Scalable Computing: Practice and Experience, ISSN 1895-1767, http://www.scpe.org

Volume 25, Issues 3, pp. 1852–1862, DOI 10.12694/scpe.v25i3.2764

# HOSPITAL MEDICAL BEHAVIOUR SUPERVISION AND OPERATIONAL EFFICIENCY EVALUATION METHOD BASED BASED ON BIG DATA PLATFORM

YI LIU* AND YI ZHANG†

**Abstract.** The application of cloud computing and big data core technologies and concepts to medical informatization can improve its flexibility and efficiency, and achieve the overall deployment and intensive management of the system. In the era of big data, the use of information management platform can optimize and standardize clinical diagnosis and treatment process, improve the quality and efficiency of diagnosis and treatment services, and improve the quality and level of scientific research, which meets the requirements of medical reform for fine management of hospitals and precise medical treatment in the era of evidence-based medicine. This paper introduces the development and application of big data analysis in the field of information technology. Through the research on the supervision of hospital medical service behavior, the top-level design is used to standardize the content of medical behavior supervision, and the effectiveness of supervision is discussed to achieve the purpose of reducing clinical paperwork. Based on the needs, the medical service behavior supervision system is proposed and constructed. Strengthen hospital medical behavior supervision through hospital big data analysis and knowledge base system support.This system can provide management with an effective monitoring and management tool, enabling them to promptly identify and solve problems that arise in medical services. By analyzing a large amount of medical data, hospitals can help predict the trend of disease occurrence in advance, thereby taking preventive and control measures in advance, and reducing the occurrence and spread of diseases. Through deep learning and analysis of patient data, personalized treatment plans can be provided for each patient to improve treatment effectiveness.

**Key words:** Big Data; Medical Behavior; Efficiency Evaluation

**1. Introduction.** In recent years, with the advancement of new medical reform, medical informatization, one of the "four pillars" and "eight pillars", is playing an increasingly important supporting role and has become the key development direction of medical system reform [1]. While medical informatization has received unprecedented attention and development, due to the arrival of the era of big data and the relatively backward development of traditional medical information technology, medical informatization also has many problems [2]. Big data and other modern computer technologies are widely applied in the construction of hospital informatization, which is the only way to change the current construction and application status of "chimney" hospital information system with high investment, low efficiency and difficult management and to establish a new type of digital hospital information platform architecture system [3]. The application of big data analysis technology in the field of medical and health care, the use of data mining and analysis technology to analyze medical data, and the combination of traditional medical data, can achieve accurate and personalized health care services [4]. Making full use of large medical data can reduce the infection rate of infectious diseases and improve public health monitoring. In terms of management, large medical data can be used for disease classification, resource management, quality control and other operations [5]. In a word, making full use of big medical data is an important way to promote medical informatization and improve the efficiency and quality of medical industry. With the gradual advancement of medical and health reform in recent years, the medical environment has been greatly improved, and more people have access to quality medical services. However, for medical institutions, due to the introduction of relevant policies and systems in the process of medical reform, hospitals have policies. The implementation and implementation basically rely on traditional meetings, training and missions, and post-intervention. It is difficult to know the implementation effect of the policy in the first time [6].The new regulatory policy on medical service behavior may have an impact on the behavior of medical

*Department of Medical Technology, Chongqing Medical and Pharmaceutical College, Chongqing, 401331, China (18996139677@163.com)
†Department of Medical Technology, Chongqing Medical and Pharmaceutical College, Chongqing, 401331, China (Corresponding author, 10758@cqmpc.edu.cn)

personnel. For example, stricter regulatory policies may limit doctors' behavior, which may lead to doctors being more conservative when dealing with patients, thereby affecting their treatment effectiveness. In addition, if regulatory policies lack fairness and transparency, it may lead to dissatisfaction and resistance from doctors, thereby affecting the quality of medical services [7]. Pareto efficiency describes the effectiveness of resource allocation in a perfectly competitive market, which is an enjoyable way of resource allocation. However, it has nothing to do with fairness. Even if all medical resources are monopolized, they can still be pareto efficient [8]. Medical and health resources are limited, non-competitive and non-exclusive, and medical service is a quasi-public product. Therefore, the principle of profit maximization and cost minimization cannot be used by hospitals to participate in market competition. Therefore, the evaluation of hospital efficiency cannot be simply measured by pareto efficiency [9]. Information-based big data analysis and medical service behavior supervision are complementary to each other. In medical behavior supervision, the process supervision of implementing medical technical norms is the basis and also the means [10]. From the perspective of hospital administrators, big data analyzes all the violations and problems of the whole hospital to analyze big data, provide a basis for managers' decision-making, monitor the work of all levels of the hospital, decompose the data at different levels, and implement the indicators to specific The executive department or medical staff achieves the purpose of multi-dimensional regulation [13].

Medical behavior supervision should integrate scattered distribution with business data of various systems, integrate and analyze these business data, and realize self-configuration of data acquisition according to actual business, interface with various applications or application systems, and subject-oriented analysis of historical data [14]. When we view the external environment of a hospital as a determined environment, such as a stable political situation, good policies, universally followed laws, and appropriate public opinion guidance. Then change the internal factors of the hospital, such as increasing or reducing beds, increasing or decreasing the number of medical staff [15]. Similarly, assuming that the internal factors of a hospital are fixed within a certain period of time, and the external factors change, such as the adjustment of medical insurance policy or the national policy adjustment, which makes foreign capital and private capital enter the medical market in a large scale, whether endogenous or exogenous factors change, can affect the operational efficiency of a hospital [16].

In this paper, we propose an algorithm based on the big data platform, which is a new algorithm for the supervision of medical behavior and the evaluation of operational efficiency in hospitals. In summary, our contributions are as follow:

1. This algorithm is a new technology based on big data platform for the problem of hospital medical behavior supervision and operational efficiency evaluation methods.
2. This technology is widely applicable in the big data platform environment, and it has high applicability for most of the solid hospital medical behavior supervision and operational efficiency evaluation methods.
3. Higher precision, wider applicability and higher recognition.

**2. Related Work..** As medicine enters the era of big data, the mining and utilization of clinical data will inevitably improve clinical decision-making and management levels, improve service efficiency, reduce medical errors, and deepen medical reform. This also puts forward higher requirements for hospital refined management [17]. IBM has creatively proposed the concepts of earth intelligence, intelligence, and medical technology as one of its important aspects of rapid development worldwide. Currently, the academic community has reached the following consensus in several stages of implementing intelligent medicine: 1. Medical data collection and analysis; 2. Big data information analysis and processing; 3. Intelligent medical knowledge learning [18]. Based on medical diagnosis and treatment support based on big data processing, some scholars believe that introducing key technologies and core concepts of cloud computing and big data into medical informatization construction is in line with the inevitable trend of modern medical development. In the era of big data, cloud computing and big data technology have become key technological support for achieving the transformation of medical informatization and promoting medical system reform [19].

Cloud computing, as a system engineering in the era of big data, has unparalleled advantages in the research and application of big data. Some scholars have introduced hospital informatization construction into cloud computing. Through overall deployment and intensive management, equipment investment has been reduced, resource utilization has been improved, system operating costs have been reduced, green hospital IT system architecture has been achieved, and a new type of hospital information construction has been established. In the process of big data processing in hospitals, it is necessary to consider the security and sharing of data. Develop corresponding data security policies to ensure data privacy and security. Meanwhile, for valuable analysis results, data sharing and exchange can be achieved through shared platforms, promoting the development of medical research [20]. Some scholars believe that big data has potential in the medical field: around how to reshape the medical system, based on the belief that medical big data contains huge wealth, medical big data has many applications, and for hospital informatization construction, meaningful information extracted from medical big data has also been greatly promoted [21]. Some scholars believe that traditional computer architectures have limited processing power for big data based on the symbiotic impact evaluation method of topological reduction of big datasets. Cloud computing provides an effective way for big data processing [22].

**3. Materials and Methods.** With the rapid development of information technology, especially the rise of cloud computing and big data technology in recent years, more and more medical institutions in China have begun to accelerate the change of the traditional mode of hospital informatization, to realize the transformation and upgrading of digital hospital construction, in order to improve their own medical service level and core competitiveness. Based on cloud computing medical cloud service mode, a new architecture of digital hospital information platform is established, which enables medical institutions to improve "patient-centered" clinical medical services and meet the needs of medical resources [23]. Is not a simple computerized medical informatization, but information sharing as the core, including internal medical institutions, medical institutions, medical institutions and community, the health administrative department, medical insurance agency information sharing between each other, maximum convenient patient medical treatment process, improve the efficiency of medical work, and the convenience of various kinds of management personnel management work of analysis and decision, give full play to the information technology application in the medical industry value, improve the effective utilization ratio of health resources. Will be the key technology and the concept of cloud computing and big data used in hospital information construction, can improve the flexibility and efficiency of medical informatization, to realize the overall deployment, intensive management system, on-demand configuration, satisfy its large-scale application in scalability, reliability and on-demand services, at the same time can make the elasticity of large data storage, centralized management and effective utilization.

The evaluation of hospital efficiency should also be discussed separately from the short-term and long-term perspectives; the short-term external environment is relatively stable, and the internal factors directly affect the hospital's economic efficiency; using a single-time panel data to measure the relative relationship between different hospitals. In the long run, because internal factors and external factors are simultaneously changing, such as the introduction of a policy, it may be good news for a certain type of hospital, and for a hospital that does not have this attribute, it may be bad news. Therefore, the long-term efficiency of the hospital cannot be measured by the accumulation of panel data. So how do you judge whether the hospital has maintained high efficiency for a long period of time, 10 or 20 years, or in which years is more efficient, and in other years is less efficient? When evaluating the technical efficiency of different hospitals, especially when the technical efficiency is related to many different factors, the multiple linear regression model is a better solution. Multivariate linear regression analysis solves the correlation between a phenomenon (interpreted variables) and multiple influencing factors (interpreted variables) in market competition activities, and can more intuitively describe what are the most significant factors affecting a phenomenon and the degree of such influence.

Firstly, the large data collection module is used to collect patient's visiting information from various hospital information systems to form user preference data, and these historical records are transformed into a simple triple:

$$dF_r = \tau b dx \tag{3.1}$$

Then use several similarity measures to calculate the similarity between users, the formula is:

$$x_{ij}^{'} = \frac{x_{ij}}{S_J} \tag{3.2}$$

In essence, the Euclidean distance represents the true distance of two points in a multidimensional space,

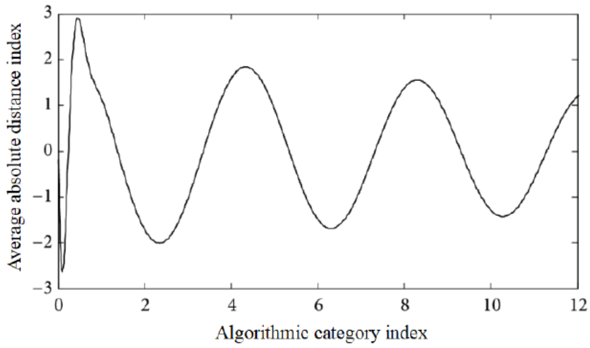


Fig. 3.1: Average absolute distance

and its formula is as follows:

$$\rho(x,y) = \begin{cases} k/(M_1 * M_2)(x,y) \in S \\ 0(x,y) \notin S, \end{cases} \tag{3.3}$$

The similarity expressed by Euclidean distance is formula 6. It can be shown in Figure 3.1.

$$F(x) = \frac{1}{1+e^{-ax}} \tag{3.4}$$

Pearson correlation coefficient represents the ratio between skew variance and standard deviation of two triples, and its calculation formula is as follows:

$$q_f = -\frac{1}{1+e^{-ax}} \tag{3.5}$$

Cosine similarity represents the cosine value of the Angle between two images of two triples in the vector space, which is used to measure the difference between them. The calculation formula is as follows:

$$S_1 = R_1 = [G^1, G^2, ..., G^k] \tag{3.6}$$

According to the similarity measure calculated by the above similarity calculation method, two types of methods are used in our system to obtain adjacent users or items, that is, neighbors based on similarity threshold and a fixed number of neighbors, as shown in Figure 3.2 and Figure 3.3.

Accuracy and recall are two measures used to evaluate the efficiency of behavior supervision and operation. Firstly, relevant data needs to be collected, including behavioral data of medical personnel, patient feedback, and reports of medical accidents. These data can be obtained through the hospital's information system, survey questionnaires, surveillance cameras, and other means. Classify the behavior of medical personnel based on the collected data. For example, behaviors can be divided into ”compliant” and ”non compliant”, or classified based on specific types of behaviors. Use machine learning or statistical methods to establish models based on collected data to predict the behavior of healthcare workers. Formulas such as Formula 3.7 and Formula 3.8 can be used to establish the model. Use a test set to evaluate the accuracy and recall of the model. Accuracy refers to the proportion of the correct number of samples predicted by the model to the total number of samples, while recall refers to the proportion of the correct number of positive samples predicted by the model to the total number of positive samples. Apply the model to actual data to monitor the behavior of medical personnel. If the accuracy and recall of the model are high, the model can effectively identify and predict the behavior of medical personnel, thereby assisting hospitals in behavioral supervision. By collecting and analyzing this data, comprehensive supervision of doctors' medical behavior can be carried out, including their prescription behavior,

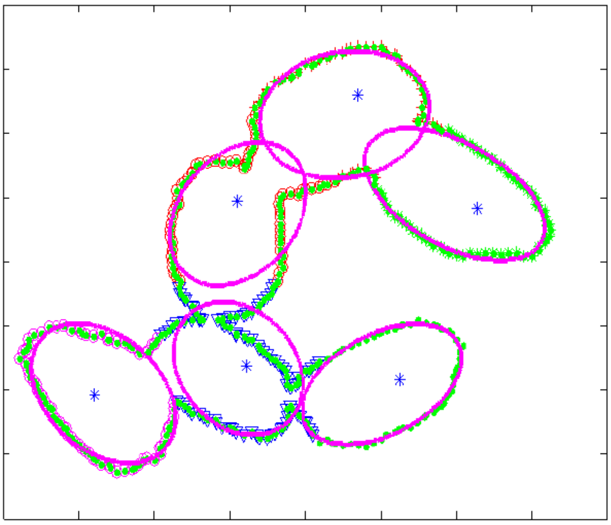

Fig. 3.2: The neighboring method based on the threshold of similarity threshold

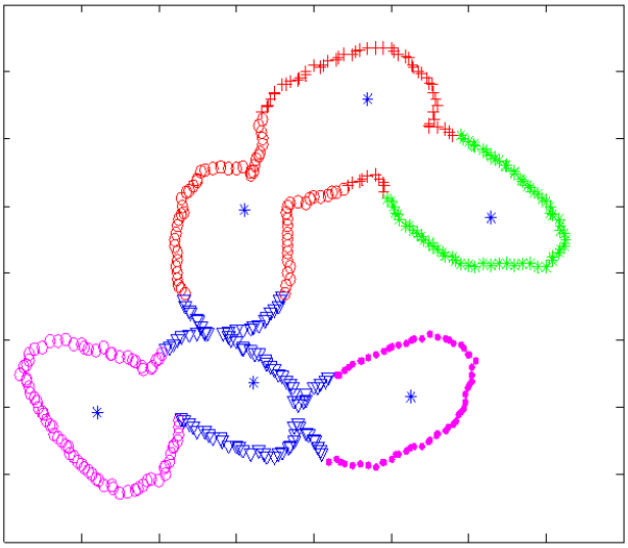

Fig. 3.3: Fixed number of neighboring methods

diagnostic behavior, and treatment behavior. These data can help us understand whether doctors' behavior complies with regulations and whether they can provide high-quality medical services. The measurement methods defined by them are Formula 7 and Form 8. The accuracy recall index is shown in Table 3.1. The types of supervision are shown in Table 3.2 and the growth of operational efficiency is shown in Table 3.3.

$$a_i = (\tau_i - \tau_{i-1})/(\rho_i h_i) \tag{3.7}$$

$$v_D = \frac{d_w}{d_t} \tag{3.8}$$

Table 3.1: Accuracy recall rate

| Actual Class | | Positive | Negative | Total |
|---|---|---|---|---|
| Actual Class | Positive | Ture Positive | Ture Negative | TP+FN |
| Actual Class | Negative | Fasle Positive | Fasle Negative | FP+TN |
| Actual Class | TP+FP | TN+FN | TP+FN+FP+TN | |

Table 3.2: Accuracy recall rate

| | No profit | Profit seeking |
|---|---|---|
| Non regulation | 0 r | -s,r |
| Supervise | -c,r | f-c-s,r-f |

In large-scale data processing, these two separate components are often used together in the following format:

$$\Delta y = M(t_0 + \Delta t) - M(t_0) \tag{3.9}$$

Multivariate linear regression analysis is used to evaluate the technical efficiency of different hospitals, which can solve the problem of hospital public welfare. The methods and results are in the following equations:

$$R_i(i) = P(q_t = s_i | y_t) \tag{3.10}$$

$$\lambda = f(x_1, x_2, x_3, x_4) \tag{3.11}$$

In conclusion, the performance formula of medical behavior supervision and operational efficiency evaluation methods in hospitals under the big data platform is as follows:

$$\begin{array}{l} min\theta_{j_0} \\ s.t. \begin{cases} \sum_{J=1}^{n} X_j \lambda_j + S^+ = \theta_{j_0} X_{j_0} \\ \sum_{J=1}^{n} Y_j \lambda_j - S^- = Y_{j_0} \\ \sum_{J=1}^{n} \lambda_j = 1 \\ \lambda_j \geq 0, j = 1, ..., n; \theta_{J_0} \in E, \end{cases} \end{array} \tag{3.12}$$

The generation of large data has gone through several stages step by step, from the initial operation of special application groups to the active generation of data by the whole people, that is, users, to the final generation of data automatically and endlessly by human intelligent sensor devices, which together constitute large data. From these data generation methods, W can clearly understand the characteristics of large data introduced in the previous section. Data generation speed is faster and faster, data volume is larger and larger, data types are diverse, and data value density is lower and lower. With the popularization of hospital information system, a large number of medical information will be generated every day, including image information (CT, MR), vital signs, clinical examination, diagnostic information and other information. These resources are valuable resources of the hospital, and have important value in patient diagnosis, clinical comprehensive display and medical research. The effective acquisition and storage of this information is the basis for the use of medical data. Platform-as-a-service provides an operational environment for the creation of application services, integrated development tools and software for medical software vendors, medical institutions at all levels, and medical management departments to support the subsequent development of medical organizations in distributed computing platforms. . By using the various interface calls provided by the platform, software tools, integrated SDKs, data mining engines and other basic services, you can quickly develop a variety of software to meet your own needs and seamlessly integrate into existing platforms.

Table 3.3: Operating efficiency growth

| Time | Growth rate |
|---|---|
| 1 | 7.68% |
| 2 | 10.37% |
| 3 | 13.29% |

Table 4.1: Economic benefits

| Number of users | 106 | 97 |
|---|---|---|
| Scale | Big | Small |
| Return on investment | 76.7% | 45.3% |

**4. Results..** The purpose is to provide medical information system service by desktop service, so that hospitals and users can obtain the permission of medical information system by "leasing" according to their own needs, and realize the mode of medical information system as a service. At the same time, for providers of medical cloud services, virtual desktop architecture allows them to quickly and cheaply build a mobile hospital information environment without modifying existing medical information systems or developing new mobile medical applications to support large-scale access to medical information systems based on cloud computing. The larger the number of users, the larger the scale of virtual desktop architecture implementation and the greater the economic benefits, as shown in Table 4. The growth rate of hospital assets is shown in Table 5. The providers and owners of medical big data service platform can be hospitals or third-party institutions independent of hospitals. Compared with the third-party medical cloud service platform, the hospital has the inherent advantages of adapting measures to local conditions. First, the hospital has a complete medical information system-level environment, which can be quickly upgraded to the cloud platform. Second, IT can be closely integrated with the hospital process rather than provide a single service, such as the storage of medical images, as a third-party service provider. Third, IT personnel and medical workers in the hospital can quickly communicate with each other, find problems in the cloud platform and solve them.

Establishing hospital data platform is one of the ways to solve the problem of hospital big data processing. Hospital data platform mainly includes data storage layer, business component layer, data interaction layer, hardware network infrastructure layer, and four levels. Two major systems: standard specification system and safety guarantee system. See Figure 4.1 for details. Building a hospital data platform and gradually realizing a new data exchange processing mode of unified and efficient, resource integration, interconnection and information sharing is an important trend in big data processing.

Nonparametric estimation efficiency is mainly the data envelopment analysis, the main ideas of this way of efficiency evaluation is by looking at a large number of actual production data, and based on the production effectiveness standard to find out in efficient point on the surface of the production frontier, is made up of all these efficient point of a surface data envelopment, comparison of the distance between the observed value and the ideal surface, measuring the effectiveness of the technical efficiency and the effectiveness of resource allocation. Evaluate the efficiency of traditional Chinese medicine hospitals in utilizing medical resources, including human, material, and financial resources. For example, is there a problem of insufficient manpower leading to a decline in the quality of medical services, or is there a phenomenon of uneven financial allocation leading to imbalanced development in certain departments. Inspect the investment and achievements of traditional Chinese medicine hospitals in medical technology innovation. For example, can the introduction, research and application of new technologies improve the quality and efficiency of medical services. Understand whether the economic burden of patients is reasonable, as well as the measures and effectiveness of traditional Chinese medicine hospitals in reducing the burden on patients. For example, is there any phenomenon of excessive examination, excessive treatment, etc. that increases the financial burden on patients.It should be noted here that as a non-parametric efficiency evaluation method, data envelopment analysis has the advantages of wide application, simple operation and relatively easy data acquisition. However, this method can only be used

Table 4.2: Asset growth rate

| Number of years | Growth rate |
|---|---|
| 2 | 16.59% |
| 4 | 18.71% |
| 6 | 19.58% |

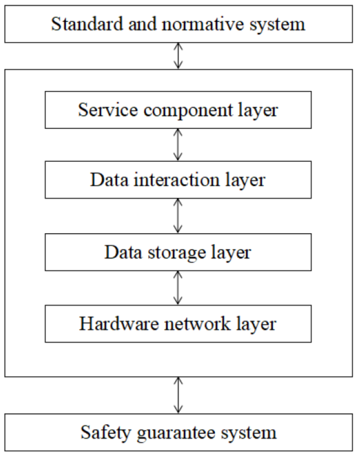


Fig. 4.1: Hospital data platform technology architecture

to evaluate the relative efficiency. Even if the efficiency value of all decision making units is 1, it cannot be concluded that all decision making units are technically effective. Data envelopment analysis can only judge the relative effectiveness of technical efficiency between a group of decision making units. Therefore, when we want to evaluate the absolute level of hospital technical efficiency, data envelopment analysis is inadequate. Using big data analysis technology, and the support of knowledge base and rule base, the medical behavior supervision system conducts big data intelligent analysis on clinicians' violations, automatically captures the problematic medical orders or prescriptions, and displays them to relevant auditing personnel to conduct violations. Review and break down the problem to find the specific root cause of the problem. At the same time, after the system automatically generates the complaint file for the violation problem, the system automatically warns the clinician that there is a violation document, and the clinician can appeal the case. For example, timely monitoring and capturing of the problem of irrational drug use interactions, the medical management department in the event and the post-mortem medical management department to review and capture the violations of the doctors, and the violations automatically captured by the system are displayed to the medical administration. Comments, thus helping the functional departments to change from terminal management to link management and process management.

The expanding medical information data is mixed with a large number of unstructured data, and the analysis data is becoming more and more diversified. The current storage architecture has been unable to meet the needs of large data applications, especially when dealing with and querying large data sets. Massive data storage system must have the corresponding level of expansion capacity. In addition to the huge scale of data, it also has a huge number of files, so how to manage the metadata accumulated at the file system level is also a difficult problem. There are real-time problems in the application of large medical data, which require real-time or quasi-real-time data processing and second-level query response. In recent years, with the development of medical information, cloud computing and the application of large data model, medical data has shown explosive growth, as shown in Figure 4.2.

In the classification and prediction analysis of medical image data, we classify them according to the char-

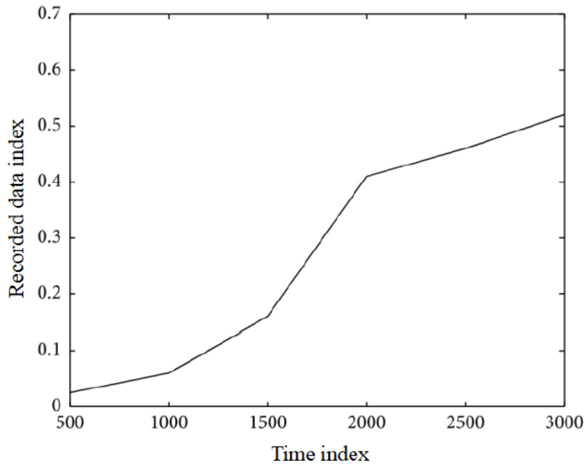


Fig. 4.2: The explosive growth of big medical data

acteristics of images and obtain knowledge and rules to predict future information. In the evaluation method of hospital medical behavior supervision and operational efficiency based on big data platforms, multidimensional analysis of image data can effectively extract and analyze key information in medical images. By constructing multidimensional features such as color, texture, and shape of images, these features can be comprehensively applied for deeper analysis and evaluation. Color feature is one of the basic features of an image, which can reflect the basic attributes of the image, such as brightness, contrast, and saturation. In medical image analysis, the extraction of color features can help doctors better understand and diagnose the condition. For example, in medical imaging, the color differences of different tissues can help doctors identify lesion areas. By extracting and analyzing color features, quantitative descriptions of color distribution, color composition, and color changes in images can be provided, providing important basis for medical behavior supervision and operational efficiency evaluation. In the similarity retrieval of image data, we can use features based on image color histogram, features based on image multi-feature composition, features with regional granularity based on wavelet or features based on image wavelet to conduct image similarity retrieval. In association mining of image data, we also mine association rules according to image features. In a particular cluster configuration, you must find a balance between cluster performance and the number of tasks. In the experiment, except for the network connection to the clinical data center, all the experimentally related hosts use the same hardware configuration and network bandwidth to ensure that there is no other than the system architecture (ie distributed and non-distributed). Differences in system performance. The specific performance is shown in Figure 4.3. When the data scale increases to reach the bottleneck of the protective gear processing, the distributed system platform can increase its capacity by increasing the number of nodes, which has good scalability, as shown in Figure 4.4.

By analyzing the utilization of medical resources, it is possible to understand whether hospitals have problems such as resource waste and insufficient resources. For example, if the bed usage rate in certain departments is too high, it may be necessary to increase the number of beds or adjust the department layout. By analyzing the treatment cycle of patients, we can understand whether there are any problems with the hospital's treatment process and whether optimization is needed. For example, if the treatment cycle of some patients is too long, it may be necessary to identify the cause and make improvements.

**5. Conclusions..** This article introduces the development and application of big data analysis in the field of information technology. By studying the regulation of medical service behavior in hospitals, using top-level design to standardize the content of medical behavior regulation, exploring the effectiveness of regulation, and achieving the goal of reducing clinical paperwork. Based on the needs, a regulatory system for medical service behavior has been proposed and constructed. Strengthen the supervision of hospital medical behavior through hospital big data analysis and knowledge base system support. By comparing the distance between observation

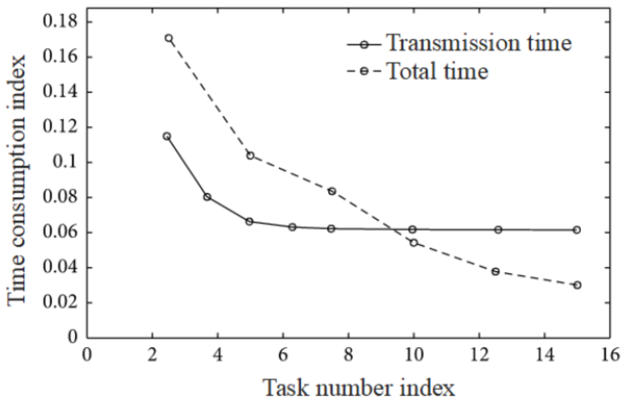


Fig. 4.3: Data collection comparison experiment results

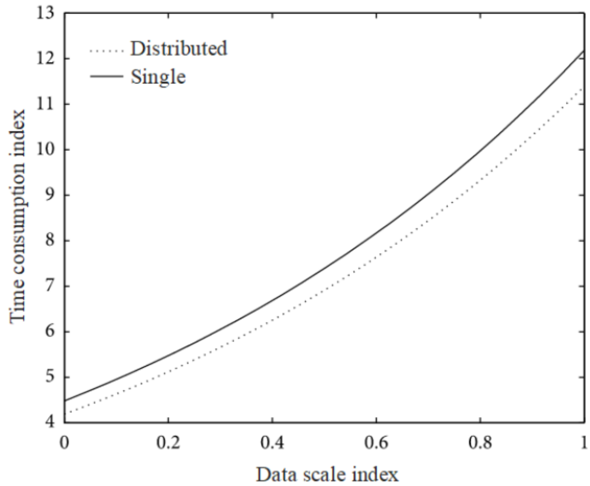


Fig. 4.4: Big data analysis performance results

values and ideal surfaces, as well as the efficiency of measurement techniques and the effectiveness of resource allocation, decision support can be provided for hospital management. Help them better understand the issues of medical behavior norms and operational efficiency, and develop corresponding improvement strategies. At the same time, this method can also provide better medical services for patients, improve medical quality and safety.

REFERENCES

[1] Schüssler, F. R. S. M., Contrepois, K., Moneghetti, K. J., et al. *A longitudinal big data approach for precision health. Nature medicine, 25(5): 792-804, 2019.*

[2] Hernandez, B. T., Bozkurt, S., Ioannidis, J. P. A., et al. *Minimar (MINimum Information for Medical AI Reporting): developing reporting standards for artificial intelligence in health care. Journal of the American Medical Informatics Association, 27(12): 2011-2015, 2020.*

[3] Himeur, Y., Elnour, M., Fadli, F., et al. *AI-big data analytics for building automation and management systems: a survey, actual challenges and future perspectives. Artificial Intelligence Review, 56(6): 4929-5021, 2023.*

[4] Serhani, M. A., T. El, Kassabi, H., Ismail, H., et al.*ECG monitoring systems: Review, architecture, processes, and key*

*challenges. Sensors, 20(6): 1796, 2020.*

[5] Sun, L., Shang, Z., Xia, Y., et al. *Review of bridge structural health monitoring aided by big data and artificial intelligence: From condition assessment to damage detection. Journal of Structural Engineering, 146(5): 04020073, 2020.*

[6] Mader, T. J., Nathanson, B. H., Soares, W. E., et al. *Comparative Effectiveness of Therapeutic Hypothermia After Out-of-Hospital Cardiac Arrest: Insight from a Large Data Registry. Therapeutic Hypothermia and Temperature Management, 4(1): 21-31, 2014.*

[7] Chen, C. M., Jyan, H. W., Chien, S. C., et al. *Containing COVID-19 among 627,386 persons in contact with the diamond princess cruise ship passengers who disembarked in Taiwan: big data analytics. Journal of medical Internet research, 22(5): e19540, 2020.*

[8] Raj, D. J. S., *A novel information processing in IoT based real time health care monitoring system. Journal of Electronics and Informatics, 2(3): 188-196, 2020.*

[9] Palanisamy, V., Thirunavukarasu, R., *Implications of big data analytics in developing healthcare frameworks–A review. Journal of King Saud University-Computer and Information Sciences, 31(4): 415-425, 2019.*

[10] Yang, D., Wu, L., Wang, S., et al. *How big data enriches maritime research–a critical review of Automatic Identification System (AIS) data applications. Transport Reviews, 39(6): 755-773, 2019.*

[11] Hayashida, K., Murakami, G., Matsuda, S., et al. *History and profile of diagnosis procedure combination (DPC): development of a real data collection system for acute inpatient care in Japan. Journal of epidemiology, 31(1): 1-11, 2021.*

[12] Selvaraj, S., Sundaravaradhan, S., *Challenges and opportunities in IoT healthcare systems: a systematic review. SN Applied Sciences, 2(1): 139, 2020.*

[13] Kadhim, K. T., Alsahlany, A. M., Wadi, S. M., et al. *An overview of patient's health status monitoring system based on internet of things (IoT). Wireless Personal Communications, 114(3): 2235-2262, 2020.*

[14] Ageed, Z. S., Zeebaree, S. R. M., Sadeeq, M. M., et al.*Comprehensive survey of big data mining approaches in cloud systems. Qubahan Academic Journal, 1(2): 29-38, 2021.*

[15] Goodday, S. M., Atkinson, L., Goodwin, G., et al. *The true colours remote symptom monitoring system: a decade of evolution. Journal of medical Internet research, 22(1): e15188, 2020.*

[16] Ghazal, T. M., Hasan, M. K., Alshurideh, M. T., et al. *IoT for smart cities: Machine learning approaches in smart healthcare—A review. Future Internet, 13(8): 218, 2021.*

[17] Cheng, W. C., Chiu, M. H. P., *How do medical researchers use open health data? A case study on data reuse behavior of using Nhird in Taiwan. Proceedings of the Association for Information Science and Technology, 54(1): 637-639, 2017.*

[18] Tzanis, G., *Biological and Medical Big Data Mining. International Journal of Knowledge Discovery in Bioinformatics, 4(1): 42-56, 2017.*

[19] Luo, J., Wang, Z., Xu, L., et al. *Flexible and durable wood-based triboelectric nanogenerators for self-powered sensing in athletic big data analytics. Nature communications, 10(1): 5147, 2019.*

[20] Schaeffer, B., Lawrence, et al. *Big Data Management in US Hospitals: Benefits and Barriers. Health Care Manag, 36(1): 87-95, 2017.*

[21] Dong, C. Z., Catbas, F. N., *A review of computer vision–based structural health monitoring at local and global levels. Structural Health Monitoring, 20(2): 692-743, 2021.*

[22] Rahman, S., Montero, M. T. V., Rowe, K., et al. *Epidemiology, pathogenesis, clinical presentations, diagnosis and treatment of COVID-19: a review of current evidence. Expert review of clinical pharmacology, 14(5): 601-621, 2021.*

[23] Hossain, M. S., Muhammad, G., Guizani, N., *Explainable AI and mass surveillance system-based healthcare framework to combat COVID-I9 like pandemics. IEEE Network, 34(4): 126-132, 2020.*

*Edited by:* Zhigao Zheng
*Special issue on:* Graph Powered Big Aerospace Data Processing
*Received:* Oct 30, 2023
*Accepted:* Nov 24, 2023