

Research Article

Application of Data Mining Technology-Based Nursing Risk Management in Emergency Department Care

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Nursing risk refers to all unsafe events that may occur in clinical nursing work. Common risk events include bed fall, fall, scald, line dislodgement, drug extravasation, and drug administration error, which easily lead to nursing-patient disputes and seriously affect the prognosis of patients. In order to effectively avoid nursing risks, strengthening nursing risk management (NRM), improving nursing management mechanism, and improving nursing operation process have become effective ways to manage risks. The emergency department is an important window for rescuing critically ill patients in the hospital, and it is also the main department where diagnosis, nursing risk events, and medical disputes occur. The traditional risk care model has failed to meet the current demand for emergency patient management, and a more scientific and standardized management scheme is urgently needed. In order to improve the quality of NRM in emergency departments and combine the advantages and characteristics of big data-related technologies, this paper proposes an algorithm based on data mining for application in emergency care. The application of data mining in medical care is summarized and combined with the work content and requirements of hospital emergency care, and the application of big data in patient condition monitoring and early warning, medical and nursing staff scheduling, and patient emotional reassurance is discussed, and then, a solution for hospitals to optimize emergency care using data mining is proposed for the special characteristics of emergency care. Initially, the optimized solution is proposed to improve the efficiency and accuracy of patient condition monitoring and early warning, to improve the real-time scheduling of medical and nursing staff, and to solve medical care problems such as patient emotional calming. The analysis shows that the application of big data in emergency care can improve the efficiency of emergency ambulance, improve the doctor-patient relationship, and promote the development of emergency care.

1. Introduction

With the improvement of people's cultural knowledge and the increasing improvement of national laws, patients' awareness of their rights has become stronger and stronger. According to the data from the Medical Administration of the National Health Commission, the number of medical disputes in China increased 10 times from 2002 to 2012 and reached a peak of 126,000 cases in 2013, and from 2014 onward, medical disputes began to show a year-on-year decline, and by the end of 2017, it had fallen by a total of 20.1% by the end of 2017 [1–3]. However, the number of medical disputes is still greater than 100,000 cases per year.

In today's increasingly tense doctor-patient relationship, the nursing industry needs to face more and more business risks, and the emergency department, as a department with emergency care as the main mode of treatment, is a high-risk and high-intensity department with characteristics such as difficult surgery, rapid changes in condition, many critical illnesses, and cumbersome nursing paperwork records. A slight oversight by nursing staff may cause serious consequences, and it is a high-risk and a high-intensity department, which is a great test for the professional requirements nursing staff. If medical and nursing staff lack a grasp of risk factors during nursing care, then they cannot predict the occurrence of risk events in time, or if the department lacks

anticipatory care measures after the occurrence of risks, they may cause certain physical damage to patients and certain economic losses to the hospital. NRM is the process of identifying and evaluating the risks of possible harm to patients and caregivers and visitors in an organized and systematic way in hospitals and taking effective preventive measures [4–8]. In order to reduce the occurrence of nursing adverse events and medical disputes, nursing staff must pay attention to risk management in nursing work, and carefully find and eliminate safety hazards to guarantee the medical safety of patients as shown in Figure 1.

Risk factors of NRM in emergency department for nursing staff include insufficient manpower. The hospital assigns insufficient nursing staff to the department, especially in a short period of time when the number of patients in the emergency department may increase faster, resulting in a larger workload for nursing staff and the chance of nursing errors becoming greater in a busy situation. *Environmental Impact*. Patients often need a good medical environment in the process of treatment, but the emergency department belongs to the open environment, and various unfavorable environmental factors intermingle with it, which seriously affects the normal nursing and emergency work. The system needs to be improved. The emergency department relies on experience for many years and lacks process-oriented rules and regulations. The potential risk factors of nursing are not clearly identified, the management is not clear about the management responsibilities, and the lack of rules and regulations will cause the management of nursing staff to be formal [9–12]. The quality of nursing staff varies widely, with different levels of education and different learning attitudes of each individual in the workplace. The above-mentioned personal reasons show a positive correlation with nursing risk avoidance. *Lack of Responsibility Awareness*. The objective factor of complex situation exists in the emergency department to resuscitate patients; thus, a wide variety of medical devices and a wide variety of drugs are used. This causes nursing staff executing medical orders to have only a short time to make correct judgments, and a lack of responsibility can lead to nursing errors. *Lack of Nursing Records*. The concept of time should be accurately grasped in emergency work, and there is often no time to perfect nursing records in a rush, but they are not replenished in time even after the resuscitation work is completed, which will also form a potential nursing risk. Patients and their families lack medical-related knowledge and do not have a correct perception of risks. They have high expectations of hospital treatment, and even lower their trust in medical personnel when their conditions are changing, which can lead to dissatisfaction and then develop into doctor-patient disputes [13]. Using legal knowledge to arm medical and nursing staff hospitals need to put legal knowledge training in the first place, improve legal cognition through the use of learning and training, and urge nursing staff to study independently to improve their quality and actively accumulate legal knowledge. Legal knowledge learning should also be accompanied by the organization of assessment to test the efficiency of learning, improve the ability of nursing staff to identify and assess risks, fully

recognize the consequences of risk occurrence, and minimize the incidence of risk events. The risk management system is very helpful in preventing the emergence of nursing risks. There are more potential nursing risk factors in emergency care, which makes nursing care more difficult, so a perfect risk control system must be established. Hospitals should conduct statistics on the common risks in current emergency care, categorize and analyze the risk factors, and develop a practical and effective management system. Nursing staff should abide by the work regulations and work in strict accordance with the corresponding procedures, which can effectively reduce the occurrence of nursing errors and thus reduce the occurrence of safety accidents. The continuous improvement of nursing staff's personal business level can improve the overall quality of care in the emergency department [14]. To improve the business quality of personnel, hospitals should provide nursing staff with more opportunities for further training, nursing staff should take the initiative to learn new nursing knowledge, and emergency nursing staff should be proficient in various nursing skills. Nursing staff of different loci should be trained in different categories in a graded manner to realize the specialization of job nursing and provide quality and efficient services. Nursing records are records of the nursing situation, and under certain circumstances, they can be used as legal evidence, so nursing records must be perfect. However, in many cases in emergency care, time is tight and nursing records are not perfect, in order to develop the habit of actively making up the records. The writing of nursing records should be standardized and follow the established format, and nursing records should be written in detail and accurately to ensure that nursing records can stand the test of time and science. *Emphasis on Communication and Establishment of Good Doctor-Patient Relationship*. In emergency care work, patients and families have high expectations and requirements for quality of care, especially in emergency care for critically ill patients, and tension and anxiety always carry through the hearts of patients and families, and nursing staff need to have high quality while providing satisfactory services, and communicate patiently and actively in response to the mood of patients and families, and mutual understanding between the two sides, more communication about patient care, elimination of potential risks and hidden dangers, and increased recognition of hospital emergency care by patients and families [15].

With the rapid development and application of the Internet, Internet of Things, cloud computing, mobile communication, and other technologies, big data technology, which was born along with the demand for massive data mining, storage, and application, has rapidly entered various fields and started to be widely used, pushing the related industries to continuously develop in the direction of information, intelligence, and precision. In 2015, China released the "National Healthcare Service System Planning Outline (2015–2020)," which clearly proposed to actively apply new technologies such as mobile Internet, Internet of Things, cloud computing, and wearable devices to promote health information services and smart medical services that

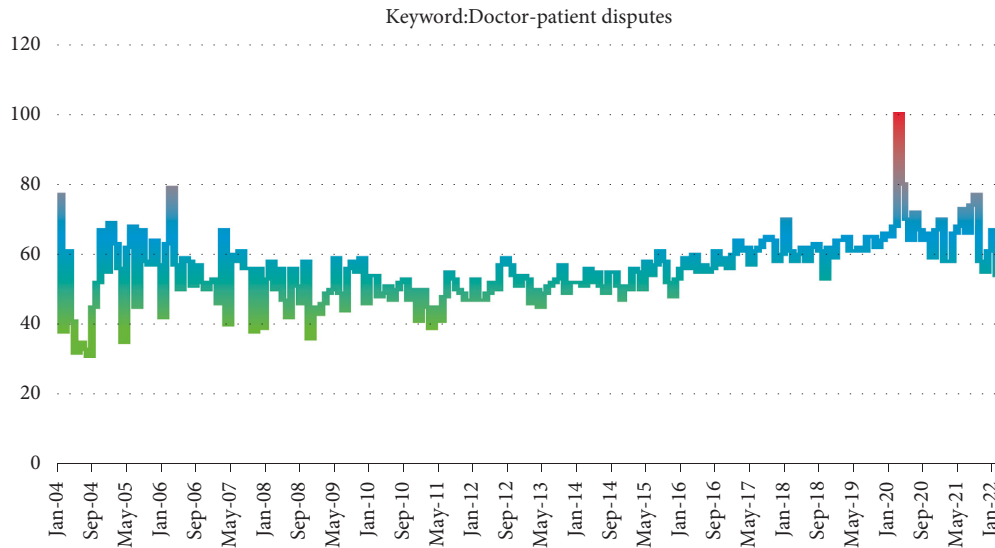


FIGURE 1: Keyword of doctor-patient dispute in Google Hot Trends global search.

benefit all people, promote the application of big health data, gradually transform the service model, and improve the service capacity and management level. Emergency care, as a very important part of medical care, urgently needs to apply big data to promote the establishment of a smart ambulance system; realize the application of big data in patient condition monitoring and early warning, medical personnel scheduling, and patient emotional appeasement; improve the efficiency and accuracy of patient condition monitoring and early warning; improve the real-time scheduling of medical personnel; and solve medical care problems such as patient emotional appeasement. This paper summarizes the application of big data in medical care; discusses the application of big data in patient condition monitoring and early warning, medical and nursing staff scheduling, and patient emotional comfort; and proposes a solution for hospitals to optimize emergency care using big data for the special characteristics of emergency care. Big data refers to a collection of data that cannot be captured, managed, and processed by conventional software tools within a certain time frame, and is a massive, high-growth, and diverse information asset that requires new processing models to have stronger decision-making power, insight discovery, and process optimization capabilities. Healthcare Big Data is primarily derived from healthcare system datasets, biomedical and molecular medicine data, social media, and sensor-generated healthcare data. By contrast, nursing big data broadly refers to high-volume data related to nursing and life and health, including data from hospital care, regional health service platform Big Data, nursing research, and disease surveillance. In addition, data on patient vital signs, changes in condition, and monitoring indicators also fall under the category of nursing big data, but nursing care big data emphasizes more on the unique care methods used by nurses to implement nursing care and health to improve patients, and the data generated by them are nursing big data. By processing nursing big data, nursing and patient-

related data can be obtained, which can be of great value in improving nursing methods, safeguarding patient safety, and improving the quality of care. The development of nursing big data has been given much attention abroad, with nursing-sensitive data integrated into health electronic systems and applied to nursing research to improve the quality of care. Standardized perioperative nursing data are analyzed and processed in conjunction with other clinical medical data to improve the quality of perioperative care and reduce complications. By applying big data to analyze nursing data recorded by the Critical Patient Severity Classification System (CPSCS) to predict patient length of stay [16], ICU observation time, and morbidity and mortality, this study demonstrates that the use of data systems can be a good predictor of observed indicators. China is still in the primary development stage of nursing big data application, and with the introduction of national policies related to medical big data and its inclusion into the national development strategy, China nursing big data ushers in the development opportunity period. As the construction of medical big data center and industrial park starts national pilot, nursing scholars begin to explore in nursing big data. *Nursing Information Construction in the Era of Big Data*. To better usher in the era of nursing big data, the first thing to do is to grasp nursing information construction. Data-based ICU nursing quality management evaluable nursing data is used to demonstrate the link between nursing provided services and patient outcomes, and to detect and evaluate the quality of care. Thus, it is clear that big data already plays an important role in nursing, but China is still in the concept exploration cut short and has not yet reached clinical application. Emergency medicine is an emerging interprofessional comprehensive clinical discipline for the diagnosis and treatment of various acute diseases and critical illnesses, acute attacks of chronic diseases, acute injuries, and acute poisoning. Emergency medicine includes emergency medical rescue, critical illness, trauma, cardiopulmonary resuscitation, pediatric emergency, and poisoning. It is

characterized by the diversity of diseases, complexity of conditions, timeliness of care, accuracy of care, and the difficulty of care. Emergency nursing staff must have rich medical knowledge, accurate judgment, and skilled nursing skills, and need a high degree of responsibility and attention to ensure that no mistakes can be made in emergency care; otherwise, it may affect the emergency process and even threaten the lives of patients. The special characteristics of emergency care objectively exist and demand a high level of nursing staff, but nursing staff can also be difficult to avoid errors due to objective physiological and psychological problems, so this paper uses information technology or high-tech means such as big data for assistance and proposes a method of applying NRM in emergency department care based on data mining technology, which can greatly improve the efficiency and effectiveness of emergency care [17].

The organizational framework of the paper is as follows: All the work related to our paper is discussed in Section 2. Section 3 explains the methods to strengthen our research. Section 4 talks about experiments and analysis. Section 5 consists of conclusion section.

2. Related Work

In this section, nursing risk management is well explained in proper way. Also, we discussed the big applications of emergency care. Finally, we talk about the data mining process.

2.1. NRM. Nursing risks include all unsafe events in the nursing process that may directly or indirectly lead to patient damage, disability, and death, and are important issues that objectively exist in clinical nursing work, which may harm patients' life safety and also increase the economic burden of hospitals and affect their overall efficiency and reputation. In recent years, with the progress and development of medical technology, patients have put forward higher-level requirements for the quality of various medical services. In order to meet the actual clinical needs of patients, exploring a more scientific model of NRM has become a topic worthy of study. Currently, hospitals in the United States have established a strict risk management system with government support and input, while the research on NRM in Chinese hospitals is still in its infancy and there is still a large gap compared to developed Western countries. In order to improve the risk management protocols in Chinese hospitals, the following paper examines the clinical progress of NRM [18]. The common risk factors in current clinical nursing work include nurses' failure to strictly implement the nursing system, lack of nurse-patient communication, and irregular writing of nursing records. Once nurses failed to implement the nursing system, it was easy to cause risk events such as medication errors, drug leakage, and infection, which affected the safety of clinical treatment for patients. Another related report showed that the lack of communication between nurses and patients tends to increase the risk of medical disputes and leads to lower patient compliance, which is not conducive to smooth patient

prognosis and recovery. Relevant reports show that irregular nursing records can seriously affect the judgment of medical and nursing staff on patients' conditions and even endanger patients' life safety in serious cases. We establish a NRM mechanism. Clinical research found that combined with the nursing work characteristics of the department, professional nursing rescue team, safety quality control team, sterilization and isolation quality control team, and nursing writing quality control team were established, and senior nurses were responsible for the work of the team, summarizing the high incidence of nursing risk events in the department, analyzing the reasons for the occurrence of various unsafe events, and formulating targeted emergency plans, which can effectively reduce nursing risks. Drug extravasation [19], catheter dislodgement, pressure sores, and falls are all high-risk clinical events, and formulating anticipatory nursing plans for such risk events can effectively improve the occurrence of adverse events, enhance the safety of clinical nursing work, and provide more satisfactory nursing services for patients. We strengthen the professional training of nurses. With the transformation of social, psychological, and biomedical models, the use of NRM to implement clinical care for patients in various departments has become an effective way to avoid risk events in order to meet the medical needs of social development and promote continuous progress in medical care. Relevant reports in China confirm that in today's brand-new stage of rapid development in the field of clinical medicine and the continuous development of new technologies, equipment, concepts, and knowledge, it is necessary for departments to strengthen nurses' professional training and improve their professional theoretical knowledge, risk prevention awareness, legal awareness, and practical operation skill level. Strengthening the contact and cooperation with other departments, carrying out regular business training for nursing staff in the department, and organizing expert lectures [20], quarterly training, regular assessment, and sound performance appraisal can effectively mobilize nurses' enthusiasm to participate in professional training, comprehensively improve the comprehensive quality of nurses, reduce the occurrence of adverse events, and standardize nursing records. Some studies show that nursing records, as important medical documents reflecting patients' conditions and treatment, have important reference values for physicians to understand the changes in patients' vital signs and make corresponding disposal measures in a timely manner. Therefore, objectively recording nursing matters and ensuring the timeliness, accuracy, and objectivity of the written content of nursing records are basic work contents of nurses. In order to improve the effect of risk event prevention and control in the department, nurses should pay attention to nursing record writing, instruct nurses to master the correct way of writing nursing records, strictly prohibit problems such as unclear handwriting, missing items and omissions, random alterations, incomplete nursing process; randomly check the nursing record writing of nurses in the department from time to time; and link the assessment results with nurses' personal title evaluation and performance rewards, which can effectively prevent and control the occurrence of nursing

risk events. The results of relevant clinical studies show that the lack of nursing records is a major cause of nursing problems. The results of relevant clinical studies show that the lack of nurse-patient communication is one of the important factors leading to nurse-patient disputes, and in order to reduce the risk of nursing unsafe events, hospitals should pay attention to nurse-patient communication skills training and improve the level of nurse-patient communication. In order to improve nursing risk prevention and control, nurses to establish the service concept of "patient-centered," so that nurses can convey the treatment opinions of physicians to patients and their families in a timely manner; take the initiative to introduce the treatment methods, treatment physicians, treatment necessity, and nursing methods; explain the role of medical expenses to patients and families; and refrain from being rude, in order to gain the understanding and trust of patients and their families in medical work, and encourage patients to cooperate with clinical treatment more actively. At present, the United States, New Zealand, and other Western developed countries have developed medical risk insurance services, usually by the physician association or medical institutions to buy medical risk insurance from the insurance company; when the risk event occurs, the insurance company is responsible for compensation. At this stage, China's medical risk insurance industry is still in its infancy, and most hospitals do not maintain cooperative relationships with insurance companies. Once nursing risks occur in the hospital, nurses are likely to suffer from multiple physical, psychological, and economic losses, which seriously undermine nursing motivation. Therefore, it is necessary to improve the life insurance mechanism for the risk events that may occur in the nursing process of nurses.

2.2. Big Data Applications for Emergency Care. In the era of big data, data mining for emergency care big data can be widely used in clinical practice. Medical records and follow-up data such as test data, image data, electronic medical records, drug formulas, and treatment methods can be stored according to the large capacity storage function of big data. By integrating systems biology and electronic medical record data, medical data mining can make individualized predictions for individual patients and give individualized treatment plans. Therefore, according to the relevant diagnosis and treatment data, combined with the patient's individualized care needs, through the mining and utilization of patient diagnosis and treatment information and data, we can achieve "medical care consistency" in emergency care, that is, to realize the nursing plan and nursing measures can be synchronized with the patient's treatment plan according to the patient's disease development and condition changes, timely follow-up, and timely adjustment, so as to achieve continuous care. This is to achieve continuous and uninterrupted care [21]. According to the development of big data and its application in the medical care field, it is urgent to promote the research and application of big data in the field of emergency care, and it is necessary to apply big data to promote the establishment of a smart emergency care

system; realize the application of big data in patient condition monitoring and early warning, medical and nursing staff scheduling, and patient emotional comfort; improve the efficiency and accuracy of patient condition monitoring and early warning; improve the real-time scheduling of medical and nursing staff; and solve the medical care problems such as patient emotional comfort. In addition, it can solve the problem of medical care such as patient emotional comfort. In summary, the use of emergency care big data can integrate data related to condition, pathology, diagnosis, and care; combine with patient emotions and preferences; and carry out intelligent and accurate emergency care, which can improve the efficiency and accuracy of patient condition monitoring and early warning, improve the real-time scheduling of medical and nursing staff, and solve the problem of patient emotional appeasement. Therefore, the development of big data for emergency care is of very high practical significance.

2.3. Data Mining. Data classification algorithm is the core content of big data mining, and its main role is to extract the valuable knowledge and information through many operations on a large amount of unordered data, analyze the characteristics of various types of information, and provide the data basis for researchers to further predict a certain trend. With the wide application of data mining technology, data classification algorithms have emerged and gradually optimized in which the classical classification algorithms are decision tree classification algorithm, plain Bayesian algorithm, support vector machine classification algorithm, artificial neural network classification algorithm, etc. As an abstract concept, big data is simply the mining and integration of massive data information, which has various types such as huge data volume, low value density, and fast growth rate, and the application value behind it can only be discovered by reasonable data mining and data analysis. With the development of production in various industries, a large amount of data is generated every day, and through big data technology, this information affects people's current life and even the development of an industry in a subtle way [22]. The data type of large data is complicated, and the data capacity is very big. So, it can be divided into structured data information and unstructured data information and semi-structured data information, such as pictures, sound, and video. These generated a large amount of data information, its single information value is very low, and the traditional analysis tools need a lot of time are very inefficient and must be supplemented by big data technology that can be processed quickly. Big data can help it better excavate the value of data meaning and the current development of the industry to analyze the current situation, to better predict the future development trend, and to provide the basis for future management. The flow chart of big data mining is shown in Figure 2. As a product of the development of network information technology in the era of big data, data mining technology mainly involves artificial intelligence, database, statistics, and so on, and involves more research contents in which one of the more important research branches is

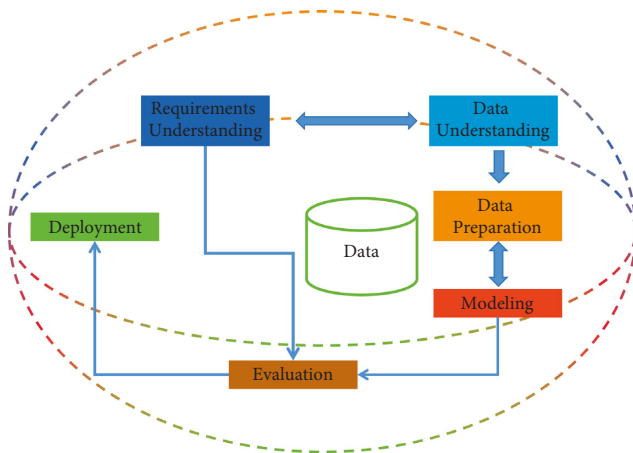


FIGURE 2: Data mining process.

classification. Data classification is the basis for data analysis and obtaining correct analysis results. The process of data classification generally consists of two steps: the first step is to construct a model from a training set of data with a known class label, which is often called the training phase and can be understood as training a classifier; the second step is to use the model to classify objects of an unknown class label. From this process, we know that the classification model should not only fit the known dataset, but more importantly, it should be able to predict the unknown objects accurately. Different classification algorithms are applicable to different application scenarios, and the differences in classification algorithms will simulate different classifiers, which will directly affect the accuracy of the classification and eventually affect the data analysis. Therefore, the implementation of deep classification for data with complex scale system or large amount of data information, and the reasonable choice of classification algorithms have important impacts on the completion of the task. At present, the research on classification algorithms related to big data mining technology in the field of computer data science in China and abroad is mainly gathered in the following two aspects: one is to apply the traditional classification algorithm directly in the actual case, or to make a simple combination of traditional algorithms and then apply them in the actual case and the other is to improve and upgrade the traditional classification algorithm by using new technology and new ideas.

3. Method

In this portion of paper, firstly discuss the design of making a model and it consists of different layers. Secondly, explain the model in technical way to get authentic results. Then, it processed data and apply data mining process.

3.1. Model Architecture. To apply big data practically to the field of emergency care, it is necessary to establish a smart emergency care system integrating data collection, data mining, data storage, data sharing, data analysis and calculation, data application, and comprehensive application of emergency care. Integrating the technology related to big

data and the characteristics of emergency care, the emergency care system can be established mainly from three aspects, such as building the backstage database, data collection and storage system, and big data application software. *Construction of Backstage Database.* According to the diagnosis and care-related data, a basic database including drug catalog data, resident health record data and other data, and a personal database with personal information as the main body of data collection is established. Build a data collection and storage system. In terms of data storage system, either self-built storage system or cloud storage can be used for storing all the diagnosis and treatment data, nursing data, patient data, and other related data of the hospital. In terms of data acquisition system, it is necessary to network all kinds of testing equipment, all types of sensors, and other data acquisition systems set up on demand to realize the acquisition of relevant data, which can be stored through the network and support software. *Construction of Big Data Application Software.* According to the needs related to diagnosis and care, a condition monitoring and early warning system, medical and nursing staff scheduling system, emergency care command system, and emergency care effect evaluation system are established, and related functions are realized through application software to establish a wise and accurate emergency care command and scheduling mechanism to achieve the purpose of improving the effect and efficiency of emergency care. The proposed system architecture is shown in Figure 3.

- (1) Interaction layer: the interaction layer is a layer that uses the system platform page to interact with the backstage and represents each function of the system module. The interaction layer enables the operation of each function in the module to realize visual monitoring of emergency department nursing operation, highway-related information query and analysis, emergency disposal and management, and emergency department nursing information service.
- (2) Application layer: the application layer is a layer of this system platform, which mainly performs background various business logic processing, system task scheduling, and processing and analysis of monitoring data for requests from the interaction layer.
- (3) Platform layer: the platform layer is the level that provides data support for the business logic processing of the application layer and contains the data results needed by the application layer. For example, data processing and analysis is to process traffic flow data and provide it to the application layer for use; data interface is to use the interface to obtain data from other application systems.
- (4) Data layer: the data layer provides storage and management for all kinds of data in the system, including all kinds of business data, emergency department nursing traffic data, emergency department nursing basic information data, and personnel information. MySQL database is applied to store and manage all kinds of data in the system.

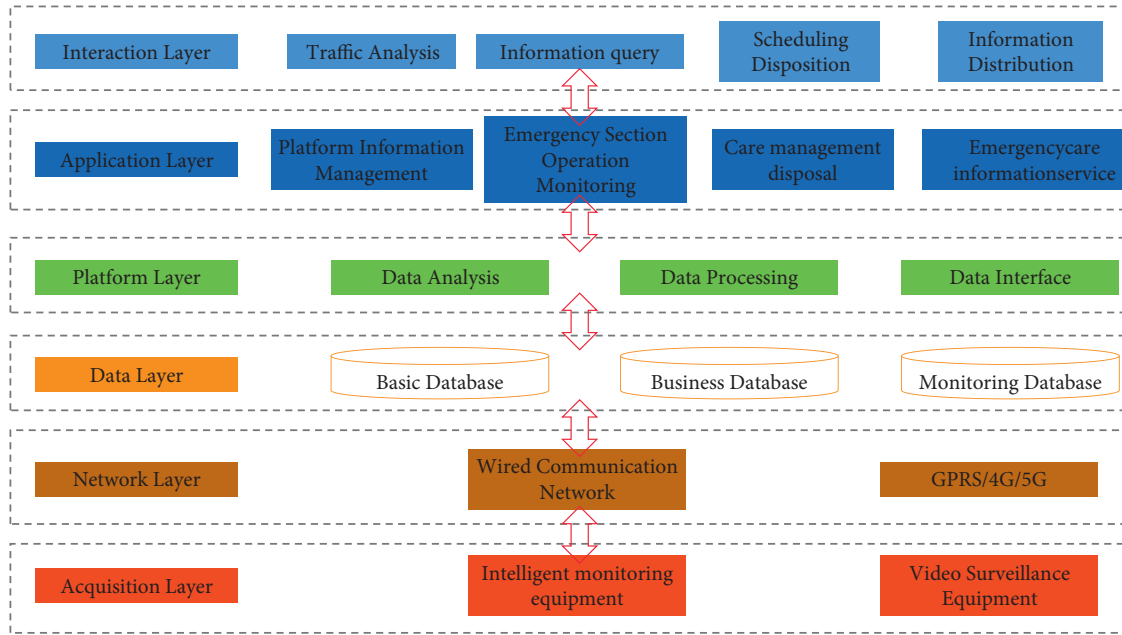


FIGURE 3: Model structure.

- (5) Network layer: the network layer is the level that provides network for system data and third-party platform interaction, and provides reliable network services for data transmission and reception between the collection layer and the data layer, and data interaction between the data layer and the platform layer. The network layer of this system includes wired communication network, GPRS, 4G, and 5G communication technologies.
- (6) Acquisition layer: the acquisition layer is the layer that uses various monitoring devices to collect data on the care situation of the emergency department, and the data completed by the acquisition are transmitted to the terminal system to provide the data basis for the operation of the functions of the application layer.

3.2. Technical Architecture. The system is divided into the main application system and the backend management system, the front-end interface of the main application system is designed with Vue framework, and the back-end business layer is designed and implemented with Dubbo distributed microservices architecture, the microservices architecture can enhance the scalability of the system, the use of this approach can maximize the loose-coupling between the various layers, and the data processing is designed with Kafka and Spark technology architecture. Kafka can ensure the reliability of data when dealing with high throughput data, and Spark Streaming in Spark component is used to process data in real time to ensure the timeliness and effectiveness of data. The backend management system is developed using Java EE architecture technology and adopts a layered idea to design each layer to interact with data

through interfaces. The technical architecture of this system is shown in Figure 4.

- (1) View layer: the view layer adopts a three-layer B/S structure, which is the level to interact with the backend business logic layer. The view layer is a responsive page built with Vue framework, including HTML code, CSS style, and JavaScript code. As the view layer is the presentation level of all the functions of the system, the system design keeps the page style uniform and beautiful in order to ensure the easy-to-use and better experience of the system.
- (2) Control layer: control layer is the level of response to page requests. The control layer uses the controller layer of Spring Boot framework. The pages in the view layer are requested to the control layer through cross-domain requests, and the control layer forwards them to the corresponding service providers for corresponding processing based on the defined request rules matching. When the business request is successful, return the result data and realize the jump to output the business processing results.
- (3) Business logic layer: the business logic layer is the level for processing business requests. The business logic layer contains the service provider and the service consumer. The control layer request finds the corresponding service consumer according to the service exposed in the configuration file and invokes the service provider by remote according to the service registry, which defines the specific service implementation class in the service provider and interacts with the data persistence layer.
- (4) Persistence layer: the data persistence layer is a relatively independent layer of the system focused on

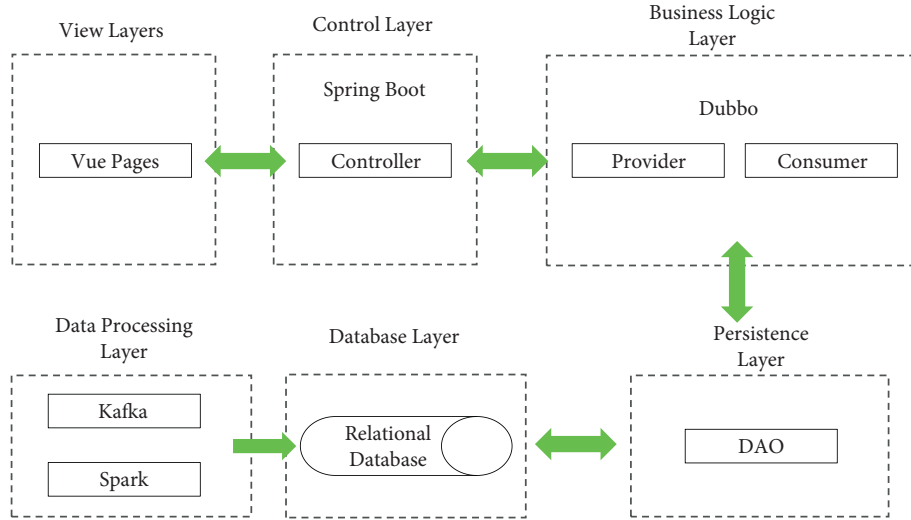


FIGURE 4: Technical architecture diagram.

achieving data persistence. It realizes the separation of data storage logic and provides an abstracted data access interface. The system uses MyBatis framework as the persistence layer design, the complex process of accessing the database through Java Database Connectivity is encapsulated, and the mapping mechanism is used to establish the correspondence between the database table and entity class, by manipulating the data entity class that can complete the purpose of the operation of the data table.

- (5) Database layer: the database layer is the level where the database management system that stores and manages data is located. This system uses MySQL to provide data services for the database layer.
- (6) Data processing layer: the data processing layer is the level where the collected traffic data are processed. The data processing layer uses Kafka to achieve persistence for a large amount of data, which is streamed by Spark Streaming by setting a reasonable pull time, and the resultant data are obtained according to the processing logic. The goal of this design is that Spark Streaming can pull data from Kafka in real time and keep it stable.

3.3. Data Processing. The system uses Spark Streaming, an extension of Spark Core API, which supports resilient, high-throughput, fault-tolerant real-time data stream processing. Spark includes complex algorithms for fast and efficient data processing. First, Spark Streaming receives data streams from Kafka and transforms them into D Stream data types, which are composed of a series of consecutive RDDs. The data transfer stage Kafka is set to send 5-minute interval data each time, Spark Streaming obtains data by subscribing to the producer side data as a consumer, and the operation on D Stream is actually converted into the operation on RDDs. The data conversion process is shown in Figure 5.

3.4. Data Mining Algorithms. The core of the data mining method proposed in this paper is the collaborative filtering algorithm. The user-based collaborative filtering recommendation algorithm is more classical and widely used and is described accordingly below to understand the working process of the traditional collaborative filtering recommendation algorithm, which is divided into 3 phases: data initialization phase, similarity calculation phase, and item rating prediction and recommendation phase. The data initialization phase is mainly established to build a populated user-item rating matrix in the form of the following equation:

$$R = \begin{pmatrix} r_{u_1 i_1} & r_{u_1 i_2} & \cdots & r_{u_1 i_M} \\ r_{u_2 i_1} & r_{u_2 i_2} & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ r_{u_N i_1} & \cdots & \cdots & r_{u_N i_M} \end{pmatrix}_{N \times M}, \quad (1)$$

where N and M are the number of patients and the number of items in emergency department care, respectively. In equation (1), the rows represent the ratings of patients on items in emergency department care, and the columns represent the ratings of individual users of an item. Similarity calculation is the most critical technique to describe the degree of similarity between two patients in emergency department care, and there are quite several similarity calculation methods, each with its own scope of application. The most representative ones are the vector cosine method and the Pearson correlation coefficient method, where the similarity between users u and v based on the vector cosine method is calculated as in the following equation:

$$\text{SIM}(u, v) = \frac{\vec{R}_u \cdot \vec{R}_v}{R_{u2} \times R_{v2}} = \frac{\sum_{i \in I_{uv}} r_{ui} r_{vi}}{\sqrt{\sum_{i \in I_{uv}} r_{ui}^2} \sqrt{\sum_{i \in I_{uv}} r_{vi}^2}}, \quad (2)$$

where I_{uv} denotes the common set of ratings of u and v . The similarity between users u and v based on Pearson's

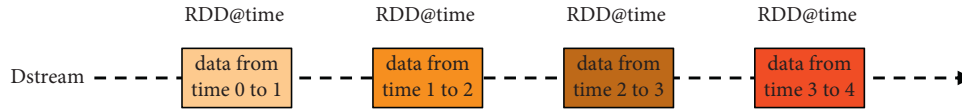


FIGURE 5: Data conversion process diagram.

correlation coefficient method is calculated as in the following equation:

$$\text{SIM}(u, v) = \frac{\sum_{i \in I_{uv}} (r_{ui} - r_u^-)(r_{vi} - r_v^-)}{\sqrt{\sum_{i \in I_{uv}} (r_{ui} - r_u^-)^2} \sqrt{\sum_{i \in I_{uv}} (r_{vi} - r_v^-)^2}}, \quad (3)$$

where r_u and r_v denote the mean values of u and v for their own rated items. After the similarity value is obtained from the item rating prediction and recommendation, the patients in emergency department care are ranked according to the similarity, and the maximum K similarity emergency department care patients are found as the neighbors of the target emergency department care patients, and then, the ratings of the target emergency department care patients on the risk of the item management are predicted according to the K neighbors, as shown in the following equation:

$$\bar{r}_{ui} = \bar{r}_u + \frac{\sum_{v \in N(u)} \text{SIM}(u, v) \cdot (r_{v,i} - r_v^-)}{\sum_{v \in N(u)} |\text{SIM}(u, v)|}, \quad (4)$$

where r_{ui} is the rating of item i by u , and $N(u)$ denotes the set of neighboring users of u . Several items with the largest ratings are used as the recommendation results for the target users. Steps of collaborative filtering recommendation with integrated user attributes and similarity: Step 1: item information is collected, and item matrix is built. Step 2: rating information is collected, and rating matrix is built at the same time. Step 3: user-item rating matrix is built based on the item matrix and rating matrix of Step 1 and Step 2. Step 4: user-item rating matrix calculates user attributes and similarity with user ratings, and gets the optimal recommendation according to the similarity and K nearest neighbors.

4. Experimentation and Evaluation

In this section, experiments done in paper are discussed in organized way and step-by-step. Firstly, gather the data of patients. Secondly, make an experimental setup to do work. Then, evaluate the experimental metrics and, finally, give experimental results.

4.1. Dataset. Two hundred and eighteen patients who attended the emergency department of a hospital in China from March to December 2018 were selected as study subjects, and all patients were divided into a control group (108 cases) and an observation group (110 cases) according to the random number table method. In the control group, there were 59 males and 49 females, aged from 21 to 81 years, with an average of (45.21 ± 7.20) years, and the types of diseases included 32 cases of neurological diseases, 25 cases of cardiovascular diseases, 38 cases of trauma, and 13 cases of

others; in the observation group, there were 63 males and 47 females, aged from 19 to 82 years, with an average of (44.57 ± 7.36) years, and the types of diseases included 31 cases of neurological diseases, 24 cases of cardiovascular diseases, 38 cases of trauma, and 13 cases of others. The disease types included 31 cases of neurological diseases, 24 cases of cardiovascular diseases, 40 cases of trauma, and 15 cases of others. There were no statistically significant differences in the general data of age, gender, and disease type between the two groups (all $P > 0.05$). Informed consent was signed by patients or their families in both groups. The study was approved and passed by the hospital medical ethics committee.

4.2. Experimental Setup. Patients in the control group were given the nursing management strategy calculated using the data mining algorithm in this paper to monitor patients' vital signs and changes in their conditions, implement basic nursing work in compliance with medical advice, and immediately inform the doctor to take disposal measures if any patient's condition is abnormal. Risk prevention nursing management was given to patients in the observation group in the following ways:

- (1) Accurately identify and assess risk events: set up a NRM team in the emergency department to manage patients throughout the whole process, predict, and evaluate the risk of possible adverse events according to the general condition of patients as well as their conditions, target risk prevention management for key nursing aspects, and, at the same time, develop a risk prevention system for the emergency department and actively explore nursing management measures and countermeasures to reduce the occurrence of risk events as much as possible.
- (2) Improve the risk awareness and professional skills of nursing staff: the department improves work responsibility and awareness of risk events by regularly organizing participation in professional training and emergency drills, and strengthens nursing work such as the use of emergency drugs, the operation of emergency equipment, and the mastery of emergency procedures to improve the comprehensive quality ability of nursing staff in order to effectively handle emergency events.
- (3) Strengthen nursing quality management: according to the assessment content of hospital nursing quality, continuous improvement of nursing quality in the department is carried out, mainly including basic nursing, nursing instruments, emergency handling, and doctor-patient communication, to ensure that nursing staff actively participate in the process of

TABLE 1: Comparison of the quality of patient care between the two groups ($x \pm s$, points).

Group	Number of cases	Nursing instruments	Emergency handling	Basic nursing care	Doctor-patient communication
Observation group	108	86.36 \pm 5.20	88.47 \pm 5.47	87.90 \pm 5.33	83.09 \pm 5.04
Control group	110	93.84 \pm 4.15	95.70 \pm 3.58	94.71 \pm 4.06	91.50 \pm 5.62
<i>T</i>		11.750	11.567	10.624	11.625
<i>P</i>		<0.001	<0.001	<0.001	<0.001

TABLE 2: Comparison of nursing adverse events and nursing disputes between two groups of patients.

Group	Number of cases	Incidence of nursing disputes	Incidence of nursing adverse events
Observation group	108	11 (10.19)	12 (11.11)
Control group	110	2 (1.82)	3 (2.73)
<i>t</i>		6.803	5.978
<i>P</i>		0.009	0.014

TABLE 3: Comparison of anxiety scores between the two groups (scores, $x \pm s$).

Group	Number of cases	Preintervention	Postintervention	<i>t</i> -value	<i>P</i> value
Observation group	108	52.45 \pm 4.65	45.38 \pm 3.28	7.858	0.001
Control group	110	52.51 \pm 4.70	37.69 \pm 2.71	17.913	0.001
<i>T</i>		0.058	11.677		
<i>P</i>		0.954	0.001		

TABLE 4: Comparison of adherence between the two groups (cases (%)).

Group	Fully compliant	Partial compliance	Nonadherence	Dependency
Observation group	15 (37.50)	17 (42.50)	8 (20.00)	32 (80.00)
Control group	26 (60.47)	15 (34.88)	2 (4.65)	41 (95.35)
χ^2				4.607
<i>P</i>				0.032

nursing quality management, which is conducive to discovering the problems of nursing staff and correcting them in a timely manner.

- (4) Improve health education services: nursing staff should do a good job of health education for patients and their families during the operation process; fully communicate with them; inform them in detail of the patient's condition, possible risk events and precautions; improve the safety awareness of patients and families; take the initiative to assume risk obligations; and ensure the smooth implementation of risk prevention nursing work.

4.3. Evaluation Metrics. The steps to evaluate metrics are as follows:

- (1) To evaluate the quality of nursing care, nursing paperwork, emergency handling, and doctor-patient communication of patients in both groups, with a score of 100 for each item.
- (2) Record the number of nursing adverse events in both groups, including nursing accidents, catheter slip-page, drug leakage, and adverse transfer events.
- (3) The number of nursing disputes between the two groups was recorded. SPSS 22.0 statistical software

was used for data processing and analysis. The quality of nursing care was expressed as mean \pm standard deviation ($x \pm s$), and *t* test was used for comparison between groups, and χ^2 test was used for comparison between groups of nursing adverse events and nursing disputes.

4.4. Experimental Results. The quality of nursing care in the observation group was higher than that in the control group in terms of basic nursing care, nursing paperwork, emergency handling, and doctor-patient communication, and the differences were statistically significant ($P < 0.05$) (see Table 1).

Comparison of nursing adverse events and nursing disputes between the two groups, the incidence rate of nursing adverse events and nursing disputes in the observation group was lower than that in the control group, and the differences were statistically significant (all $P < 0.05$) (see Table 2).

Before the intervention, the anxiety scores of patients in both groups were compared with similar data ($P > 0.05$); after the intervention, the anxiety scores of patients in both groups were lower than those before the intervention, and the anxiety scores of patients in the observation group were lower than those in the control group, $P < 0.05$, as shown in Table 3.

The compliance of patients in the observation group was higher than that of the control group ($P < 0.05$) (see Table 4). Dependency of observation group is 80.00, and the dependency of control group is 95. But overall compliance of observation group is better.

In this part, control group performance is compared with observation group. Some experiment levels are good in observation group and some in control group. Like as compliance of patients is higher than in observation group. But anxiety scores have parallel data in both groups.

5. Conclusion

The emergency department is a clinical department involving many kinds of critical illnesses, and the patients' conditions are complex and fast-changing. The nursing staff work under high pressure, and it is easy for nursing misconduct to occur, which leads to adverse events, affects the treatment effect, increases the risk of nursing disputes, and prolongs the hospitalization time of the patients. Risk prevention nursing intervention is to accurately identify and evaluate nursing risk events and eliminate risk hazards in a timely manner by developing risk prevention systems and management measures, while promoting continuous improvement of nursing quality in many aspects such as basic nursing care, nursing paperwork, emergency handling, and doctor-patient communication by improving the risk awareness and professional skills of nursing staff in emergency departments, improving health education services, effectively ensuring nursing safety and reducing it can effectively ensure nursing safety, reduce the risk of nursing adverse events, and effectively improve the efficiency of nursing in the emergency department. So far, the application of big data in diagnosis and care has become more and more widespread, and emergency care has special characteristics such as complex care, heavy tasks, high labor intensity, and the inability to make mistakes. It is necessary to use big data to establish a smart rescue system; realize the application of big data in patient condition monitoring and early warning, medical and nursing staff scheduling, and patient emotional appeasement; improve the efficiency and accuracy of patient condition monitoring and early warning; and improve medical and nursing staff. It can improve the efficiency and accuracy of patient condition monitoring and early warning, improve the real-time dispatching of medical personnel, solve the problems of medical care such as emotional comfort of patients, improve the doctor-patient relationship, and promote the development of emergency care. Therefore, the method proposed in this study based on the application of NRM in emergency department care based on data mining technology for the application of big data in emergency care is of very high practical significance and is recommended to promote the research and application in the field of emergency care.

Data Availability

The datasets used during this study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Weiwei Han and Songqin Wang contributed equally to this work.

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