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A COMPUTER SYSTEM OPERATION AND MAINTENANCE INTERACTION PLATFORM BASED ON ARTIFICIAL INTELLIGENCE

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Abstract. To address the challenge of inefficient data management in computer operation and maintenance across various scales, the author suggests an artificial intelligence-driven platform for computer system operation and maintenance interaction. A computer operation and maintenance management approach has been devised, leveraging artificial intelligence technology. This method entails the segmentation of the computer operation and maintenance structure to efficiently manage signals transmitted by computers, ensuring swift signal transmission. With the integration of artificial intelligence, the approach achieves superior space utilization and data throughput. By comparing past computer operation and maintenance management methods. The experimental results show that the maximum space saving percentage can reach 75%, and the minimum is also higher than 40%. The throughput is the highest at various data scales, with an average throughput of 704.67 MB/s. The higher the average throughput value, the higher the management efficiency. Conclusion: Computer operation and maintenance management methods based on artificial intelligence technology have better management effects, can better save space, and improve management efficiency.

Key words: Artificial intelligence technology, Operation and maintenance management, Network intelligence

1. Introduction. As computer networks grow larger and data volumes increase, traditional network management and maintenance approaches fall short of meeting the demands of modern network environments. To tackle this issue, there's been a widespread adoption of artificial intelligence technology in computer network management, ushering in innovative solutions to address the evolving needs of networks[1]. Artificial intelligence can discover network faults and abnormal behaviors by learning and analyzing large amounts of network data, and provide precise network management and optimization strategies. Furthermore, artificial intelligence contributes to enhancing the security and reliability of networks while boosting the quality and efficiency of network services. The pivotal role of computer network technology in the advancement of modern society is underscored by its significant development and positive impact[2,3]. While bringing many conveniences, there are many security risks in the operation of computer networks, especially malicious attacks that can cause serious losses and pose a great threat to computer network security.

Artificial intelligence is a product of the healthy development of computer science. Introducing artificial intelligence technology into computer network operation and maintenance can improve the running speed of computers, help them achieve high-speed operation, and serve users to the maximum extent possible. Artificial intelligence technology encompasses a burgeoning scientific and technological domain dedicated to exploring and advancing theories, methods, technologies, and application systems aimed at replicating, augmenting, and broadening human intelligence. It endeavors to emulate the information processing capabilities of human consciousness and cognition. Hence, judicious utilization of artificial intelligence technology holds promise for more effectively serving users[4-6]. With the advancement of technology, artificial intelligence technology is constantly improving. Adding artificial intelligence technology to computer network operation and maintenance can not only improve data security, but also pose certain threats. Continuous in-depth research on artificial intelligence technology can effectively promote the progress of artificial intelligence, but also promote the progress of computer network technology and deepen network intelligence [7]. The design of a computer resource security monitoring and management system can monitor and manage computer network resources in real time, quickly locate and solve faults that occur, timely prevent security risks, and ensure the security of computer network resources.

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2. Literature Review. Artificial Intelligence (AI) is a technological science that utilizes computer technology to simulate and implement human intelligence. It simulates human thinking and intelligent behavior, enabling machines to have certain automation and intelligence capabilities, enabling them to reason, learn, judge, and make decisions like humans [8,9]. The core of artificial intelligence technology is machine learning, which enables machines to learn and extract patterns from large amounts of data by constructing and training models, thereby continuously optimizing and improving their performance. CHENSiyu et al. designed how to manage railway security systems more efficiently and comprehensively, and built an intelligent security operation and maintenance platform. This platform uses "CMDB" as the database for integrated operation and maintenance management of "supervision and control", achieving a unified security equipment asset configuration management library, integrated sharing of security information, standardization of security workflow management, real-time status monitoring of security equipment operation, environmental monitoring, intelligent identification of prohibited items, fault prediction and other functions. It improves the overall intelligence level of security equipment management, is conducive to detecting safety risks in station operation, improving security work efficiency, and ensuring the smooth and efficient operation of security work [10]. Li, W. et al. have pioneered the development of a distributed system merging mixed reality (MR) and Internet of Things (IoT). Their methodology involves two key steps: firstly, generating a digital model by integrating design blueprints with real-world environments, then constructing a Unified Perception Network (UPN) MR system using a game engine and the OpenXR platform. Secondly, they establish an IoT cloud platform, leveraging API collections and cloud services, to seamlessly interface with the MR system. Sensor data communication with MR devices is facilitated via the Socket method, while a Kalman algorithm-based data filtering model is employed to enable information exchange between on-site workers and backend managers[11]. ZONGPan et al. conducted a comprehensive and detailed analysis of the application of integrated operation and maintenance systems in airport luggage systems, and analyzed the advantages and design requirements of operational systems to improve the operational speed of airport luggage systems and the level of aviation information construction [12].

Entering the information society, human beings have increasingly high requirements for data processing. In order to meet the processing needs of massive data such as scientific and engineering calculations, supercomputers are widely used in various industries. Computer network operation and security management are very important and necessary, and should be given high attention. Computer information management should be done seriously, and risk management efforts should be strengthened. In response to potential security risks in computer networks, efforts should be made to highlight the important role of computer network operation, maintenance, and management. Computer information technology should be applied effectively to prevent common computer network security issues. At the same time, the computer network information security management system should be continuously optimized to achieve better computer network operation, maintenance, and security management.

3. Method.

3.1. Selection of Computer Operation and Maintenance Data Collector. In order to ensure that the system can obtain the most primitive data information, each component collects raw data from the system's hardware or software devices and stores it in the local database of the system. According to the operational needs of the system, the author selected the SCS2458-KF168-290 model data acquisition and transmission instrument as the data collector for the network operation and maintenance management system. This model of data collector has many interfaces, not only supporting communication and transmission functions such as GPES/4G/5G/Ethernet, but also supporting the unique IC165-5900 communication protocol in cloud computing environments. To bolster the online monitoring and early warning capabilities of the network operation and maintenance management system, a data collector is deployed to interface with diverse sensors within the network's operational environment. This collector gathers data from these sensors and subsequently uploads it to the network operation and maintenance server for analysis and processing[13]. Figure 3.1 is a schematic diagram of the connection of the network operation and maintenance data collector.

3.2. Selection of Computer Operation and Maintenance Data Memory. Considering the need for massive data storage, the author chose JF165-1650 model data storage as the storage hardware for massive data, with an output power of 48KHz and a normal operating voltage of 22V. This memory integrates 6

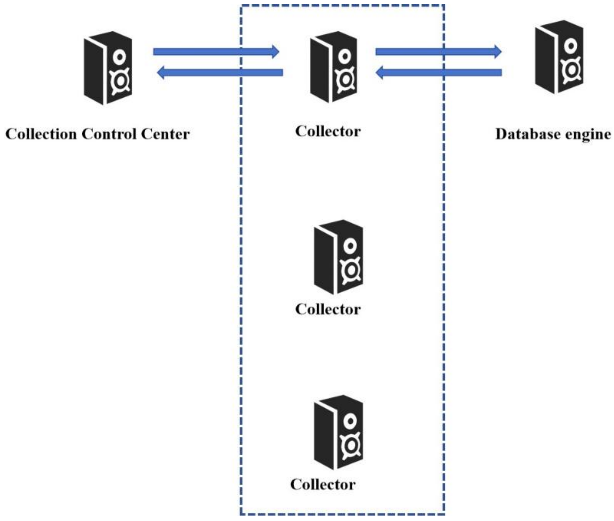

Fig. 3.1: Connection diagram of computer operation and maintenance data collector

labeled controller domain network bus interfaces, which can achieve real-time storage of computer operation and maintenance data by connecting other hardware structures to the controller domain network bus. At the same time, in order to ensure the stability of network operation and maintenance data storage and transmission, 6 analog data transmission paths and 2 universal input/output ports are reserved to meet the needs of data input and output.

3.3. Design of Computer Operation and Maintenance Data Storage Scheme. The basic function of computer operation and maintenance is to store massive amounts of data. Combining the above hardware conditions, the author designs a computer operation and maintenance data storage technology scheme based on digital twin technology [14]. Among them, the first type of data refers to data that describes the data structure. Generally, there is a data structure first, and then the relevant data information content is filled in. The second type of data is inconvenient to use, usually filled data and data without data structures, such as audio, video, images, etc. The third type of data contains implicit or irregular data, such as sound, graphic files, etc. The author uses MongEG as the storage database for the computer operation and maintenance management system, which can complete the storage of the three different types of data structures mentioned above. At the same time, MongEG supports a wide range of languages, and its syntax is closer to object-oriented query languages. Therefore, it can achieve most single table query functions, making it easier to quickly find the data resources that need to be queried during operation and maintenance.

3.4. Develop intelligent operation and maintenance cycles for network centers. Assuming that the maintenance cycle of the system throughout its entire lifespan is X, the interval between each operation and maintenance cycle should be Ti, where i is the number of operation and maintenance cycles, with values of i=1,2,3,..., n. In the previous cycle, when the information reliability of the network center exceeds the preset reliability threshold L, the system needs to automatically recognize and complete the maintenance of the network center; When the reliability threshold L is reached for the Nth time, it indicates that there is a problem with the network center at this time, and it is necessary to perform replacement operation and maintenance on the relevant modules; If the network center experiences failure during the operation and maintenance cycle, a minimum maintenance approach should be adopted to restore some of its problematic modules, in order to minimize operation and maintenance costs while ensuring the reliability of the network center operation [15]. Based on the above analysis, the formula for calculating the network operation and maintenance cycle is:

$$exp(\sum_{T_i} h_i(t)) = K(t) \tag{3.1}$$

In the formula, T_i represents the time interval of network operation and maintenance, represents the loss rate during the i-1st and i-th operation and maintenance cycles of the network center, and K (t) represents the running time of the network center. By setting the operation and maintenance cycle, the intelligent operation and maintenance of the network center are completed according to the big data based network operation and maintenance data storage technology scheme mentioned above, thereby ensuring the security of massive data in the cloud computing environment.

3.5. Managing Computer Signals. After dividing the computer operation and maintenance management structure, it is necessary to predict the transmission destination of computer signals, because predicting the transmission process and destination of computer signals in advance, planning the transmission path in advance, can save transmission time and improve computer transmission efficiency. In the actual work process, in order to ensure the effectiveness of computer operation, the setting of information transmission points will be minimized as much as possible. Although there are few information transmission points that cannot fully integrate various functions in the computer at once, if the signal receiving point moves, it will reduce the possibility of signal interruption. Therefore, in order to ensure the effectiveness of the computer during use, it is necessary to predict the direction of the transmitted network signals. The linear discrete state equation and observation equation of computer signals are represented as follows.

$$\begin{cases} A_k = f[A_{k-1}, k-1] + \omega[A_{k-1}, k-1] \cdot B_{k-1} \\ C_k = c[A_{k-1}, k] + D_k \end{cases} \tag{3.2}$$

In equation 3.2, A_k denotes the matrix characterizing the communication network's discrete state, while C_k represents the observation function associated with the communication network's discrete state, B_{k-1} represents the network noise matrix, and D_k represents the noise observed by the communication network in a discrete state. Communication network signals are mostly linear during transmission. Therefore, in the calculation process, the communication network signals need to be linearized to obtain the prediction equation for the direction of the communication network signals, as follows:

$$A_{k,k-1} = f[\widetilde{A}_{k-1}, k-1] \tag{3.3}$$

Equation 3.3 enables the calculation of the transmission dynamics of communication network signals, facilitating the determination of signal destinations. Moreover, it enhances the reliability of destination prediction. Once the calculation aligns with the actual conditions of the communication network, it enables effective management of ongoing signal transmissions within the network.

3.6. Calculation of operation and maintenance management indicators based on artificial intelligence technology. Utilizing equations 3.2 and 3.3, the signal transmission path can be determined, and the prediction error arising during the transmission process can be computed. This function can be expressed as follows:

$$S = E[\widetilde{A}_k, \widetilde{A}_k^T] \tag{3.4}$$

In equation 3.4, $\widetilde{A}_k$ represents the possible error value of signal k during transmission, and the effectiveness of the transmission process can be determined based on the results.

In practical management work, data from multiple inspection points can be transmitted to the data center, and then analyzed and statistically analyzed through the data center, and various problems that arise in the computer can be handled. Afterwards, if similar problems occur again, they can be quickly addressed based on past experience to ensure the transmission efficiency of the computer.

In addition, in computer operation and maintenance management, identifying faults that occur during the communication process is also a major challenge. Previous communication methods cannot quickly locate communication faults, which may lead to communication network interruptions and cause huge losses [16].

For small networks, signal transformation is often used to determine the fault point. However, for some large-scale communication networks with long-distance transmission, using this method to locate the fault point poses certain difficulties. Hence, to enhance the efficiency and precision of fault detection and expedite troubleshooting

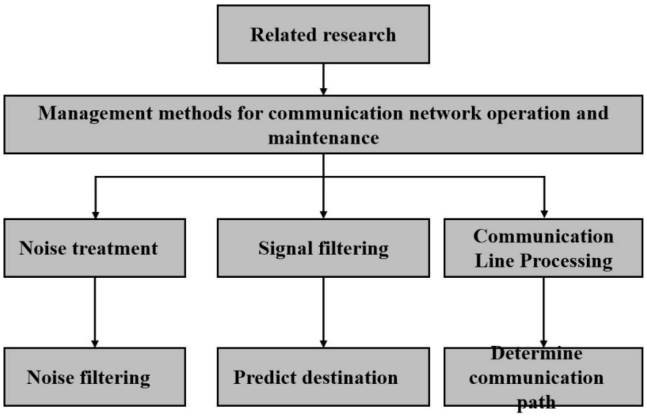

Fig. 3.2: Division of Communication Network Operation and Maintenance Management Process

during computer operation, the integration of artificial intelligence technology becomes imperative. Leveraging artificial intelligence, the author can pinpoint network faults, assess the performance of communication network operation and maintenance management methods, and compute indicator values to evaluate their efficacy. The detailed calculation process unfolds as follows:

$$P = \frac{\sum_{k=1}^{n} S_k}{\sqrt[n]{S_K}} \tag{3.5}$$

Equation 3.5 encapsulates the iteration count of communication network signal transmission denoted by 'n', while 'P' signifies the specific numerical value of the operation and maintenance management method indicator. Through computation of these numerical values, the rationality of the operation and maintenance management method can be assessed, thereby validating its efficacy.

3.7. Refine the communication network operation and maintenance management structure. In order to better carry out communication network operation and maintenance management work, the process of communication network operation and maintenance management can be refined. For various problems that may arise during the process, the author proposes targeted suggestions and solutions to make the communication network operate better. The specific division of the communication network operation and maintenance management structure is shown in Figure 3.2.

Drawing from an analysis of historical trends in communication network user growth and usage patterns, and in alignment with practical requirements, a streamlined operation and maintenance management process for the communication network is devised [17]. In practical implementation, the signal transmitted through the communication network undergoes noise processing as a preliminary step, as depicted in Figure 3.3.

Using wavelet denoising method to process signals, avoiding the transmission speed of signals not being fast enough due to the presence of noise during subsequent transmission, and preventing users from receiving information quickly. After dealing with signal noise, filter the transmitted signal to reduce unnecessary signal interference with communication quality. In addition, for noisy signals transmitted in, certain corrections should be made to ensure the correctness of signal transmission. In addition, after noise processing and signal filtering, it is necessary to process the path where the signal is about to be transmitted. By analyzing and diagnosing the communication line, the subsequent communication path can be determined, which can make the signal transmission process more accurate and rapid [18].

By calculating the numerical values of operation and maintenance management, it is possible to verify whether the operation and maintenance management method is reasonable. In summary, the design content is integrated to ensure that each part is interrelated and independent, and applied to the calculation of communication network operation and maintenance management method indicators. The communication network operation and maintenance management method is designed, as shown in Figure 3.4.

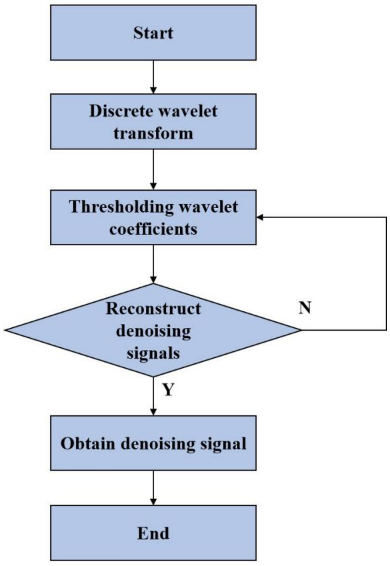

Fig. 3.3: Communication Network Signal Noise Processing Process

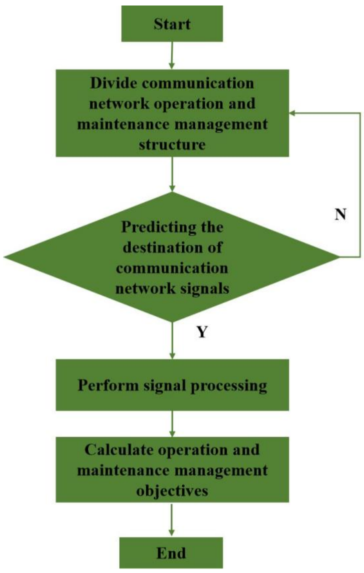

Fig. 3.4: Communication Network Operation and Maintenance Management Flowchart

3.8. Experimental Preparation. In order to objectively analyze the effectiveness of computer operation and maintenance management methods based on artificial intelligence technology, the author conducted simulation experiments. The testing environment is built on a Windows system, with MySQL as the database and Java as the main language used for backend development. The Angular framework is mainly used for frontend development, as shown in Figure 3.5. The dashed box represents the application, where users interact with the application and transmit data through the server.

4. Results and Discussion. Table 4.1 provides a comparative analysis of the efficacy of four operation and maintenance management methods employing signal acquisition and reception equipment alongside high-

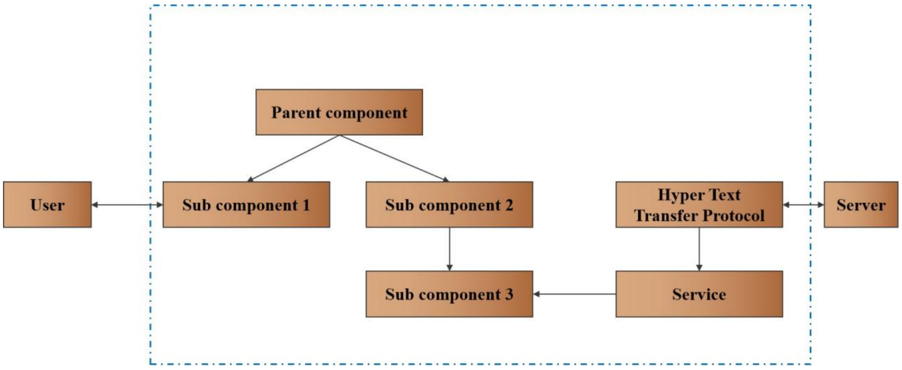

Fig. 3.5: Angular framework structure

Table 4.1: Space savings percentage of four management methods under different data scales/unit:%

Data scale	Method 1	Method 2	Method 3	Method 4
1000	45.1	40.5	40.3	39.1
2000	48.4	43.2	40.5	38.2
3000	47.5	45.4	43.2	40.5
4000	50.5	45.2	40.4	38.5
5000	60.2	50.2	45.7	42.4
6000	75.3	60.3	55.4	49.7

Table 4.2: Throughput of Four Management Methods at Different Data Scales Unit: MB/s

Data scale	Method 1	Method 2	Method 3	Method 4
1000	801	705	681	651
2000	751	685	674	643
3000	651	635	602	597
4000	749	723	705	684
5000	601	651	634	603
6000	683	661	652	635

precision time measuring instruments. Method 1, devised by the author, utilizes artificial intelligence technology for computer operation and maintenance management. Method 2 employs big data for management purposes, while Method 3 relies on neural networks. Finally, Method 4 represents the conventional approach to computer operation and maintenance management.

Comparative analysis shows that Method 1 can save up to 75% of space, while Method 2 can save up to 60% of space, Method 3 can save up to 55% of space, and Method 4 can save up to 49% of space, therefore, compared to other management methods, Method 1 has a higher percentage of space savings and better compression effect[19]. Note that, in practical applications, the computer operation and maintenance management method based on artificial intelligence technology designed by the author has a higher percentage of space savings, lower data transmission costs, better space savings, and better management effects.

In computer operation and maintenance management, the size of incoming signal data directly impacts the overall effectiveness of the management method. To assess the efficacy of operation and maintenance management methods across various data scales, four management approaches are compared based on data throughput. The throughput results are detailed in Table 4.2.

According to Table 4.2, Method 1 has the highest throughput for each data scale, with an average throughput of 704.67 MB/s. The higher the average throughput value, the higher the management efficiency. Although Method 2 has similar throughput to Method 1 for different data scales, there is still a certain gap, with an average throughput of 673.33 MB/s. Method 3 has relatively less data throughput compared to the first two methods, with an average throughput of 655.5 MB/s. Method 4 has the lowest average throughput, which is 633 MB/s. In summary, the computer operation and maintenance management method based on artificial intelligence technology designed by the author has higher data throughput, greater space savings, higher management efficiency, and better management effects at different data scales[20]. Through the above two experiments, it can be seen that in practical applications, compared with traditional operation and maintenance management methods, the operation and maintenance management method based on artificial intelligence technology designed by the author can better save space, transmit data faster, improve management efficiency, and achieve better management results at different data scales.

5. Conclusion. The author proposes a computer system operation and maintenance interaction platform based on artificial intelligence. Artificial intelligence technology has strong data analysis capabilities and can analyze various states and behaviors of computers. Applying it to computer operation and maintenance management will bring huge changes to computer operation and maintenance management. The computer operation and maintenance management method based on artificial intelligence technology designed by the author can effectively improve network management efficiency and ensure network reliability. Although there are some shortcomings, with the continuous improvement of artificial intelligence technology in China, these shortcomings will gradually be made up for.

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