Research on Data Optimization Method of Software Knowledge Base Operation and Maintenance Based on Cloud Computing

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Abstract. To improve the accuracy of data matching in software knowledge base operation and maintenance, a data optimization method based on cloud computing is proposed. In order to achieve the goal of accurate detection, the steps of anomaly detection of software knowledge base operation and maintenance data are improved, and the optimization of software knowledge base operation and maintenance data is completed. Finally, the experiment proves that the matching accuracy of the software knowledge base operation and maintenance data optimization method based on cloud computing is significantly improved compared with the traditional operation and maintenance method.

Keywords: Cloud computing · Software · Knowledge base · Operation and maintenance data

1 Introduction

With the rapid development of modern technology, the scale of software knowledge base data cluster is gradually expanding. In order to better guarantee the stability of knowledge base operation, it is necessary to further improve the database operation and maintenance technology of software knowledge base [1]. Therefore, through the analysis and research of the current common methods of operation and maintenance data optimization, it is found that due to the unreasonable structure of software knowledge base and the lack of effective association matching module, it is difficult to distribute and mine the massive dimension data accumulating in the database in time, resulting in the poor quality of data operation and maintenance and other problems [2]. In order to solve the above problems, combined with cloud computing method to optimize the operation and maintenance data method of software knowledge base, through the effective collection of multi-dimensional information of knowledge base, and according to the results of collection, the dimension data association of software database is analyzed, and the dimension operation and maintenance data relationship of

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database is judged and matched scientifically and reasonably. Thus, the data feature management and potential value of software knowledge base operation and maintenance can be effectively excavated, and the quality and efficiency of data operation and maintenance can be effectively improved.

2 Data Optimization of Software Knowledge Base Operation and Maintenance Based on Cloud Computing

2.1 Cloud Computing-Based Knowledge Base Operation and Maintenance Data Association Algorithms

Operations and Maintenance Related Knowledge Base includes two parts: Operations and Maintenance Database and Data Retrieval System. In order to achieve the research goal of optimizing the Operations and Maintenance Data, the first step is to initialize the Operations and Maintenance Data Association in the Knowledge Base. In the construction of software knowledge base structure, the characteristic change period and stability of operation and maintenance data are mainly judged by the delay time and the quality of anti-interference factors in the operation and maintenance process [3]. Without considering the influence of interference factors for the time being, the longer the period of data feature change, the higher the accuracy of data extraction in software knowledge base.

According to the above principles, combined with the network optimization scheduling algorithm, the arbitrary change time of the data features in the knowledge base is set to α. If the data amount in the software knowledge base is n and the feature acquisition interference degree of the data amount is x, then using the feature distribution extraction principle, the initial feature change degree of the data can be effectively described by the algorithm. The specific calculation formula can be expressed as follows:

$$C_n(x) = \begin{cases} 1 - \left(\frac{x}{\alpha}\right)^{-\alpha}, x \geq \alpha \\ 0, 0 < x \end{cases} \tag{1}$$

According to the principle of the algorithm mentioned above, if the data stream ς in the software knowledge base DRC is processed by feature classification, If m is the common characteristic parameter of data, D is the data flow of data change in database HOL, and ϑ is the lowest tail parameter of data potential relevance. Then the probability algorithm for feature association of abnormal data can be described as:

$$S_m(x) = \begin{cases} \frac{[\vartheta * C(x)]^{\varsigma}}{[DRC\text{-}\mathrm{HOL}_{n-1}]^{\vartheta}} - \vartheta \\ \exp D * \left(\frac{\alpha - 1}{1 + \sqrt{n}}\right) \cdot \frac{[DRCn * C(x)]^{\varsigma}}{[\mathrm{HOL}_m]^{\vartheta}} \end{cases} \tag{2}$$

If the probability index of feature change of all data in knowledge base is t, the standard information association matching parameters of all data in data stream $\varsigma(x)$ and $\vartheta(x)$ can be obtained, which is expressed as [4, 5]:

$$A(n) = \begin{cases} S_m(x)[\alpha - t(n)] - 1, t_{\max}[n] > \alpha \\ S_m(x)[t(n) - 1] + \frac{t}{\alpha}, t_{\max}[n] < \alpha \end{cases} \tag{3}$$

According to the above algorithm, we can accurately grasp the relativity of operation and maintenance data in software knowledge base.

2.2 Software Knowledge Base Operation and Maintenance Data Anomaly Detection

In the process of operation and maintenance, a large number of abnormal data are easy to occur, which leads to the unrelated results of data operation and maintenance. This paper combines cloud computing method to optimize the database operation and maintenance management method [6, 7]. According to the acquisition of abnormal data features, the types and characteristics of abnormal data can be accurately judged and matched in the database, and the required knowledge data can be selected for comparison and correction, so as to complete the effective operation and maintenance of abnormal data. It is very important to collect the key parameters of abnormal data features in the process of abnormal data detection and correction. If there are errors in data acquisition, it will directly affect the effect of data association matching and operation and maintenance [8, 9]. Due to the relatively complex collection function of abnormal data, in order to facilitate subsequent operations, the spatial behavior of data is visualized, to promote the effective operation and maintenance of similar abnormal data in the future, and finally achieve the optimization of operation and maintenance of acid-base knowledge base data.

The spatial behavior of software knowledge base includes social behavior data, logical language behavior data and spatial movement behavior data. The steps of mining spatial behavior data are divided into four stages: spatial behavior data preparation, data mining, data presentation and data evaluation. The process is shown in Fig. 1.

In the process of mining the spatial behavior data of the operation and maintenance of the software knowledge base according to the above steps, the minimum support degree of data mining is assumed to be s and the minimum confidence degree to be C_0, and then the candidate item set will be obtained. If the support degree of the set is greater than or equal to the minimum support degree, it is called the frequent item set. The data in the database is scanned until no new candidate sets are generated.

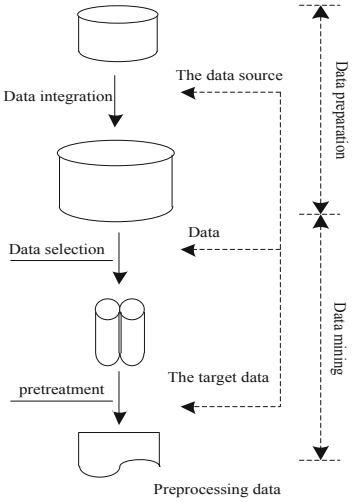


Fig. 1. Software knowledge base operation and maintenance data mining steps

According to the above software knowledge base operation and maintenance data mining steps, social behavior data is mined. Social data, topics, named entities and their associations are defined as hierarchical semantic model. Each message is defined as a node.

$$\prod = \{\mathrm{n{:}n} \in \mathrm{V_T}\} \tag{4}$$

Where n represents the message data in the spatial behavior data, and V_T is the message set of the same topic. The clustering graph obtained after partition traversal is represented by matrix vector, and the graph expression is shown in formula 2.

$$AG = \langle V_T, E_T \rangle \tag{5}$$

In Eq. (5), E_T is the classification relationship of named entities. According to the same mining method, the data of logical language behavior and spatial movement behavior in spatial behavior are mined, and the clustering fuses spatial behavior data to output the final mining results.

The spatial behavior data information in the operation and maintenance data of the software knowledge base is converted into the representation of the graph, so the spatial behavior trajectory needs to be transformed. The transformation process is divided into two steps, namely the generation of spatial behavior trajectory and the trajectory transformation. The generation of spatial behavior trajectory needs to calculate the distance of behavior and judge the direction of spatial behavior. When calculating the distance and direction, each node in the space needs to be traversed, and

the buffer of the path intersects to obtain the set L of spatial behavior, then the total distance length is also L, where the length coefficient between each two nodes is κ, then the overall direction value of spatial behavior is calculated as follows:

$$L_\alpha = \kappa_1\alpha_1 + \kappa_2\alpha_2 + \cdots + \kappa_n\alpha_n \tag{6}$$

The direction Angle of each space segment is α_n, the value of the direction Angle and the distance length value are calculated, and the result of the spatial behavior trajectory transformation of the operation and dimension data of the software knowledge base is finally obtained.

2.3 Implementation of Data Optimization for Operation and Maintenance of Software Knowledge Base

After completing the effective matching of massive data by using the knowledge base operation and maintenance data association algorithm, the abnormal data which failed to match is detected and corrected. After the correction of abnormal data is completed, the existing operation and maintenance system communication transmission technology is used to encrypt the operation and maintenance data and other aspects of management and transmission processing, so as to avoid the intrusion of aggressive data [10, 11]. Since the content of data operation and maintenance management is trivial, I will not make more statements here.

After data management and validation, the validation information is fed back to improve the accuracy, security and effectiveness of data operation and maintenance of software knowledge base. In order to effectively optimize the operation and maintenance data of software knowledge base, first of all, it is necessary to collect and analyze the data features, and add the corresponding functions of feature recognition, category analysis, data storage and retrieval of associated data into the structure of software knowledge base [12, 13]. By setting and optimizing data management module, feature classification change module (application layer) and data transmission and publishing management module (data support layer) in software knowledge base, the accurate feature extraction of different operation and maintenance data can be realized effectively. According to the acquisition characteristics to determine the correlation between data, and in the software database to complete the data transmission and management work. Integrating the previous ideas and algorithms, the data transmission process of operation and maintenance of software knowledge base is designed, and the following Fig. 2 is obtained.

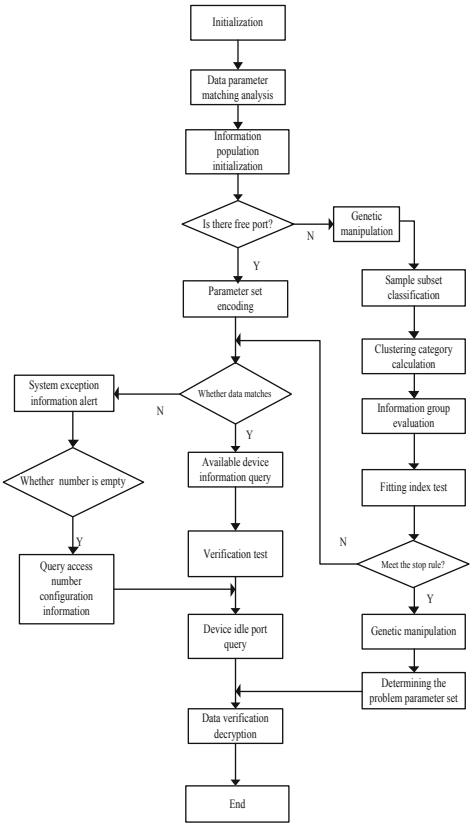


Fig. 2. Software knowledge base operation and maintenance data transmission process

As shown in the Fig. 2, combined with the previous method to optimize the software knowledge base operation and data transmission process, combined with data feature collection, data encryption and other technical principles, the process of data encryption transmission and decryption verification realizes the construction of IoT data movement operation and maintenance model Therefore, the abnormal data in the knowledge base is detected in time to achieve the goal of accurate collection and optimization of operation and maintenance data.

3 Analysis of Experimental Results

In order to verify the practical performance of the cloud computing-based software knowledge base operation and maintenance data optimization method, a simulation experiment was carried out, and the functional and non-functionality of the operation and maintenance system were compared and tested. In order to clarify the detection target, the problems in the test are corrected and perfected. Firstly, the data and

information system of the operation and maintenance system is recorded, and the following Table 1 is obtained.

Table 1. Operation and maintenance data optimization test standards

Purpose	Testing standard
Testing requirements	Reasonable layout and complete functions
	Information matching
Test procedure	Register log in Data authentication upload
	Functional operation detection
	Information detection
	Data authenticity detection
Test results	The match is reasonable and the test passes
	The data detection is complete without defects, the data is in line with expectations, the abnormal data is reduced, the matching degree is improved, and the functional test is passed

Experiments were performed according to the standardized data in the above table. The software knowledge base operation and maintenance data optimization method and the traditional operation and maintenance method are compared and verified by combining the cloud computing method. The operation and maintenance effects are judged by comparing and analyzing the data matching degree. The specific detection results are as follows (Fig. 3).

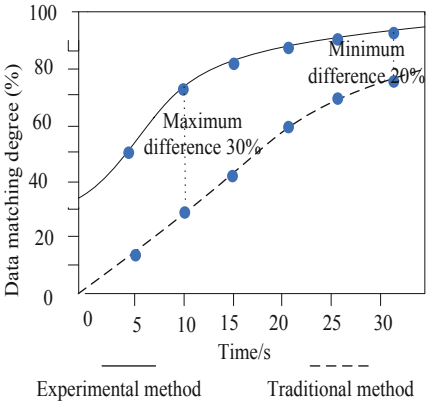
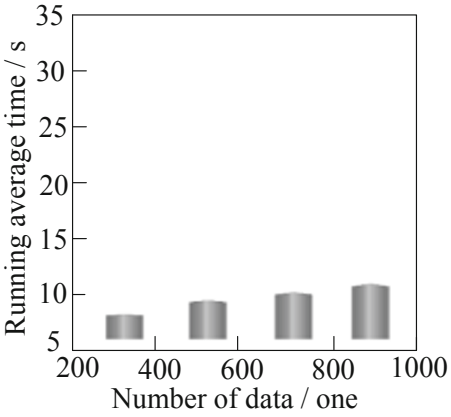


Fig. 3. Compare experimental test results

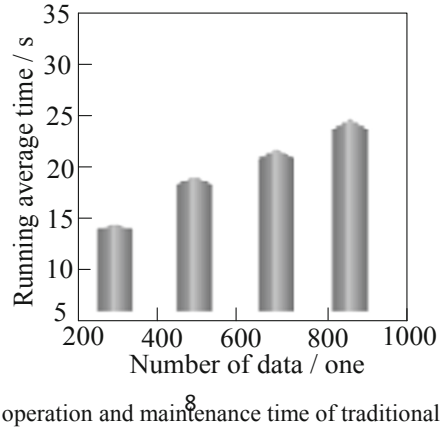
According to the above experimental results, it is not difficult to find that the data matching degree of the software knowledge base compared with the traditional method

is improved by the cloud computing method, and the overall matching situation is improved by 20%–30% compared with the traditional method. In the operation and maintenance process, the higher the data matching degree, the less the abnormal data is, and the higher the operation and maintenance effect is. Therefore, it is confirmed that the cloud computing method fully satisfies the research requirements of the software knowledge base data operation and maintenance method.

The proposed method is compared with the traditional method for data operation and maintenance (s). The experimental results are shown in the Fig. 4 below.



（a）The average maintenance time of the method presented in this paper



（b）Average operation and maintenance time of traditional methods

Fig. 4. Comparison of data operation and maintenance average time in different methods

Figure 4 shows the average data operation and maintenance time of the two methods under different data volumes. According to Fig. 4, with the increase of data volume, the running time of both methods increased. However, through comparison, it

can be seen that the running time of the traditional method is much higher than that of the proposed method, and the running time increases more during the experiment. By comparison, this method is superior to the traditional method and has higher data operation and maintenance efficiency.

4 Conclusions

The cloud computing method is used to innovate and optimize the software knowledge base of the software knowledge base to ensure the safe and reliable operation of the knowledge base. The comparison experiment is carried out to compare the optimization effect of the method. The experiment proves that the combination of cloud computing method has a strong practical value for the software knowledge base data operation and maintenance method, which can process data information more quickly and accurately, and ensure knowledge. The security and stability of the library data processing capabilities.

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References

1. Ding, Y.: Technical analysis of intelligent monitoring system for operation and maintenance data collection and business process of broadcasting system. Western Radio Telev. **426**(10), 189–190+193 (2018)
2. Jin, X., Yan, L., Liu, J., et al.: Fault analysis and operation research for enterprise database: taking Oracle Database as an example. Software **38**(10), 178–181 (2017)
3. Dou, J., Dai, F.: Research on operation and maintenance scheme of intelligent log analysis platform based on big data environment. J. Jiujiang Vocat. Tech. Coll. **25**(04), 96–98 (2017)
4. Simplicity, Jing, G., Hu, C., et al.: Software vulnerability detection algorithm for 8031 single chip microcomputer system based on vulnerability knowledge base. J. Beijing Inst. Technol. **34**(4), 371–375 (2017)
5. Zheng, P., Shuai, L., Arun, S., Khan, M.: Visual attention feature (VAF): a novel strategy for visual tracking based on cloud platform in intelligent surveillance systems. J. Parallel Distrib. Comput. **120**, 182–194 (2018)
6. Zhong, L., Guo, T., Zhang, M.: Design and implementation of online ceramic mineral resources management knowledge base based on LINGO. Intell. Comput. Appl. **36**(1), 68–71 (2018)
7. Liu, S., Li, Z., Zhang, Y., Cheng, X.: Introduction of key problems in long-distance learning and training. Mobile Netw. Appl. **24**(1), 1–4 (2018). https://doi.org/10.1007/s11036-018-1136-6

8. Wang, F.: Summary of technological innovation of broadcasting operation and maintenance data collection and process monitoring and processing system. Modern Telev. Technol. **34** (5), 138–141 (2017)
9. Zhao, C., Sun, L., Gao, X., et al.: Discussion on protection intelligent operation and maintenance technology based on source data maintenance mechanism. Power Grid Clean Energy **52**(09), 82–87 (2017)
10. Tan, L., Zhong, H.: Operation and maintenance practice of data center construction based on cloud computing model. Inf. Comput. (Theor. Ed.) **408**(14), 21–23 (2018)
11. Shuai, L., Weiling, B., Nianyin, Z., et al.: A fast fractal based compression for MRI images. IEEE Access **7**, 62412–62420 (2019)
12. Yang, Y., Zhang, S., Kang, Q.: Design of intelligent early warning system based on grid operation and maintenance data. Inner Mongolia Electric Power Technol. **35**(4), 20–23 (2017)
13. Shuai, L., Gelan, Y.: Advanced Hybrid Information Processing, pp. 1–594. Springer, New York