and are reluctant to speak their innermost thoughts even during the counseling process, and the counselor is unable to determine whether the patient is lying, so he or she will reach the wrong conclusion in the diagnosis and delay the illness. Based on the above, it is essential to establish a remote system based on artificial intelligence to improve the above situation.

3. The state of artificial intelligence psychotherapy

3.1. Research on artificial intelligence dialogue robot

Chatbots are computer programs that mimic and process human conversation based on natural language processing technology, allowing people to interact with digital devices as if they were real people. Chatbots vary in complexity, from basic programs that answer simple queries with one-line responses to digital assistants that learn and evolve as they collect and process information, increasing their level of personalization. In psychological counseling, chatbots can use deep learning technology to draw on the professional knowledge and experience of a large number of consultants, construct psychological counseling models through emotional dialogue generation theory, and provide professional psychological counseling services for clients [1].Researchers at Stanford University have developed a chatbot called Woebot, whose conversation design is based on Cognitive Behavioral Therapy(CBT). Woebot has been shown to be effective as an auxiliary tool in the treatment of

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postpartum depression, as well as in the treatment of adolescent psychological problems[6][7]. In addition to Woebot, other artificial intelligence chatbots can also help reduce the negative emotions such as anxiety and depression of cancer clients, and reduce the loneliness of the elderly and job burnout of nurses in nursing homes [1]. Chatbots powered by artificial intelligence can address the issues of low consultant morale and high consulting costs. Its high privacy also ensures the "face" of clients and avoids discrimination due to psychological problems. Studies have shown that many clients even say a lot of privacy problems when facing chatbots [1].

3.2. The shortcomings and deficiencies of artificial intelligence psychotherapy

The retrieval model depends on the text matching technology. In many candidate responses, select match scores the highest as a reply, but since most of the existing retrieval type dialog dialogue logic data sets are not concerned, the evaluation index cannot reflect the model directly on the degree of master dialogue logic. Ask a conversational robot, for example, “How long is three hours from now?” and you may not get the reply you expect. The retrieval model depends on the text matching technology [8]. In many candidate responses, select match scores the highest as a reply, but since most of the existing retrieval type dialog dialogue logic data sets are not concerned, the evaluation index cannot reflect the model directly on the degree of master dialogue logic, Ask a conversational robot, for example, “How long is three hours from now?” and you may not get the reply you expect. Although retrieval type bots can cope with many problems, for objective factual questions they still can’t accurately answer. The main cause of this problem is that the currently existing semantic relevance model only judges the reply, not the knowledge base, resulting in normal people’s being wrong. For example, if you ask it whether it should wear thick or thin clothes in winter, you may not get the answer you expect [9]. In the present bot, almost all will only receive text messages. In normal conversations, we consider the other person’s emotions and expressions because the same word may have different meanings under different emotions, such as anger, which is often expressed with irony and irrational negative factors. Happy people speak with positive factors such as praise, which cannot be received by current chatbots [9].

4. Using facial expression recognition technology to aid psychotherapy

4.1. The principle of facial expression recognition

Facial expression recognition includes two aspects: facial expression encoding and facial expression recognition. Facial expression coding includes descriptive coding and judgmental coding. Facial expression recognition includes four processes: face detection, face registration, feature extraction, and expression classification [10].

4.1.1. Facial expression coding. Facial expression coding can be divided into descriptive coding and judgmental coding. Descriptive coding is to decompose various facial movements into action units and describe the decomposed action units in natural language. For example, there are more than ten kinds of descriptions of the parts of the eyes, such as blinking and eye closing. Based on descriptive coding, judgmental coding adds emotional labels to decomposed action units to help researchers better understand them. Among descriptive coding methods, facial behavior coding systems (FACS) and facial animation parameters (FAP) are the most widely used. FACS is Ekman’s method of dividing facial muscles into several independent and interconnected motor units AU according to the characteristics of facial anatomy, and depicting the corresponding relationship between different facial muscle movements and different expressions. FACS classifies a large number of human expressions in real life and describes almost all possible facial expressions with facial actions. It is the authoritative reference standard for facial expression muscle movement at present. FAP, the facial animation parameter, is used for 3D facial expression recognition.It is a set of parameters of MPEG-4 standard (MPEG-4 is a general content-based multimedia coding standard), which is used to synthesize virtual

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facial expression animation. Its encoding scheme is based on the location of the key feature points of the face in the model grid of the face.

4.1.2. Facial expression recognition process. Face detection is to find and frame the face part in the face image. Current face detection methods include algorithms based on traditional knowledge, algorithms based on geometric features, algorithms based on AdaBoost and algorithms based on neural networks. Face registration is based on face detection to remove the influence of rotation, occlusion, and other factors and accurately locate the face feature points. At present, the algorithms for face registration are mainly based on parametric models and regression. Feature extraction is to extract the feature points on the image and judge whether the point belongs to a certain type of feature. At present, the classical algorithms for feature extraction are Principal Component Analysis (PCA) and Local Binary Pattern (LBP). Expression classification is based on the extracted image features to determine the category of the expression. The specific categories can be AU units divided according to FACS, or the six basic expressions currently used, or categories divided according to time information. Now the main methods used are the hidden Markov model algorithm, the K-nearest neighbor algorithm, and so on.

4.2. Application of facial expression recognition in psychotherapy

Micro-expression is a very short and uncontrollable facial expression revealed by humans when they try to suppress or hide their true emotions. The duration of micro-expression is very short, usually between 1/25 and 1/5 seconds, and the frequency of micro-expression is low, and the recognition rate of micro-expression is not high [11]. According to studies, the trained algorithm can identify micro-expressions more accurately than human [12]. Relevant researchers have found that the number of sad expressions and the reaction time of depressed patients are higher than those of ordinary people. However, since there are more conscious expressions on various social occasions [13]. Fu Xiaolan et al. published a study on facial expression recognition of depressed patients in 2015. According to the research results, it is very necessary to study the micro-expression recognition of patients with depression so as to make the diagnosis of depression more scientific, rather than subjective judgment as in the past, and to increase the accuracy of depression diagnosis [14]. Use of facial expression recognition systems can help good psychological consultants determine the real emotional state of clients, help determine the symptoms of clients, and give accurate advice and countermeasures. In addition, facial expression recognition systems can also be found in the video now before the consultation process. Consultants have not found the details of the problem. These functions can improve the probability of consultants determining the symptoms of clients, reduce the risk of problems caused by misdiagnosis, and also make up for the shortage of some consultants' ability to a certain extent.

5. Discussion

In describing the disadvantages of chatbots, it notes that existing chatbots such as Woebot, Replika, etc., receive only text messages from Clients. However, Clients can see Clients' expressions in a conversation with a real consultant in addition to the text messages. Receive Clients' emotions, which is not currently available in chatbots. Therefore, when facial expression recognition technology is added to the chatbot, it will have a multimodal dialogue function, so that it can recognize clients' emotions and give a more accurate response. Sun Bo et al. developed a virtual teacher program "Magic Learning" for online distance education. The virtual teacher can find the emotional state of students during Learning through the micro-expression recognition technology and give timely replies[15]. When the learners show happy expressions, Virtual teachers give praise through emotional expressions such as a smile, nod or Victory gesture. When the learner's attention expression appeared, the virtual teacher gave normal learning guidance to the learner. When the learner's expression is confused, the virtual teacher gives encouragement and help by smiling, patting on the shoulder and other emotional expressions. When learners are tired, virtual teachers intervene by shaking their heads,

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tapping their shoulders, and other emotional expressions [16]. When facial expression recognition technology is applied to psychological counseling, similar technology can also be used to provide virtual images for robots and receive timely emotional feedback from customers. This not only provides robots with the ability to exceed modal dialogue, but also speeds up the emotional dependence of robot customers on time. For example, Ellie, an AI robot appears on the screen as a virtual human and consults with users face to face, it combines virtual reality and emotional computing to analyze customers' oral reactions, facial expressions and voice, which is more effective than traditional chat robots. In addition, this kind of chatbot can also assist in the early detection of depression by analyzing the facial muscles and eye-related movement characteristics of the subject, when clients are prone to depression or already suffering from depression. Compared with the current clinical practice of interviewing doctors, The diagnosis method of depression based on facial visual features has the obvious advantages of being objective, efficient, popular and low cost, which can greatly alleviate the insufficient proportion of doctors and patients and the high misdiagnosis rate [17].

6. Conclusion

This paper introduces the current problems of consultants and clients respectively, and then combed the artificial intelligence technology in the development process of the psychological counseling industry as well as the disadvantages of the present. Finally, this paper introduces the principle of facial expression recognition technology, as well as existing applications of this technology in the psychological consultation industry and prospect. Although facial expression recognition has a broad prospect, there are still many problems at present, such as fewer micro expression datasets and insufficient training models for model generalization ability. However, in practice, people's expressions are complex and they can combine multiple expressions. In addition, when facing unclear pictures and partially occluded faces, the model recognition ability is low due to insufficient lighting. In future research, more attention should be paid to establishing more micro expression data sets, more expression classification, and more methods to solve the problems of unclear images and face occlusion.

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