

3rd International Conference on Machine Learning and Big Data Analytics for IoT Security and Privacy

Evaluation and Application of Cloud Computing in Mental Health Service Platform

Xue Han^a, Lu Bai^{b,*}, Bing Han^c

^aManagement School, Harbin University of Commerce, Harbin, 150028, Heilongjiang, China

^bSchool of Accounting, Harbin University of Commerce, Harbin, 150028, Heilongjiang, China

^cSchool of Food and Engineering, Harbin University of Commerce, Harbin, 150028, Heilongjiang, China

Abstract

With the continuous development of the times, internet technology has gradually matured, and internet medicine has gradually entered the field of mental health. The mental health service platform can help people identify their psychological problems and provide treatment, but there are still shortcomings in current mental health service platforms, so new technologies need to be added for improvement. This article focuses on the research and application of cloud computing in mental health service platforms, aiming to improve the quality of mental health service platforms through cloud computing. Through experiments, this paper tests that after using cloud computing technology, the accuracy of the mental health service platform for users' psychological test is 78% at the highest and 70% at the lowest, while the accuracy of the mental health service platform for users' psychological test before using cloud computing is 60% at the highest and 50% at the lowest. From this experimental data, it can be seen that the use of cloud computing in mental health service platforms is very effective.

© 2023 The Authors. Published by Elsevier B.V.

This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0>)

Peer-review under responsibility of the scientific committee of the 3rd International Conference on Machine Learning and Big Data Analytics for IoT Security and Privacy

Keywords: Mental Health; Service Platforms; Cloud Computing; Research and Application

1. Introduction

In the new situation, with the rapid development of internet technology and service models, internet healthcare is rapidly spreading to various sub fields of healthcare at an unprecedented speed, from registration, diagnosis,

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .

E-mail address: hanxue@hrbcu.edu.cn

treatment, medication purchase, and rehabilitation, to mental health management. Nowadays, the use of mental health service platforms is becoming increasingly widespread and highly worthy of in-depth research.

Many people are studying mental health service platforms, and Arango C believed that in the future, emphasis should be placed on promoting mental health, and intervention measures should be taken in clinical settings, schools, and communities with the basic support of society and decision-makers [1]. Kumar A believed that an increasing amount of empirical evidence reveals the value of natural experiences for mental health. With rapid global urbanization and reduced human contact with nature, key decisions must be made on how to protect and increase opportunities for natural experiences [2]. Liu J J demonstrated how to extend ecosystem service assessment to include mental health and provided a heuristic conceptual model for this [3]. Although there is a lot of research on mental health, there is still insufficient research on mental health service platforms.

As an important module of physical health, mental health needs to be given our attention. Many people do not pay attention to mental health at the initial stage, and serious mental diseases have emerged later. The mental health service platform can effectively solve psychological problems and find problems. This paper studies the mental health service platform based on cloud computing. Through experimental testing, this paper finds that the accuracy of psychological test of the mental health service platform has become higher after using cloud computing. This indicates that cloud computing has a good effect in mental health service platforms.

2. Use of Cloud Computing in Mental Health Service Platforms

2.1 Standards for Mental Health

In real life, there is no standard for evaluating the mental health of college students, and there is no need to pursue such an absolute standard. Health is not static or static [4-5]. After conducting certain research on people's psychological and behavioral performance, as well as displaying social life, and adhering to the four basic principles of development, overall coordination, relativity, and image, the psychological health standards of college students can be considered from the following aspects [6-7].

1) Intelligence is an important indicator for measuring a person's mental health, which is the sum of various operational and cognitive abilities centered on thinking ability. The most basic prerequisite for a person's learning, life, and work is their intelligence. Generally speaking, the so-called supernormal intelligence refers to an IQ of over 130; the so-called normal intelligence refers to an IQ of between 90 and 129; the so-called subnormal intelligence refers to an IQ of between 70 and 89; the so-called "backward intelligence" refers to people with an IQ below 70. When measuring a person's intellectual development level, comparing it with the intelligence of peers can timely detect and avoid abnormal intellectual development. The symptoms of intellectual abnormalities include delusions in thinking, delayed or sensitive responses to external stimuli, and hallucinations in perception [8-9].

2) Some people believe that happiness represents mental health, just like a normal body temperature represents physical health. If a person is in a good mood, they would have a positive attitude towards life and hold hope and faith in everything. The judgment of a person's mental health is not based on whether they are prone to negative emotions, but on the duration of the negative emotions they generate and the proportion of such negative emotions in their entire emotional life. People with mental health may also experience negative emotions such as anxiety and sadness, but these negative emotions would not last [10-11].

2.2 Construction of Mental Health Service Platform

With the advent of cloud computing and big data era, the demand for establishing online service platforms is also increasing. The designed mental health online service platform mainly includes the following modules: registration management for schools and students; online psychological counseling and counseling; the interaction between teachers and students in online teaching; teaching and sharing by psychological counselors; establishment of mental health records; online prediction and evaluation system [12-13].

2.2.1 Establishment and Management of Mental Health Records

The online service platform emphasizes the principle of confidentiality to protect students' privacy, respect everyone, and make them feel able to open their hearts in a safe environment. Students with needs can register themselves and log in using their username and password after registration. After the school's information registration is successful, corresponding confidentiality measures would be taken to ensure its security. After logging in with a username and password based on the school, the entire student list of the school can be imported into the school and managed by grade and class. Every year or every semester, students are asked to conduct mental health tests on this platform for middle school students, which can help schools screen out problematic students and provide effective crisis intervention for them. In addition, it is possible to regularly establish mental health records for each student [14-15]. All information would be stored in a database, provided by the school, and then entered into their own mental health records. Through student file management, it is possible to have a dynamic understanding of each student's psychological development during the middle school stage, and to conduct longitudinal comparisons. For the problems commonly reflected in mental health tests, it also helps to promote schools to better adjust and carry out mental health education [16-17].

2.2.2 Online Psychological Counseling and Interaction

Modules such as online chat and discussion have been set up, allowing experts to interact with students on a daily basis and provide them with an interactive discussion environment about a particular case or problem. Online services provide one-on-one online psychological counseling and guidance to problematic students with psychological counselors, conducting relevant psychological scale measurements for students in need of special assistance, predicting their psychological status, and understanding their severity. If students with serious psychological problems are found, appropriate intervention should be given to them and attention should be strengthened. For some very serious students, they would be advised to switch to on-site counseling or referral to professional psychological counseling institutions. At the same time, notices would be issued to their parents to provide them with a clearer understanding of the student's specific situation. In addition, he also provided special psychological counseling videos prepared by psychologists for students through online live streaming, allowing them to watch on their own, which is very helpful for their "three perspectives" [18-19].

2.2.3 Online Psychological Test and Risk Assessment

Conducting online psychological tests has two functions: firstly, it helps schools provide students with psychological health information; students are individually tested with a psychological scale, which means that when a psychological counselor conducts online tutoring and identifies problematic learners, they are targeted to receive corresponding psychological scale tests. Counselors can evaluate students' risk based on the test results, and appropriate intervention measures can be taken for those with higher risk [20].

2.2.4 Technical Requirements for the Development of Online Service Platforms

On this basis, it is necessary to combine network technology and database technology. System reliability requirements: During the testing process, the number of system interruptions and failures that occur per month shall not exceed 3, and during the entire system warranty period, the number of interruptions and failures shall not exceed 1 per month. The system must ensure continuous and effective operation for 74 hours. The system should have a sound error handling mechanism and provide clear error handling prompts to guide users to use them correctly. The system should have a mechanism for automatic data transfer and recovery. The application system must have a security measure to ensure the normal operation of the system. Requirements for system efficiency: For ordinary business web pages, the results required by the user must be provided within 3 seconds. For logically strong web pages, it is necessary to reply to the user's requested results within 5 seconds. Easy to install: It is compatible with common assembly types and provides a simple, intuitive, and user-friendly graphical operation interface. Easy to get started: There is no difficulty in using it. Ease of use is to provide a quick and convenient method for commonly

used functions. The interface of each module is unified, with rich online assistance; Scalable system: In the design and construction of the system, the expansion requirements of the system are fully considered; Storage system stores a large amount of data generated over five years. The module of mental health is shown in Figure 1:

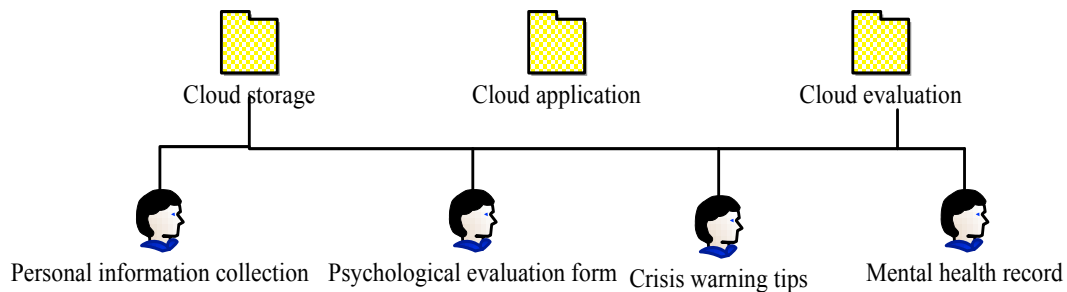


Fig.1 Mental health module

2.3 Overview of Cloud Computing

Cloud computing refers to the process of breaking down massive amounts of data into several small programs through the “cloud”, which are then processed and analyzed by a system composed of multiple servers to obtain the final results and provide feedback to users. Cloud computing is an emerging computing technology that has evolved from various technologies such as distributed computing, efficient computing, parallel computing, network storage, hot backup, virtualization, etc.

Cloud models can be divided into three categories: public cloud, private cloud, and hybrid cloud.

Public cloud generally refers to a usable cloud provided by third-party suppliers to users. It can generally be used on the internet, either for free or at a low cost. Its core attribute is shared resource services.

Private clouds can provide the most effective data control, security, and service quality for individual users. The company has an infrastructure and can control the deployment of response processes on this infrastructure. Private clouds can be deployed on defense walls of enterprise data or on secure hosts, and the core attribute of private clouds is private resources.

Hybrid cloud is a new form of cloud that combines public and private clouds, and is currently the mainstream development direction of cloud computing. People all know that private enterprises are generally aimed at enterprise users. For their own security, they would rather store their data in a private cloud than use the computing resources in the public cloud. Therefore, hybrid cloud has been widely adopted, combining public and private clouds to achieve the best results, achieving a cost saving and ensuring system security.

2.4 Operation Mode of Cloud Computing Mental Health Service Platform

The front-end of this service model is connected to the physician workstation, achieving the docking and transmission of personal data, and achieving mental health management. The backend is combined with the mental health network platform to achieve integrated services. By constructing a psychological evaluation and analysis system, the function of collecting and analyzing real psychological data of people has been achieved. The specific operation method is in the process of managing the psychological health of the public, their psychological data would be automatically collected to form a curve representation of their psychological state, and they would be monitored, tutored, or warned to facilitate their preventive measures in advance. For existing psychological problems, the system would automatically provide them with a set of basic psychological counseling programs, conduct a crisis warning for the public’s psychology, cooperate with psychological counseling personnel, and provide them with corresponding measures to regulate the citizens’ psychological state, thereby controlling their negative emotions. Professional psychological counseling personnel can also provide one-on-one professional follow-up counseling to effectively solve the problem. The specific process is shown in Figure 2.

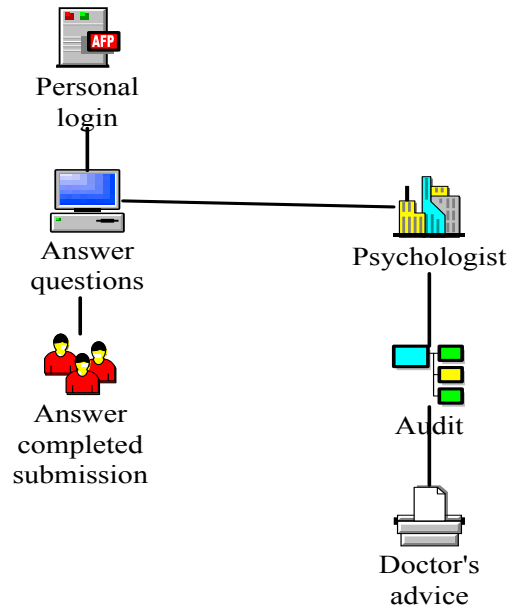


Fig.2 Mental health management operational model diagram

2.5 Use of Cloud Computing Algorithms

In cloud computing technology, network clustering topology fault-tolerant algorithms are often used. Under the probability calculation method of cluster head selection, the main cluster head is mainly responsible for collecting and fusing data from all nodes in the cluster and transmitting it to the nodes. Therefore, it consumes more energy compared to other nodes. The relationship between node probability and remaining energy is shown in Formula 1:

$$P = k * N_i / N_{\max} \quad i \in L \quad (1)$$

In Formula 1, k is the probability coefficient of the main cluster head; N_i is the remaining energy value of node i ; N_{\max} is the maximum energy of node i , and L is the set of nodes without selected cluster heads. In Formula 2, $C(i)$ is the probability that the i -th node becomes the cluster head in round b , and P is the proportion of cluster head nodes.

$$C(i) = \frac{P}{1 - P * (1/b)} \quad i \in M \quad (2)$$

Compared with other nodes, wireless sensor nodes consume the highest energy during the transmission phase during operation. When sending signals, the energy consumed per second is shown in Formula 3:

$$Q_n = q_n + q_i c^i \quad (3)$$

In Formula 3, q_n is the energy consumed per second for transmission; q_i is the energy coefficient consumed during the transmission phase; c is the transmission range; i is the loss during the transmission process.

3. Cloud Computing Mental Health Service Platform Simulation Experiment

People's mental health is very important, so people need to pay special attention to mental health. This paper would test the effect of cloud computing in the mental health service platform through experiments. This paper

selects the mental health service platform before and after cloud computing to test users' mental health. The accuracy of the mental health service platform's psychological test of users before and after cloud computing is shown in Figure 3:

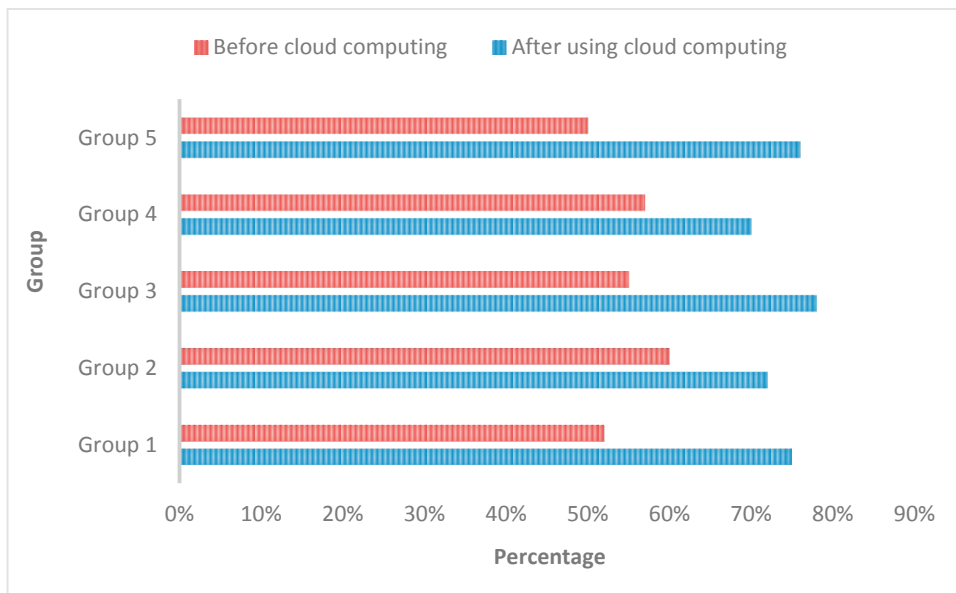


Fig.3 Accuracy of mental health service platform for users' psychological tests before and after using cloud computing

According to the experimental results in Figure 3, after using cloud computing technology, the accuracy of the mental health service platform for users' psychological test is 78% at the highest and 70% at the lowest, while the accuracy of the mental health service platform for users' psychological test before using cloud computing is 60% at the highest and 50% at the lowest. From this experimental data, it can be seen that after using cloud computing technology, the mental health service platform has significantly improved the accuracy of users' psychological test, which may be due to the excellent computing power of cloud computing. This can accurately control the data of users' answers and obtain accurate mental health status of users.

This paper also investigated the satisfaction of users of the mental health service platform with the psychological test of the platform after the use of cloud computing technology, because the higher the user's satisfaction is, the more satisfied the users are with the results of the mental health test. The results of the questionnaire survey are shown in Figure 4.

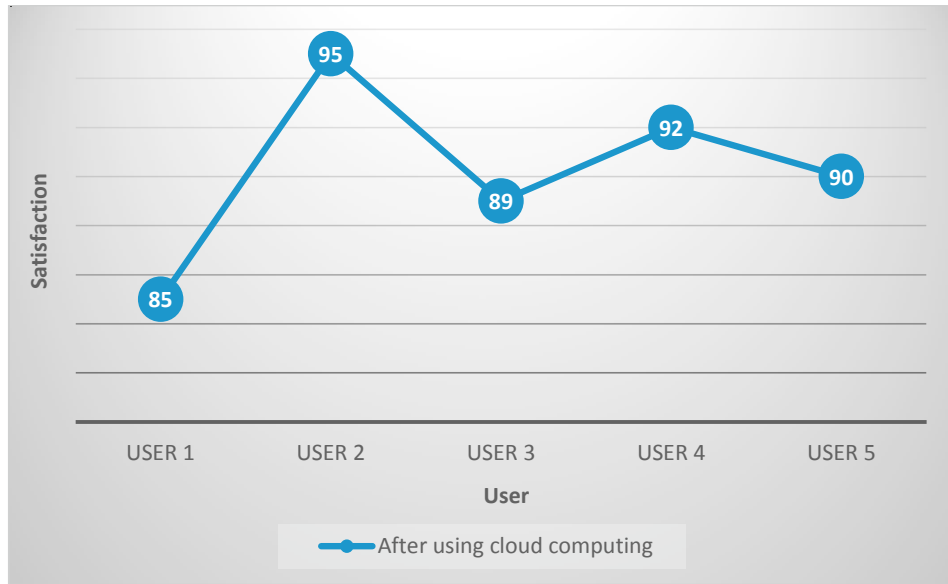


Fig.4 Questionnaire survey results

From the experimental results in Figure 4, it can be seen that after using cloud computing technology, user satisfaction was the highest at 95 points and the lowest at 85 points in the user survey results. From this experimental data, it can be seen that users are still very satisfied with the mental health platform, and it also proves that cloud computing technology has a good effect in user survey results.

4. Conclusions

Mental health has always been the focus of people's attention. It can make people study and live better, so the improvement of mental health and the test of mental health are very worthy of research. The mental health service platform can enable people to test their mental health, thereby enabling them to handle their mental health problems in a timely manner, and greatly reducing the risk of major psychological diseases. Therefore, it is very meaningful to study the mental health service platform. This article focuses on the research and application of cloud computing in mental health service platforms, aiming to combine cloud computing with mental health service platforms and enable them to play a better role. This article tested the accuracy of mental health testing on a mental health service platform after using cloud computing through experiments, and found that the results were very good. This indicates that cloud computing can have good effects in mental health service platforms. Due to space limitations, the number of experiments conducted in this article is not sufficient and would be improved in the future.

Acknowledgements

This work was supported by the general project of philosophy and social sciences in Heilongjiang Province in 2020, "Inheritance of Northeast Anti-Union Spirit and Integration into Ideological and Political Education in Universities" (Grant No. 20SZB10), the teacher innovative supportment projects of Harbin University of Commerce in 2021, and Humanities and Social Science Research Project of the Ministry of Education, "Research on the Northeast Anti-Alliance Spirit and College Students' Ideological and Political Collaborative education under the background of Great Ideological and Political Education" (Grant No. 22JDSZ3040). Key entrusted project of higher education teaching reform in Heilongjiang Province: Research and implementation of online and offline mixed practical teaching for Food science and engineering major in school-enterprise cooperation mode (SJGZ20200081).

References

- [1] Arango C, Diaz-Caneja C M, McGorry P D, et al. Preventive strategies for mental health. *The Lancet Psychiatry*, 2018, 5(7): 591-604.
- [2] Kumar A, Nayar K R. COVID 19 and its mental health consequences. *Journal of Mental Health*, 2021, 30(1): 1-2.
- [3] Liu J J, Bao Y, Huang X, et al. Mental health considerations for children quarantined because of COVID-19. *The Lancet Child & Adolescent Health*, 2020, 4(5): 347-349.
- [4] Knapp M, Wong G. Economics and mental health: the current scenario. *World Psychiatry*, 2020, 19(1): 3-14.
- [5] Pfefferbaum B, North C S. Mental health and the Covid-19 pandemic. *New England journal of medicine*, 2020, 383(6): 510-512.
- [6] Cullen W, Gulati G, Kelly B D. Mental health in the COVID-19 pandemic. *QJM: An International Journal of Medicine*, 2020, 113(5): 311-312.
- [7] Campion J, Javed A, Sartorius N, et al. Addressing the public mental health challenge of COVID-19. *The Lancet Psychiatry*, 2020, 7(8): 657-659.
- [8] Moreno C, Wykes T, Galderisi S, et al. How mental health care should change as a consequence of the COVID-19 pandemic. *The lancet psychiatry*, 2020, 7(9): 813-824.
- [9] Talevi D, Socci V, Carai M, et al. Mental health outcomes of the CoViD-19 pandemic. *Rivista di psichiatria*, 2020, 55(3): 137-144.
- [10] Shatte A B R, Hutchinson D M, Teague S J. Machine learning in mental health: a scoping review of methods and applications. *Psychological medicine*, 2019, 49(9): 1426-1448.
- [11] Vahia I V, Jeste D V, Reynolds C F. Older adults and the mental health effects of COVID-19. *Jama*, 2020, 324(22): 2253-2254.
- [12] Evans T M, Bira L, Gastelum J B, et al. Evidence for a mental health crisis in graduate education. *Nature biotechnology*, 2018, 36(3): 282-284.
- [13] Zhou J, Liu L, Xue P, et al. Mental health response to the COVID-19 outbreak in China. *American Journal of Psychiatry*, 2020, 177(7): 574-575.
- [14] Kola L, Kohrt B A, Hanlon C, et al. COVID-19 mental health impact and responses in low-income and middle-income countries: reimagining global mental health. *The Lancet Psychiatry*, 2021, 8(6): 535-550.
- [15] Kilbourne A M, Beck K, Spaeth - Rublee B, et al. Measuring and improving the quality of mental health care: a global perspective. *World psychiatry*, 2018, 17(1): 30-38.
- [16] Howard L M, Khalifeh H. Perinatal mental health: a review of progress and challenges. *World Psychiatry*, 2020, 19(3): 313-327.
- [17] Whitney D G, Peterson M D. US national and state-level prevalence of mental health disorders and disparities of mental health care use in children. *JAMA pediatrics*, 2019, 173(4): 389-391.
- [18] Greenberg N, Weston D, Hall C, et al. Mental health of staff working in intensive care during Covid-19. *Occupational Medicine*, 2021, 71(2): 62-67.
- [19] Tillmann S, Tobin D, Avison W, et al. Mental health benefits of interactions with nature in children and teenagers: A systematic review. *J Epidemiol Community Health*, 2018, 72(10): 958-966.
- [20] Oswalt S B, Lederer A M, Chestnut-Steich K, et al. Trends in college students' mental health diagnoses and utilization of services, 2009–2015. *Journal of American college health*, 2020, 68(1): 41-51.