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Regional Geological Disasters Emergency Management System Monitored by Big Data Platform

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Abstract: In order to deal with the hazards caused by geological disasters in time, an emergency management system is proposed based on association rule data mining. With the support of a big data platform, a regional geological disaster emergency management system is built based on monitoring data. In the result analysis, the association rule algorithm demonstrates high computing power in the test, which can filter the data with strong association rules. In addition, the big data platform can allow data visualization, which has good data storage capacity and disaster early warning capacity. In the simulation test of the emergency management system, it was found that the system is feasible in theory. When it is applied to the actual disaster emergency management, it wasfound that, in the face of geological disasters, the processing speed of relevant departments increased by 59.4%, and the allocation of personnel and materials wasmore reasonable. The above results show that the big data platform monitoring data can improve the regional geological disasters emergency management capacity and ensure the safety of people's lives and property.

Keywords: geological disasters; emergency management system; big data platform; disaster warning

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1. Introduction

Geological disasters area common natural phenomenon thatgreatly affects human life with theirsuddenness and strong destructiveness. Therefore, for the sake of our survival and the normal development of human society, a large number of research at home and abroad purposefully proposed disaster emergency management program [1,2].

Tang et al. proposed a high-resolution remote sensing technology to help with forest fire emergency rescue and hidden danger prediction [3], which extracts disaster elements through high-resolution remote sensing texture features, acquires comprehensive information (such as rescue routes), collects spectral features to implement dynamic monitoring of disaster scope and migration changes, predicts the disaster trend, puts forward emergency deployment suggestions for rescue in real time, and implements disaster emergency management, but this method has poor data adaptability. Xu et al. proposed a theoretical study on the monitoring and early warning of sudden loess landslides [4]. Based on the acquired deformation-time curves of multiple sudden loess landslides in Heifangtai, the characteristics and laws of the deformation curves are analyzed. A comprehensive early warning model wasestablished for landslide geological disasters, but this method takes a long time in the system response and has a negative impact on the emergency management system. Higuchi proposed integrated use of geostationary satellite data for disaster management and risk mitigation [5]. Through third-generation geostationary meteorological satellites (GEOs), it provides advanced imagery and atmospheric measurement data of the earth's weather, ocean, and terrestrial environment at high frequency intervals, and disaster management is carried out based on data, but this method has the problem of long response time. The reason for the above problems in traditional methods lies in the poor data communication. Therefore, how to achieve disaster emergency management with the support of big data is the primary research direction at present [6–9].

In the early days, big data was only used to describe excessive data sets demanding batch processing in network indexing. Afterwards, with computer development, big data gradually became the core content of Internet and cloud computing. At the same time, with the gradual development of information technology and Internet technology, the research on big data technology is gradually deepening. In the field of engineering, Ye Kang et al. introduced big data technology into power grid monitoring in 2019, thus realizing the intelligent management of power grid monitoring [10]. Wang introduced big data to design key technologies in the fault diagnosis of transmission lines in 2020, thus successfully identifying line fault under high noise [11]. In other fields, domestic scholar Yu Jun used big data as the basis for the formulation of teaching plans in the ideological and political education of colleges and universities and used big data to create a new educational environment and cultivate the correct values and outlook on life among college students [12]. In order to guarantee the security of Internet big data processing, foreign scholar Ahad MA constructed an energy-saving security framework on the basis of distributed systems [13]. Darwish et al. proposed a traffic intelligent decision-making method with the support of traffic big data, which can identify nearby traffic flow information and network conditions to enhance the application performance of intelligent transportation systems [14]. Starting from big data network security, Qureshi et al. proposed a flow-based authentication mechanism and introduced key authorization, thereby improving the multi-homed network compatibility and reliability of data block processing in a distributed environment [15].

To sum up, in the current research, big data is the research focus at home and abroad, and disaster emergency management also serves as the basis for various countries to safeguard people's safety. Therefore, how to avoid disaster risk, on the basis of big data, carries great practical significance. In order to cope with the continuous and unpredictable geological disasters, and at the same time, to ensure the safety of personnel and reduce economic losses after the disaster, we research and combine big data platforms formonitoring regional geological disasters and analyzingregional geological disasters and build an emergency management system based on this, so as to provide theoretical support for natural disaster management. After data mining, the data needs to be stored. The purpose of data storage is to facilitate the real-time retrieval of big data platform data, so as to update geological disasters in real time. In order to ensure data reliability and economy, cloud storage is used to store data. In the research, HDFS (Hadoop Distributed FileSystem) is used to realize the distributed management of data. By dividing files into multiple blocks, the blocks are stored on different data management nodes to improve the fault tolerance and disaster tolerance of data storage [16].

2. Construction of Disaster Emergency Management System Based on Big Data Platform

2.1. Data Mining and Processing Technology

In the environmental construction of the big data platform, the original geological disasters big data is huge, so it is necessary to establish a scientific database for capture. The establishment of the database is to guarantee that more accurate information is captured in data extraction to assist the platform in geological disasters warning. In the geological disasters big data platform, the existence of the database is crucial, and the data mining of the database is also extremely important. The accurate mining of geological disasters information helps to construct a perfect data platform. In data mining, in order to provide complete data in geological disasters, an association rule algorithm is used to mine the correlation of disaster data, so that data comprehensiveness is guaranteed.

An association rule algorithm is a widely used algorithm in data mining technology. The main calculation rule in the association rule algorithm is to perform association analysis on the associated itemsets in the instance. Generally speaking, association rules involve an extremely huge data amount. In association analysis, data association rules need to be screened and filtered. In the research, support and confidence are used to perform the above operations. First, the support between the two sets is analyzed as shown in Formula (1).

$$Support(A \rightarrow B) = P(A \cup B) \tag{1}$$

In Formula (1), A and B represent the two itemsets in the instance, respectively. Where A is set as the leader, and B is set as the successor, indicating the association rules existing between the two. Formula (1) expresses the probability of including A and B in any instance, that is, the support of $A \rightarrow B$. The confidence of the two itemsets is calculated as shown in Formula (2).

$$Confidence(A \rightarrow B) = P(B|A) \tag{2}$$

In Formula (2), it represents the probability of B appearing in the instance after A is obtained following data mining, that is, the confidence of $A \rightarrow B$. In the process of data mining, regarding the use of the association rule algorithm, we need to set the minimum support and the minimum confidence in advance and use the two as the threshold of data mining for data screening. The settings of minimum support and minimum confidence are shown in Formula (3).

$$\begin{cases} Support(A) \geq Min\_Support \\ Confidence(A) \geq Min\_Confidence \end{cases} \tag{3}$$

In Formula (3), $Min\_Support$ represents the minimum support, and $Min\_Confidence$ represents the minimum confidence. In the setting of minimum support and minimum confidence, if an itemset in the instance meets both minimum support and minimum confidence, the association rule derived from the itemset is a strong association rule. In the association rule algorithm, the Apriori algorithm is commonly used to perform layer-by-layer search iterations. The Apriori algorithm has two steps in the calculation. The first step is to find the frequent itemsets and candidate itemsets in the database through iterative scanning and connect the remaining frequent itemsets to obtain the candidate itemsets. The itemsets below the support degree are deleted, and so on, until all reasonable itemset output results are obtained. Although the traditional Apriori algorithm can manage excessive data mining based on the support and confidence, it faces shortcomings such as excessive load and low time efficiency during operation. At the same time, in order to enhance the information value of the Apriori algorithm in data mining, it is recommended to introduce the threshold of interest degree to generate suitable strong association rules. Take itemsets X and Y as examples, the interest degree can be expressed as in Formula (4).

$$P(X \rightarrow Y) = \frac{P(XY)}{P(X)P(Y)} \tag{4}$$

In Formula (4), $P(X)$ represents the occurrence probability of itemset X, $P(Y)$ represents the occurrence probability of itemset Y, and $P(XY)$ represents the probability of simultaneous occurrence of two itemsets. In the calculation of interest degree, when the value is greater than 1, it indicates a positive correlation between the two itemsets; when the value is smaller than 1, it indicates a negative correlation between the two itemsets; when the value is 1, it means the two itemsets are independent and uncorrelated.

The introduction of interest degree can effectively increase the accuracy of association rules in data mining. Meanwhile, it can delete the pseudo association rules generated under the support degree. Moreover, it can be seen from the interest degree calculation method that interest degree can filter the irrelevant association rules and screen the candidate itemset to further reduce the useless operations in data mining and enhance the algorithm efficiency. In addition, when the confidence threshold is judged using the association rule algorithm, the interest degree can ensure that the association rules therein are all realistic. After data mining, the data needs to be stored. The purpose of data storage is to facilitate the real-time retrieval of big data platform data, so as to update geological disasters in real time. In order to ensure data reliability and economy, cloud storage is used to store data. In the research, HDFS (Hadoop Distributed FileSystem) is used to realize the distributed management of data. By dividing files into multiple blocks, the blocks are stored on different data management nodes to improve the fault tolerance and disaster tolerance of data storage.The specific data collection and processing process is shown in Figure 1.

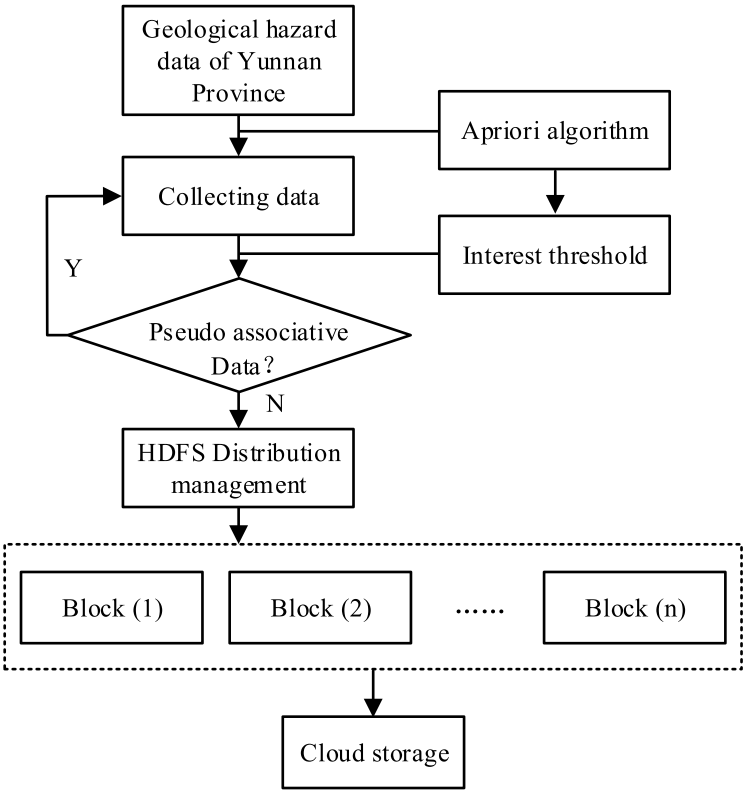

Figure 1. Geological hazard collection and treatment process.

Figure 1 shows that the research starts with the geological disaster data of Yunnan Province. First, data mining technology is used to achieve data collection, and the pseudo association data among them is processed using the interest threshold. HDFS distributed management is adopted in the data storage process to divide the data into multiple blocks, and finally realize cloud storage. The database foundation of big data platform is built through the collection and processing of geological disasters to facilitate the early warning and processing of geological disasters.

2.2. Construction of Big Data Platform for Geological Hazards

The safety of people's property in areas prone to geological disasters is an object of key national concern, so how to design early warning decisions is crucial to protecting the safety of life and property. With people's understanding of geological disasters, there are increasing result data under real-time observation. At the same time, due to geological differences and disaster differences, there is huge amount of complicated data [17–19]. In order to provide accurate early warning of regional geological disasters and put forward the corresponding emergency management strategies, the first step is to integrate various geological disasters data and build a big data platform to achieve real-time retrieval of data in the database. Geological hazard data mainly exhibits non-spatial and spatial characteristics. Non-spatial data is mainly geological hazard data collected from fixed-point surveys and engineering management operations. Spatial data is image and video data observed by remote sensing technology and sensor technology [20,21]. Under the big data background of geological disasters, in order to build a perfect emergency management system, all big data should be comprehensively processed first to build a big data environment.

In the construction of geological disaster big data environment, geological disaster information should be determined first. According to the geological disaster information of Yunnan, the research will use monitoring instruments to detect the disaster indicators of each disaster point in real time. According to the collected data and historical information, 1258 geological disasters can be found in the study area, including landslide, debris flow, collapse, ground collapse, slope, land subsidence, and ground fissure. According to the relevant survey information of seven geological disasters and the characteristic information of each geological disaster type, the geological disaster database is constructed and applied to the construction of big data platform [22].

In natural geological disasters data mining, the association rules algorithm can be used to quickly search for frequent itemsets and data with strong association rules in the database, reduce the scanning time in database construction of the geological disasters big data platform, and increase the construction efficiency of the big data platform. Through the data mining of management rules, the big data platform environment is constructed as shown in Figure 2.

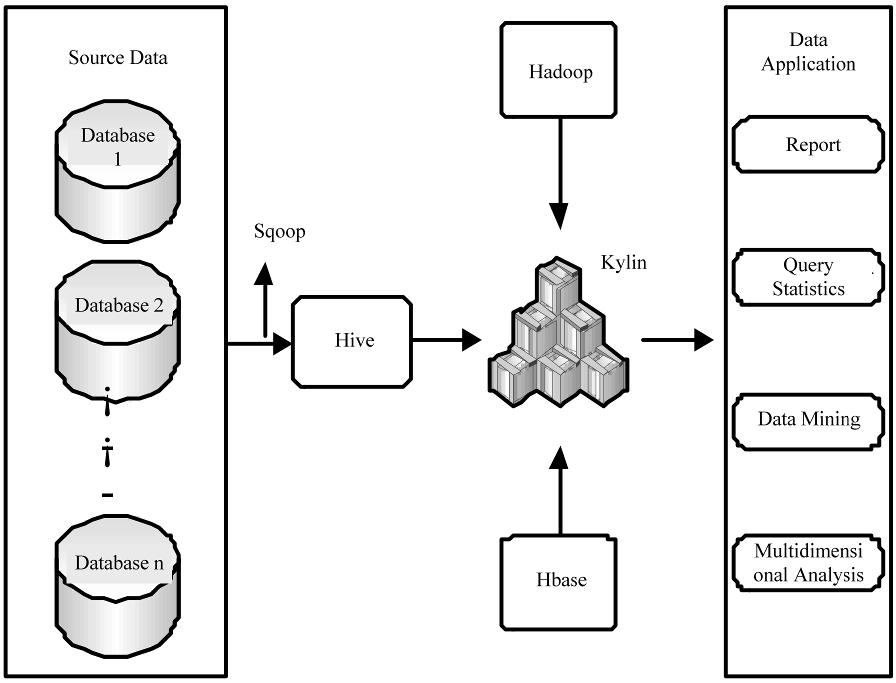

Figure 2. Big data platform environment construction.

As shown in Figure 2, in the big data processing of geological disasters, the environment architecture is built mainly based on Kylin. Under Kylin, it is implemented through the combination of three technologies: Hadoop, Hive, and Hbase. For the geological disasters source data, Hive technology is used to extract the disaster database, and Sqoop technology is used to extract various types of data, such as disaster type and disaster distribution, from the geological disasters database and then transmit the data to Kylin. Afterwards, Kylin uses the interior Hadoop technology to perform distributed storage and calculation of various data. Under the premise of various data redundancy, Hbase technology is combined to achieve structured and unstructured data optimization processing. Then, Kylin will perform multi-dimensional analysis of the processed data and simulate the big data environment as a kind of database to achieve data mining and data query. There are three main functions that need to be implemented in the big data platform, namely data storage, data visualization and geological disasters warning.

In terms of data storage capability, compared with the traditional data storage method, the use of Kylin supports multi-node addition, that is to say, Kylin technology can increase the data storage capacity under multiple nodes. At the same time, when querying data, it also reduces query time. In the visualization presentation of data, Tableau visualization tools are used to make multi-dimensional analysis of location, space, time, etc., and the establishment of multi-dimensional visualization is to prepare for early warning. In the early warning function, according to the real-time data collection, the information is displayed in the visualization module, and the prediction calculation is performed according to the display results. When the predicted value exceeds the set threshold, the warning is processed, and the warning information is sent to the place where the disaster occurs, so that relevant measures can be taken.

2.3. Regional Geological Disasters Emergency Management System

The big data platform set up herein utilizes a comprehensive platform of big data combined with geographic information technology, which is mainly to perform data storage and calculation of geological disasters based on the geological disasters monitoring, thereby achieving visualization of geological disasters information [23,24]. The support of big data platform monitoring technology facilitates the construction of geological disasters emergency management system. Due to the different distribution and types of regional geological disasters, it is necessary to implement regional real-time monitoring and processing in the construction of emergency management system [25,26]. The geological disasters emergency management system is shown in Figure 3, which mainly includes pre-disaster preparation, timely response during disaster, and post-disaster recovery.

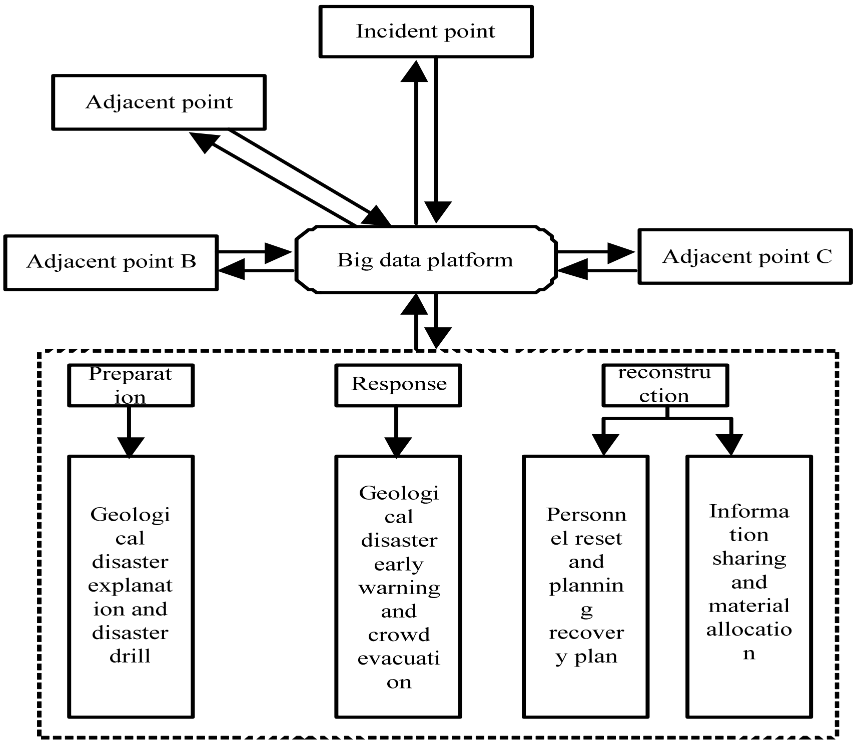

Figure 3. Emergency management system based on big data platform.

As shown in Figure 3, with the big data platform as the core, different locations in the region play different roles in the emergency management system. With the support of the big data platform, focused protection is given to areas prone to geological disasters, in which local departments need to explain geological disasters to the masses and carry out exercises [27,28]. For the area where the geological disasters occur, early warning information of the geological disasters is collected based on the big data platform. Within a limited time, the regional leaders and management departments are required to conduct early treatment of the geological disasters in the area, including informing the crowd to evacuate, soothing the crowd, and planning the follow-up recovery program. At the same time, the big data platform receives the information of the incident site, spreads the relevant information to adjacent places, so that adjacent places can formulate mutual assistance plans based on this information. Under the disaster data monitoring of the big data platform, information sharing and material allocation can be efficiently achieved, and the population data provided by the big data platform can help the areas adjacent to disaster areas better arrange support materials. In the post-disaster reconstruction work, the big data platform collects the geological disasters warning information before the disaster and the personnel mobilization and material allocation information during the disaster relief process, so that reconstruction plan can be accurately formulated.

In the emergency management system, the big data platform is used for early warning and processing of geological disasters, and it is necessary to perform fuzzy risk assessment of disasters in disaster early warning [29]. Fuzzy evaluation is a process of fuzzy transformation and the evaluation result is determined mainly through the weight analysis of various elements, as shown in Formula (5).

$$B = A \times Y \tag{5}$$

In Formula (5), B represents the row vector of the fuzzy evaluation result, A represents the weight distribution matrix for all indexes in the risk warning, and Y represents the membership matrix in the evaluation. The weight of each index is determined as shown in Formula (6).

$$a_{ki} = \frac{x_{ki}/S_i}{\sum_{i=1}^{n}(x_{ki}/S_i)} \tag{6}$$

In Formula (6), x_{ki} represents the value of the evaluated i factor in k evaluation unit, n represents the total number of elements, and S_i represents the base point value. The function of the base point value in Formula (2) is to eliminate the error in the dimension. Generally, the average value of all data is used. The vector composed of all indexes is the weight distribution matrix of all indexes, which can be expressed as $A = [a_{k1}, a_{k2}, \ldots, a_{kn}]$. The membership function in the evaluation is shown in Formula (7).

$$Y = \begin{bmatrix} y_{11} & y_{12} & y_{13} & y_{14} & y_{15} \\ y_{21} & y_{22} & y_{23} & y_{24} & y_{25} \\ M & M & M & M & M \\ y_{n1} & y_{n2} & y_{n3} & y_{n4} & y_{n5} \end{bmatrix} \tag{7}$$

In Formula (7), the vertical y represents the index in the geological disasters risk assessment, and the horizontal line represents the level of each evaluation index, which is divided into 5 levels. Considering data regularity, the weighted average principle is used to comprehensively evaluate the relevant information of the index data, as shown in Formula (8).

$$Q = \frac{\sum_{j=1}^{n} a_j q_j}{\sum_{j=1}^{n} a_j} \tag{8}$$

In Formula (8), a_j represents the weight, q_j represents the evaluation element, that is, the evaluation index.

3. Effect Analysis of Emergency Management System under Big Data Platform

3.1. Performance Display of Big Data Platform

The main function of the big data platform is to store and classify various types of data in the region. Seen from the research, the constructed big data platform has a data storage module, a visualization module, and a disaster warning module. The development environment of the big data platform in the study is shown in Table 1.

Table 1. Development environment.

Hardware Item	CPU	GPU	Memory	Video Memory
Hardware Content	Inter core i7	GeForce GTX 1080	32 GB	8 GB
Software Name	Operating System	GISPlatform	Development Platform	Database
Software Content	Linux	ArcGIS 10 1 for Server	MATLAB	MySQL8.0.20

Table 1 shows that the big data platform is compiled according to MATLAB, under the ArcGIS 10 1 for Server architecture. The performance of the Apriori algorithm in the association rules proposed herein is analyzed. First, the execution time of the Apriori algorithm in the data mining process is analyzed under different number of nodes, as shown in Figure 4.

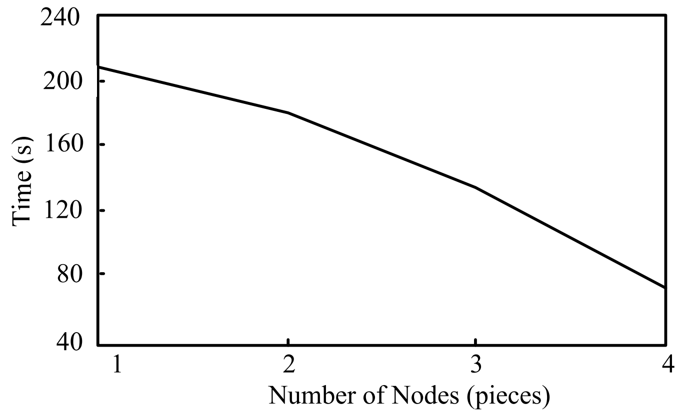

Figure 4. Apriori algorithm execution time.

As can be seen from Figure 4, when the number of nodes in the Apriori algorithm is 1, the execution time of association rules learned in data mining reaches 208 s. As the number of nodes in the Apriori algorithm continuously grows, the execution time of association rules in data mining is gradually reduced, which finally reduces to 70 s when the number of nodes reaches 4. The above results show that the number of nodes in the Apriori algorithm affects the efficiency of the association rule algorithm in data mining. Therefore, in practical applications, the number of nodes in the Apriori algorithm should be reasonably set to guarantee the data mining efficiency of the algorithm and reduce its internal consumption. In addition, the execution effect of the Apriori algorithm introduced with the interest degree in the screening of strong association rules is analyzed. The running time of the Apriori algorithm after the interest degree optimization and the traditional Apriori algorithm in the same data set is compared for verification, as shown in Figure 5.

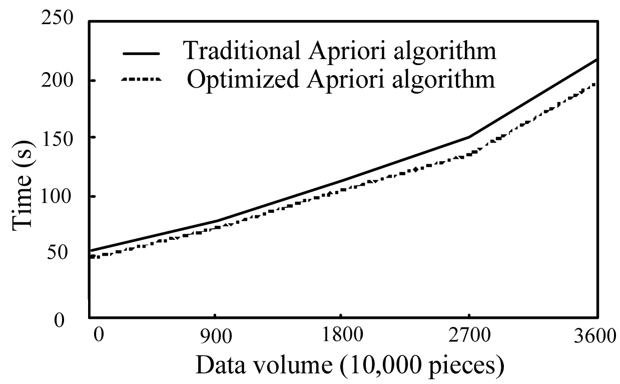

Figure 5. Running time of association rule algorithm.

As can be seen from Figure 5, under the premise of the same amount of data, the traditional Apriori algorithm has significantly lower running time in the calculation of association rules than the Apriori algorithm after the optimization of interest degree. The reason for the above results is that the traditional Apriori algorithm cannot filter out and delete the data with weak or no correlation in the calculation of association rules, while the Apriori algorithm after optimization of interest degree can filter the candidate itemset andretain the data of strong association rules, so it takes longer running time. The above results also suggest that the Apriori algorithm with optimized interest degree can perform long-term data mining on excessive data sets under the premise of continually increasing data volume, which has long-term effectiveness in practice.

In the performance test of the big data platform, it is necessary to analyze the function of each module and analyze the data storage performance of the big data platform, as shown in Figure 6.

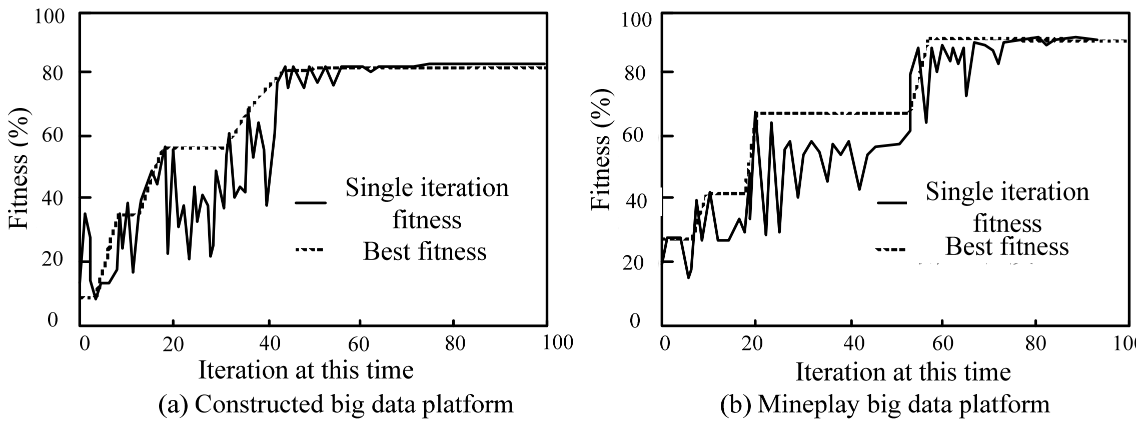

Figure 6. Data sensitivity analysis of big data platform.

As shown in Figure 6, in the test of the data storage capability of the big data platform, the data fitness is first analyzed to explore the sensitivity to geological disasters data. As shown in Figure 6a, when the constructed big data platform performs a selective search in the face of a large amount of data, with the increase of the number of iterations, its fitness gradually increases, indicating gradually increasing data sensitivity and strong learning ability. At the same time, it can be seen that the big data platform can continuously exhibit optimal fitness in the long-term test. Figure 6b shows the Mineplay big data platform involved in the comparative analysis [30]. It can be seen from the fitness changes that the fitness gradually increases with the increase in the number of iterations. However, in the selection of optimal mineplayfitness, it is impossible to search for optimization as many times as in the big data platform herein, that is, it is difficult to jump out of the long-term optimal state. By comparing the overall situation of the two big data platforms, it can be found that the proposed platform demands few iterations to achieve the optimal fitness, and the optimal fitness can be continuously searched during the test, which means better real-time performance. In the visualization module, taking Yunnan Province as the object, the relevant information of Yunnan Province is collected. In geological disasters, rainfall has always been an important influencing factor. Therefore, in the analysis of the visualization function, the rainfall in a certain place in Yunnan Province is selected for visualization, as shown in Figure 7.

As shown in Figure 7, the study displays the rainfall changes in the area for three days from 15 July 2018 to 17 July 2018. As can be seen from the figure, the big data platform has an ideal data display effect, which can clearly show the rainfall changes in the 3 days. At the same time, it can be seen from the figure that in addition to the rainfall change curve, there is also a supplementary curve, that is, the missing data are supplemented in the follow-up investigation. Therefore, it can be seen from the test results that the big data platform built by the research has a good visualization ability, and at the same time, in the big data environment, the real-time renewal ability of the data is effectively guaranteed. Finally, the disaster warning function of the platform is analyzed, and the geological disasters information is set through simulation and input into the big data platform. The simulation test results are shown in Figure 8.

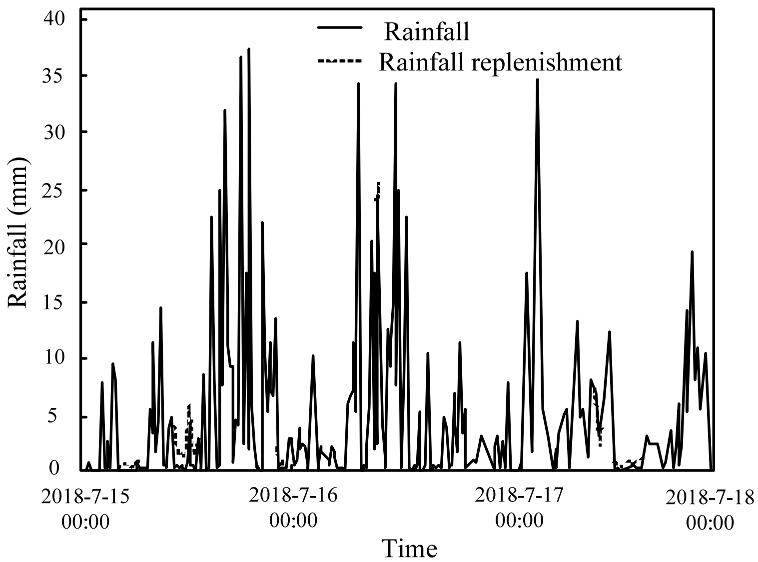

Figure 7. Visualization effect analysis of big data platform.

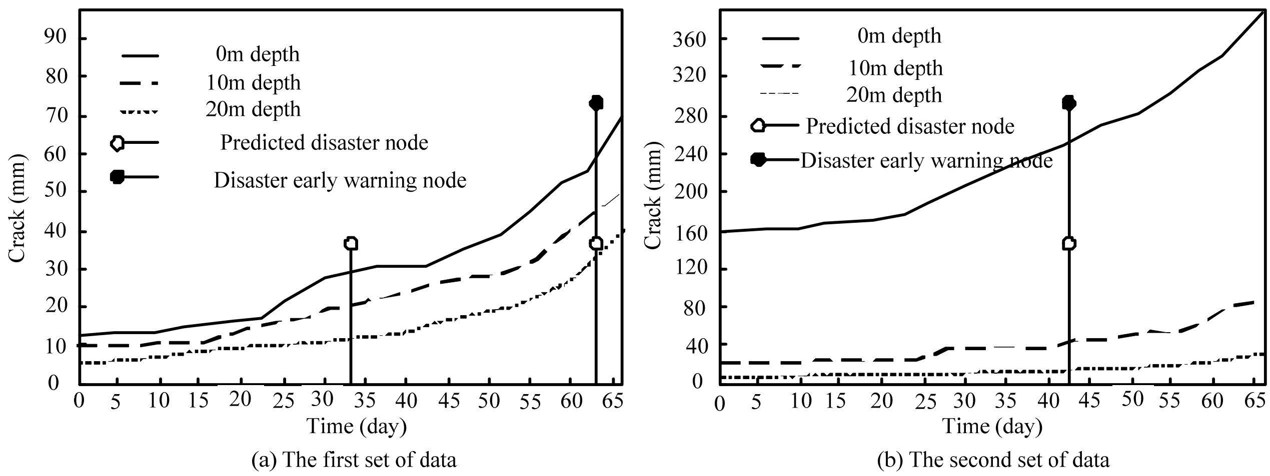

Figure 8. Early warning performance analysis of big data platform.

As shown in Figure 8a, with the increase of the test time, the size of the mountain cracks continuously increases, and the warning time of the big data platform is constantly changing. The reason is that the big data platform predicts changes in the next time by calculating the data at each time. If the actual change is smaller than the predicted value, no warning will be given. Seen from the curve change, with the increase of the crack size, the alarm processing starts when the crack size exceeds the warning line during the monitoring process of the big data platform. Figure 8b shows another group of landslide crack information. It can be seen that the big data platform starts early warning processing when the curve reaches the first predicted value, indicating that the increase rate of cracks has reached or exceeded the prediction value calculated by the big data platform. In order to guarantee the safety of people's lives and property, early warning is required. The above results suggest that the data storage module, visualization module, and disaster warning module of the big data platform function normally, which display a certain degree of advantages, compared with other big data platforms.

3.2. The Effect of Geological Disasters Emergency Management

In the research, with the support of the monitoring function of the big data platform, a geological disasters emergency management system is constructed, and the rationality of the system needs to be determined by simulation analysis. The management system simulation in the study is completed in the JADE software. The geological disaster emergency management system is compiled and developed using Java language, and GUI interface is provided to manage it. Secondly, set the corresponding parameters of the emergency management system, including the type, scale, and location of geological disasters. The type of geological hazard is set as 7, and the scale of geological hazard is adjusted to be slight, ordinary, and serious. The geological hazard occurrence point is based on the geological conditions of Yunnan Province, and the reasonable occurrence location is set.In the simulation analysis, a complete regional management system is first built, and the geological disasters management system is imported. The main regional personnel information is shown in Table 2.

Table 2. Personnel information of each management department (person).

Department	Disaster Occurrence Site	Adjacent Place A	Adjacent Place B	Adjacent Place C
Commander-in-Chief	1	1	1	1
Deputy Commander-in-Chief	3	2	2	3
Team Leader	7	5	5	4
Team member	30	21	18	20
Volunteer	30	20	20	20

Table 2 shows that the management personnel in each region are set up at different levels, including five levels, namely the commander in chief, deputy commander in chief, group leaders, group members, and volunteer teams. There is a significant difference between the management of volunteers and the management of team members. Volunteers need to focus on their own wishes first. Therefore, in the simulation, the study adds two kinds of decisions: yes and no to achieve volunteer management. Through the connection of the big data platform, areas without geological disasters can distribute materials to the incident site in time. According to the set area information, a simulation experiment is carried out on the emergency management system, as shown in Figure 9.

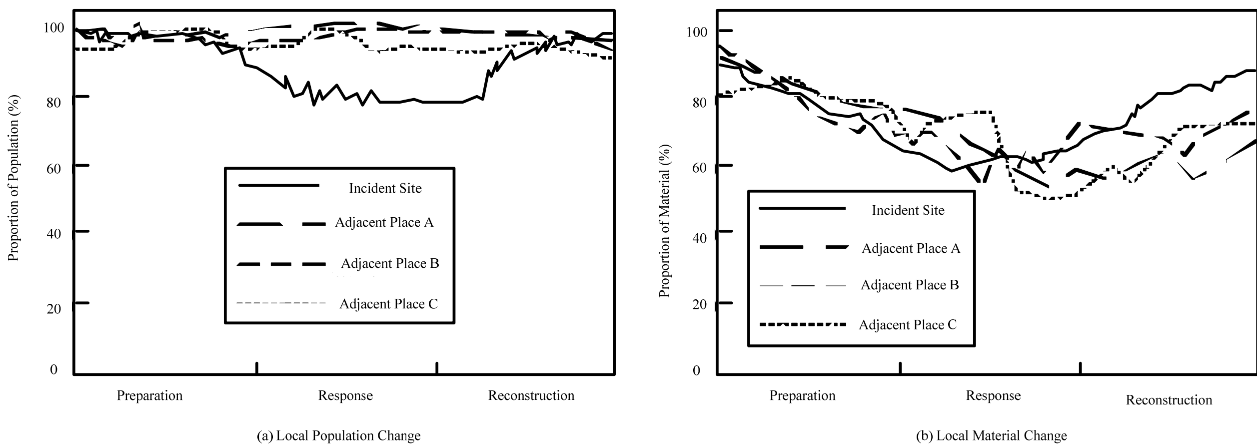

Figure 9. Simulation analysis of emergency management system.

As shown in Figure 9a, in the preparation stage before the outbreak of geological disasters, there are gradually fewer people at the incident site, because the early warning information prompts people to evacuate. As for the other three adjacent places, there is a sudden increase in population due to receipt of the evacuated people from the incident site. In the disaster relief activities after the outbreak of geological disasters, the overall population of the incident site increases by a certain extent, and the population of the three adjacent places decreases slightly, suggesting that rescuers enter the incident site. During the post-disaster reconstruction, the population of the incident site begins to recover gradually, and at the same time, the population of the three adjacent places gradually decreases, indicating that the evacuated people constantly return to their hometowns as the reconstruction progresses. Figure 9b shows the changes in the total amount of materials in each region. The materials at the incident site maintain a normal use attenuation rate before the geological disasters strike. After the warning comes, a large number of materials are transported, which is also manifested in the sudden drop of the curve. When the geological disasters come, the materials at the incident site are further reduced. With the connection support of the big data platform, the other three places begin with emergency handling of material distribution. The curve shows that the materials at the incident site begin to increase, while the materials in the adjacent places begin to decrease, and this trend continues until the post-disaster reconstruction work at the incident site. According to the above simulation results, the constructed emergency management system is reasonable and feasible in theory, and the changes in population and materials in various regions are reflected in the simulation. Finally, the feasibility of the emergency management system in application is reflected through empirical analysis, as shown in Figure 10.

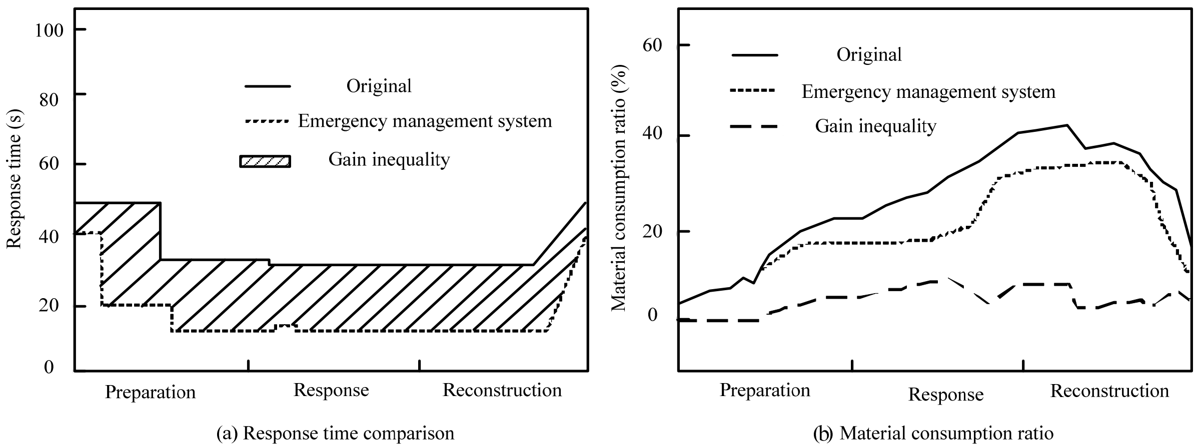

Figure 10. Practical application analysis of emergency management system.

As shown in Figure 10a, in the preparation stage, the reaction time in the original means starts from 50s, and with the arrival of the warning, the reaction time begins to drop to 32s. At the same time, the corresponding management team begins to formulate measures. With the advent of geological disasters, the response time is further reduced, but only by 1s. With the development of disaster relief and reconstruction work, the response time returns to normal. Under the emergency management system, the initial preparation time is set to 40s, and in the early warning, the response time is reduced to 13s, which is 59.4% higher, compared to the original means. However, in disaster relief, the response time is increased by 1s. The reason is that the population data change affects the information of the big data platform, resulting in short-term changes, and finally, the change trend in the reconstruction is consistent with that of the original means. Figure 10b shows the material consumption change process. With the support of the original means, the highest material consumption reaches 42.1% during the reconstruction process. With the support of the emergency management system, the maximum material consumption reduces to 35.7%. In the entire consumption process, the emergency management system displays a better effect in material distribution, and the average material consumption is reduced by 8.5%. Therefore, the geological disasters emergency management system, based on the data monitoring of the big data platform, is not only reasonable in theoretical analysis, but also feasible in practical application. Moreover, the emergency management system herein has an obviously better management effect than the original means.

4. Conclusions

The continuous expansion, in the scope of human activities, leads to a gradually greater impact of geological disasters. Therefore, formulation of a sound emergency management system for geological disasters is a powerful guarantee for the safety of people's lives and property. In the study, a big data platform was constructed using the geological disasters big data, and based on this, a regional geological disaster emergency management system was established. The results show that the built big data platform has better capabilities in data storage and disaster early warning. The geological disasters emergency management system, formulated based on the big data platform, has demonstrated rationality in the test and is more effective in emergency processing. In the empirical analysis, the geological disasters emergency management system improved the response speed of regional events by 59.4%, and the average consumption of materials was reduced by 8.5%. The above results show that the big data platform can provide early warning of geological disasters. On this basis, the emergency management system can respond quickly, improve the incident processing speed, save material consumption, and reduce the safety risk of people's lives and properties.

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