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Application of Big Data Information Platform in Medical Equipment

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Abstract: The application of big data in the medical device industry mainly refers to the analysis and processing of various medical devices, so as to provide patients with better treatment and rehabilitation services. At present, our country already has a relatively mature and reliable large database system. This article studies the application of medical equipment in the big data information platform. The main methods used in this article are survey method, case analysis method, and interview method. The big data information platform and medical devices are studied from different aspects. The survey results show that 41% of people completely agree with the role of big data information platforms in medical devices.

1 Introduction

Medical equipment refers to an instrument that uses computer technology to analyze and diagnose various physiological parameters of the human body based on wearable vital signs information and provide corresponding treatment plans. At present, people have begun to pay attention to the huge role of big data in medicine. Use large database technology to improve the level of hospital information system construction. By establishing a complete, advanced, mature and reliable information management system, we can help us solve various problems caused by the widespread use of computer network facilities and equipment in most large domestic hospitals. Therefore, this article is worth a try on the application of big data on medical equipment.

There are many researches on big data information platform and its role in medical devices. For example, Li et al. [1] believes that healthcare big data is an important basic strategic resource for the country. Building a national health and health management big data platform is of great significance to the development of our country's health and medical field. Some scholars using accessible technology, a platform has been developed that will generate small registers (small, regularly updated data sets) for monitoring to identify patients who have not been selected for use and to influence clinicians to change practices to improve care. The platform has been tested in five medical professional departments, enabling experts to quickly and effectively exchange clinical problems, disease knowledge, clinical

workflow, and improve opportunities [2]. Wang [3] said that at this stage, because society is in a gradual development form. In the era of big data, various new types of medical equipment have also appeared one after another, which is of great help to medical work. Therefore, the research in this article is the product of the times and has certain practical significance.

This article first studies cloud computing and big data technology, and then studies the role of data mining algorithms in information. After that, the research is on the demand and overall design of the information integrated platform and the information management of hospital medical equipment logistics. The last research is related to medical device management knowledge and questionnaire surveys, and conclusions are drawn.

2 Application of Big Data Information Platform in Medical Equipment

2.1 Cloud Computing and Big Data Technology

2.1.1 Cloud Computing

Cloud computing resources, platform management and component hardware are the most important components of cloud resources. From the perspective of server usage, the foundation formed by the bottom layer is the key to the formation of a cloud data center. When calculating the storage capacity of big data, it is possible to realize the data sharing between the used application equipment and the distributed application [4,5].

Cloud computing has the following characteristics:

- Activate to get service. Various terminal devices can be accessed between cloud computing.
- The visit is very extensive. Various terminal devices can be accessed between cloud computing.
- Centralized data resources. Sharing and coexistence are managed in a way of resource sharing.
- Demand for services. Cloud computing provides users with data storage, infrastructure, applications and other resources, and automatically allocates resources to users [6,7].

2.1.2 Data Scheduling

Strategies adopted by dispatch management:

Load balancing: It is mainly distributed resource scheduling to achieve load balancing.

Increase resource utilization: mainly through the use of virtualization to improve resource utilization, virtual machine dynamic migration and data backup in the event of a disaster.

The user sets the value according to the preset. VMware implemented a virtualized IT architecture to interact with the dual centers by setting up remote server groups.

2.1.3 Key Technical Data Scheduling

Including distributed computing, parallel computing, performance computing, storage network, virtualization process, load balancing and other computing technologies. When designing an efficient and real-time cloud data set for different business needs, this is very necessary and very important for resource planning strategies [8,9]. Key technologies include:

(1) Planning strategy: The main goal of the planning strategy is to first determine the goal of resource planning. If resources are insufficient, you must deal with unmet demand tasks.
(2) Objective optimization: The control center should define various objective functions to determine the advantages and disadvantages of the plan.

(3) Scheduling algorithm: In general, the scheduling algorithm is basically NP-hard. A good scheduling algorithm can determine the optimization result and objective function. In a short period of time, it will not consume a lot of resources at the same time.

(4) The architecture of the planning system is closely linked to the technology and framework of the cloud data center. The popular architecture is usually a hierarchical distributed architecture.

(5) The relationship between data center resources and their mutual restriction: The mutual restriction and analysis of resources contribute to the complete balance of various factors in the planning algorithm.

(6) Analyze the characteristic business process of the data center: it helps to understand the characteristics of the business process and optimize the planning algorithm [10,11].

2.2 Data Preprocessing of Medical Information Data Mining

2.2.1 Data Mining Function

The classification is divided into categories. This type of method must first provide a priori knowledge base, that is, classified data samples. This type of program is based on the analysis of previous knowledge base data to extract relevant features, and uses statistical methods to classify and predict unknown data [12].

Calculate the prediction category. Use a large number of independent variables and existing values to simulate and generate function curves, which can be used to predict the possible values of continuous variables [13].

Sequence rule class. Know the possibility of two or more events happening at the same time.

2.2.2 Association Rule Mining

Association rules are most suitable for analyzing patient needs and predicting behavior. When searching for association rule mining algorithms, a variety of different algorithms can be used for searching. Depending on the content of the exploration, different methods can be used, but the main method is to modify the model through an iterative process of replacing data samples, so as to gradually identify the parameters of the model and extract the association rules hidden in the data.

The advantage of the Apriori algorithm is that it is easy to understand and implement, but the disadvantage is also obvious, that is, frequent data access and low algorithm efficiency.

2.2.3 Cluster Analysis

Cluster analysis is a data-driven classification of information, and its most common use is to classify documents. The cluster analysis process can be divided into four steps. The first is to remove noise from information and data. The purpose is to filter information and data, remove invalid data and retain useful information. Secondly, for sampling statistics and feature extraction to classify and aggregate information or data, it is necessary to solve the measurement problem and abstract the feature set to represent specific things in the result. Third, based on the determination of the measurement method, the data samples are used for measurement, and the corresponding algorithm is used to create an aggregate classification model to obtain the typical vectors of different aggregate groups to form the basis for classifying certain samples. Finally, use the similarity calculation method to classify the new data.

The k-means algorithm is currently a widely used method in cluster analysis. The main method is to perform cluster analysis based on specific data samples, establish classification standards, and realize the classification of data samples.

For discrete measures, discrete digital variables are used to correspond, and the angle cosine formula is used to calculate the similarity of different objects. The calculation formula is as follows:

$$P(a_i, a_m) = \cos(a_i, a_m) = \frac{\vec{a}_i \cdot \vec{a}_m}{\vec{a}_i \cdot \vec{a}_m} \tag{1}$$

Among them, a_i, a_m are the feature vectors of the medical device composition sample i and the device cost composition sample m.

As for the selection of the evaluation function, the purpose of cluster analysis on the cost composition of medical devices is to cluster medical devices into different types. The expression of the evaluation function is:

$$M = \sum_{x=1}^{x} \sum_{f=1}^{Q_x} \left(P(a_x, a_f) \right)^2 \tag{2}$$

where M is the evaluation function, a_x is the feature vector of the x-th cluster, and a_f is the feature vector of the f-th sample.

2.3 Hospital Medical Equipment Logistics Information Management

In the context of the development of big data, medical equipment in hospitals can also be managed through big data information systems. Its characteristics are as follows:

For hospital consumables, comprehensively manage the process in terms of quantity and quality.

At the same time, it meets the requirements of logistics and accounting, and realizes the integration of accounting; realizes more refined management, and eliminates the inconsistency and inconsistency of accounts.

Standardize the management process, especially the planned procurement link.

Careful handling of consignment products.

The entire process of material circulation is monitored to prevent asset loss due to abnormal factors. Material safety monitoring puts the responsibility on the patient.

Real-time monitoring of material consumption and actual material inventory.

Expiration warning, safety stock, maximum stock, out of stock, and certificate validity period management.

Provide efficient analysis methods for the hospital to reduce the use of inventory funds and improve the efficiency of fund use.

2.4 Medical Device Management
2.4.1 Medical Device Industry Background

- With asset management as the mainstay, drug management and expense management are becoming increasingly standardized.
- Equipment emphasizes access, weak management, and light maintenance.
- The handling of high-quality consumables and implantable materials is inconsistent and defective.

- It is very difficult to perform statistical analysis on the efficiency of large-scale equipment and appliances.
- Other company foundations are supplemented by electronic documents and manual signature and approval processes.
- Lack of integration with technical management.

2.4.2 Specific Process of Medical Device Management

The overall goal of Medical Device Management is to improve the management level in the field of medical device management, and drive and promote the gradual standardization, institutionalization, systematization and integration of medical device management in medical institutions.

The specific process of medical device management is as follows:

(1) Business analysis and system boundary determination.
Warehouse management is the management of medical equipment that enters the medical institution by the medical institution equipment management department in collaboration with the warehouse management personnel, the financial room, and the use department.
(2) Establish a business service model according to the business modeling method.
(3) Define the service interface and determine the input and output of the service.

2.4.3 Service Design and Business Support Design

Service Design include three layers:

The user-level user interface provides system users with a service interface call interface to perform business functions. In order to communicate with the user interface, the user layer first analyzes the permissions of the client, and then the user layer displays different user interfaces to the user according to the user's operating permissions.

The business support layer is the subject of research and consists of many system service components.

Data resource layer. This layer is used to store business and control data. Such data is stored in multiple databases. It consists of a database management system and a database running on the system.

The Business Support Layer Design is as follows:

Service support layer. This layer includes service support software, including database engine, service support components, etc.

Basic service layer. This layer does not provide business-oriented services, but provides finely tiered service units.

Business service layer. This layer provides atomic or composite services related to business logic.

Service collaboration management layer. This layer contains many service management and monitoring components.

2.5 Application of Big Data Information Platform in Medical Equipment

First of all, the application of the big data information platform in the hospital can effectively manage and allocate various resources of the hospital. The management of the medical machinery and equipment designed in this article can be verified by inputting and outputting the machine into the computer, and then assigning it to each department that needs it. Then monitor the performance and service life of medical machinery in real time. Through big data, you can know the basic information

and damage degree of various medical devices at any time. Then, according to the performance analysis of the equipment in the data information platform, an excellent machine can be selected for medical treatment. In general, its application can start from the following aspects:

2.5.1 Management

Based on the above, we can know that the use of big data information platform can manage medical devices. Medical device management in medical institutions is the life cycle management of medical devices in medical institutions. Management activities can be divided into seven areas: planning and procurement, acceptance management, logistics and facility management, application quality management, information and document management, medical device evaluation and evaluation and monitoring. Planned procurement is the core part of medical device management. Ensure that medical devices entering medical institutions are legal, safe, and effective, and make better use of medical resources. The acceptance of medical devices is the first hurdle of quality management testing and an important link in the implementation of testing contracts. Acceptance is carried out on time in accordance with applicable requirements and procedures. Especially for large imported medical devices, a comprehensive review of the quantity, quality and accessories ordered by the contract is required. Medical equipment assets and logistics activities include: warehouse management, output management, transfer management, loss and rejection management, inventory management, inventory management, asset management and statistical management. The purpose of medical device application quality management is to ensure that the medical devices used meet the prescribed standards and technical requirements, are in a safe, accurate, and efficient working state, and meet the quality requirements of clinical research, education and science. Information management, use, maintenance, maintenance, repair and file management related to medical devices refers to the process of collecting, retrieving and summarizing information, and is the basis for further improvement of medical devices. The management process, the generation of management requirements and the continuous improvement of management decision-making capabilities. The evaluation of the organization, services and personnel of medical institutions is a necessary work for medical institutions, and it is also the basis for improving and improving the existing working conditions of medical institutions. In order to strengthen the safety management of the clinical use of medical devices, reduce the risk of clinical use of medical devices, improve the quality of medical treatment, and protect the legitimate rights and interests of physicians and patients, government departments need effective supervision.

2.5.2 Monitoring

Secondly, using the big data information system, we can know the performance data of various medical devices at any time and monitor them in real time, so as to prepare for disposal and introduce new equipment and equipment at any time.

The record of the error status of the medical device information platform is an important part of the medical device information platform, and it is also an important guarantee for the realization of the main functions of the medical device information platform. For medical devices and device information platform requirements, when users describe medical device failures, it is important to have detailed and accurate information about the failure status. In order to obtain accurate and detailed error conditions, the finite state machine is used to determine the user's needs. Using this dialogue method is more conducive to the user's complete expression of his needs. After the user logs in to the medical device information platform through a dialogue with the interface, the last step is to recover the error situation, and the cause of the error can be clearly described, forming a standard REQ format

in the CSP restriction problem. In the recommendation process of a big data information platform, knowledge-based CSP constraints are mainly used for service recommendation. After getting the REQ error conditions in the previous step, you should check the recommended task example table designed before, and use the rule table stored in the knowledge base for comparison and search. Then let us continue with the recommendation part based on the association rules, the request can be obtained from the finite automata. Find common problems through the work log of the recommendation system, and sort out the recommendations and common problems of the standard recommendation system on the homepage. Dig the maintenance log, sort according to the number of options selected by the end user, and list the most popular maintenance service plans.

2.5.3 Allocation

According to the type of equipment and equipment, medical equipment can be used and allocated. Supplement the equipment materials to the corresponding departments.

At present, the calculation of the appropriate storage capacity of surgical medical devices is based on traditional calculation methods, that is, based on the results of historical demand analysis. However, there are still frequent outages and closing due dates. Frequent transfers increase the frequency of outages and increase logistics costs.

First, according to the area provided by the warehouse management team for a specific sub-warehouse supply, a list of covered customers is created based on basic customer information. Based on this list, we can extract the transaction records of sales to these customers in the past 5 years from the data warehouse. From this, the commonly used degree range can be calculated. Take out the transaction records of the past year and calculate the monthly average sales volume. The optimal storage quantity is determined according to the current replenishment frequency from the main warehouse to the auxiliary warehouse. In an era of increasingly fierce competition, it often takes only one year to one and a half years to launch more sophisticated products. At the beginning of the exchange, the new and old models appeared in the transaction records at the same time. Usually, the new model is normally placed and the old model is picked. Therefore, when analyzing the historical record of a certain model of product, the replacement information of the new and old models of the product should be combined, otherwise the historical record will be incomplete and cannot be used to analyze the long-term market demand and use of this product.

2.5.4 Performance Forecast

According to the established data mining model, the product of the estimated annual number of diagnosed and treated cases of a certain type of device and the cost per case is the estimated annual revenue of the device minus depreciation and maintenance costs. Consumable medical equipment cost, reagent cost, electricity cost, water cost, personnel cost and management cost are the annual net income of a given equipment.

3 Questionnaire Survey and Medical Device Management Service Design Experiment

3.1 Questionnaire Design

This article focuses on the topic of research on the application of big data information platforms in medical devices, and selects citizens in different positions to conduct a questionnaire survey. The contents of the designed questionnaire include:

(1) The basic information of the person filling in the questionnaire, such as gender, occupation, age, etc.
(2) Understanding of big data information platforms, such as: understanding, ignorance, general understanding
(3) Knowledge of medical equipment, such as: disinfection machine, MRI machine, round corner pusher, operating table, etc.
(4) Attitudes towards the role of big data information platforms in medical equipment
(5) Expectations for information platform design
(6) Application of big data platform in medical equipment
(7) The relationship between big data information platform and medical equipment

3.2 Questionnaire Process

A total of 100 copies of the questionnaire in this article were printed, and patients, nurses, doctors, etc. in hospitals in this city were invited to visit and fill in the questionnaire. This questionnaire used a combination of online and offline methods. A total of 100 questionnaires were distributed and 90 questionnaires were collected. The questionnaire process lasted 2 weeks, and the effective questionnaire reached 90%.

3.3 Service Design

The medical device management platform adopts a design concept based on a multi-level system structure, combined with the design principles of granular and low affinity, and divides the middle layer into a business logic layer and a business support layer. The business modeling of medical equipment is composed of three service components, namely basic service, business service and process service. Taking into account the many modules of the medical device management platform, it is also used for more detailed research on the use of service-oriented technology in the project. According to the demand analysis, design different units and their mutual relations to meet the demand. This is the only way to better and more accurately meet these requirements.

4 Result Analysis

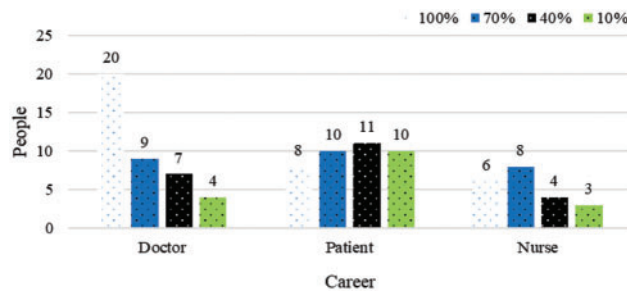#### 4.1 Data Recognition Analysis of Big Data Information Platform

According to the questionnaire survey, we collected data and concluded that people in hospitals have different attitudes towards big data information platforms. Details are shown in Table 1.

Table 1: Data recognition of the big data information platform

	100%	70%	40%	10%
Doctor	20	9	7	4
Patient	8	10	11	10
Nurse	6	8	4	3

As shown in Fig. 1, we can see that the people who support the data authenticity of the big data information platform are mainly doctors. The number of people with low recognition of the reliability of big data is low. Most patients have an intermediate attitude. Generally speaking, the support for big data is slightly higher than those who do not.

**Figure 1:** Data recognition of the big data information platform

4.2 The Role and Attitude of Big Data Information Platform in Medical Equipment

People hold three attitudes towards the role of big data information platforms in medical equipment, one is agreed, the second is neutral, and the third is disagree. The specific number of supporters is shown in Table 2.

Table 2: Attitude towards the role of big data information platform in medical devices

	Agree	General	Disagree
Doctor	16	14	3
patient	13	12	10
Nurse	12	13	7

As shown in Fig. 2, we can see that the majority of people agree, while the number of people who disagree is relatively small. Although there are not a few people who remain neutral, there are more people who agree than those who are neutral. This shows that the role of big data information platforms in medical devices has been supported to a certain extent. However, on the other hand, it is necessary to strengthen the use and promotion, so that it can gain more support in the hearts of the people.
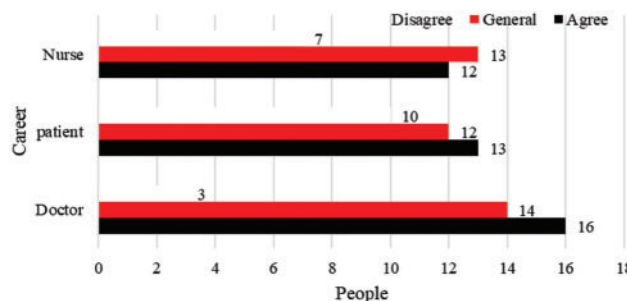
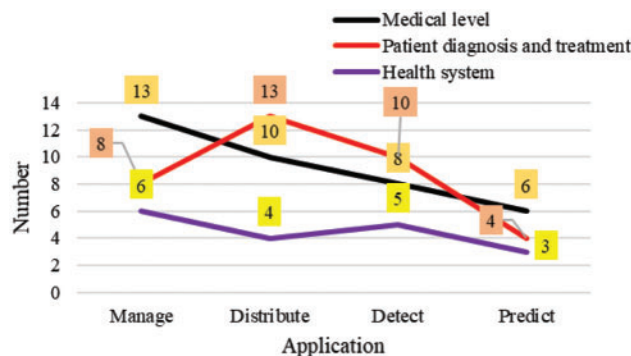**Figure 2:** Attitude towards the role of big data information platform in medical devices

4.3 Application Analysis of Big Data Information Platform in Medical Equipment

This article analyzes the application of big data information platform in medical equipment from four aspects of management, distribution, detection and prediction, and integrates it with the medical level, patient diagnosis and treatment and health systems, and obtains the data in Table 3.

Table 3: Application of big data information platform in medical devices

	Medical level	Patient diagnosis and treatment	Health system
Manage	13	8	6
Distribute	10	13	4
Detect	8	10	5
Predict	6	4	3

As shown in Fig. 3, we can see that medical devices are of great significance in providing high-quality medical and health services. The lack of safe, efficient and effective medical equipment will have a very negative impact on the overall health and performance, because it is related to the diagnosis and treatment of patients, and even the development of the entire health system.

Figure 3: Application of big data information platform in medical devices

From the above results, the following conclusions can be drawn:

First, doctors account for the highest proportion of medical big data, followed by nurses and patients.

Second, the role of big data information platform in medical devices has been supported to some extent, but the approval rate is still low. It is necessary to improve people's recognition of big data information platform.

Third, big data medical information platform plays an important role in the application of medical devices and equipment. It is urgent to improve the coverage of big data platform and the recognition and recognition of big data platform.

Health and medical big data include data generated in the daily operations of medical and health institutions, health insurance companies, health monitoring institutions at all levels, and other medical and health institutions and related industries. Health and medical big data is an important strategic basic resource at the national level. Building a national health management big data platform can promote the rapid development of China's health and pharmaceutical industry, and will surely drive further progress and reforms in the industry. With the help of the Internet of Things and big data technology, the establishment of a big data platform can effectively alleviate some problems in the process of medical equipment, fully realize the management level and management efficiency

of medical equipment, and improve the management level and management efficiency of medical equipment.

5 Conclusion

In medical equipment, the information sources of big data platforms are mainly through the Internet, mobile communication networks, etc., and these are based on the analysis and mining of a large amount of user behavior data. In big data era, medical devices can be well regulated and distributed. According to the survey results in this article, a small number of people still have doubts about the data provided by big data. In addition, the role of big data in medical devices is supported and expected by more than half of the people. Therefore, it has certain guiding significance for its role in medical equipment.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

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