

Application and Practice of AI-based Intelligent Operation and Maintenance Systems in University Informatization

Wang Weijie, Luo Dabiao

Information Network Center, Chengdu University, Chengdu, China

Keywords: AI Technology; Intelligent Operation and Maintenance; Informatization Construction; Automation

Abstract: This paper explores the application and practice of AI-based intelligent operation and maintenance (O&M) systems in university informatization. It analyzes the advantages of AI-driven O&M systems in enhancing operational efficiency, reducing manual intervention, and optimizing resource allocation. The article introduces the basic concepts of AI-driven intelligent O&M systems and their specific application scenarios in universities, demonstrating how these systems improve efficiency and quality through concrete case studies. It also discusses the challenges faced in current implementations and proposes strategies for addressing them. The research concludes that AI technology will provide more efficient and intelligent O&M support for university informatization, ushering in a new era of smart development in university information systems.

1. Introduction

The informatization of universities plays a pivotal role in advancing educational modernization and refining management processes. However, as information systems grow increasingly complex and management pressure escalates, traditional manual operation and maintenance models can no longer meet the demands. Leveraging the capabilities of AI-driven intelligent O&M systems, with their automation, efficiency, and adaptability, presents a vital solution to these challenges. This paper delves into the concept and key technologies of intelligent O&M systems, exploring their practical applications and outcomes in university environments. Through machine learning, data analysis, and automation, AI technology not only enhances operational efficiency and reduces labor costs but also strengthens the stability and security of university information systems. The analysis of real-world cases reveals the significant role intelligent O&M plays in university informatization and highlights its potential for future development [1].

2. The Development Status of AI in University Informatization

2.1 Background and Challenges of University Informatization

With the rapid advancement of information technology, university informatization has become a cornerstone for enhancing educational quality and management efficiency. By leveraging modern information technologies, universities can optimize resource allocation, elevate teaching and research

standards, and implement intelligent management. However, the path to full informatization is fraught with challenges. Firstly, the expansion of educational scales has intensified the pressure on information system management, rendering traditional manual maintenance models inadequate. Secondly, the increasing complexity of information systems complicates the integration and protection of software and hardware resources. Thirdly, limited financial and technological resources in some universities have delayed the informatization process, preventing them from fully realizing the potential of technology. To address these challenges, the transformation and upgrading of university informatization must be driven by emerging technologies, particularly AI [2].

2.2 The Development and Application Trends of AI Technology

The remarkable advancements in AI, particularly in machine learning, deep learning, and natural language processing, have instigated profound transformations across industries. In the realm of informatization, AI provides efficient data analysis and automated processing solutions, demonstrating exceptional capabilities in intelligent decision-making support and predictive maintenance. The application of AI in university informatization is diversifying, offering solutions that not only optimize resource allocation and improve management efficiency but also autonomously detect and rectify system issues, reducing the need for manual intervention and mitigating associated risks. As 5G and IoT technologies evolve, the integration of AI with these cutting-edge technologies will further propel the intelligent development of university informatization. The future holds vast potential for AI to deepen its role in university informatization [3].

2.3 The Potential and Prospects of AI in Higher Education Informatization

The potential of AI in university informatization is primarily reflected in the realms of intelligent operation and maintenance, smart teaching, and data analytics. Firstly, AI enables real-time monitoring of system status, automatically detecting and repairing faults, alleviating operational pressure on informatization departments, and enhancing system stability. Secondly, in the domain of smart teaching, AI can analyze student behavior and academic performance, tailoring personalized learning plans and fostering educational innovation. In the future, AI will expand its applications to drive intelligent campus management, promote system interoperability, and enable self-optimization and intelligent decision-making. Moreover, AI will facilitate data value mining, offering scientific insights for decision-makers. Thus, the application prospects of AI are vast, providing universities with more intelligent and efficient solutions for informatization construction [4].

3. Overview and Key Technologies of Intelligent Operation and Maintenance (O&M) Systems

3.1 Basic Concepts and Framework of Intelligent O&M Systems

Intelligent operation and maintenance (O&M) systems leverage artificial intelligence (AI) technologies to enable the automated monitoring, fault diagnosis, predictive analytics, and self-repair of IT systems, devices, and networks. Through the integration of data collection, machine learning, and automation, these systems provide real-time monitoring of system health and early fault detection, reducing the need for manual intervention while enhancing operational efficiency. The core framework of an intelligent O&M system typically comprises several layers: the data collection layer, which gathers monitoring data; the data analysis layer, where machine learning and data mining techniques are applied to identify potential risks; the decision support layer, which generates optimization recommendations or operational instructions; and the execution response layer,

responsible for carrying out tasks such as fault repair and resource allocation. The implementation of intelligent O&M systems substantially reduces operational costs and labor expenditures, while simultaneously boosting the stability and efficiency of IT infrastructure.

3.2 Machine Learning and Data Analytics

Machine learning and data analysis represent the core technologies underpinning intelligent O&M systems, facilitating fault diagnosis, performance optimization, and self-repair capabilities. Firstly, machine learning algorithms analyze historical data to identify system fault patterns and optimize them, thereby improving the accuracy of fault prediction and enabling automated fault detection and resolution. Secondly, data analysis, through the in-depth exploration of large datasets, assists in pinpointing system bottlenecks and provides vital decision support. For instance, intelligent O&M systems may predict potential faults by correlating monitoring data with user behavior, and make proactive adjustments. By incorporating deep learning techniques, such systems are also capable of autonomously learning and responding to previously unknown issues, thus enhancing the system's self-repair capabilities and its overall level of intelligence. As technological advancements continue, machine learning and data analysis will play an increasingly prominent role in the informatization management of universities [5].

3.3 Comparison between AI-driven and Traditional O&M Models

There is a stark contrast between AI-driven intelligent O&M systems and traditional maintenance models. On the one hand, traditional O&M models primarily rely on manual monitoring and experiential judgment, with maintenance personnel tasked with troubleshooting and resolving issues one by one based on alarm notifications. This approach is not only time-consuming and labor-intensive but also prone to human error, potentially resulting in the missed opportunity to address issues at their most optimal stage. In contrast, AI-driven O&M systems continuously monitor system health through real-time data surveillance, machine learning algorithms, and automated responses. These systems offer early-stage fault alerts and, in certain cases, can autonomously perform repairs, thereby reducing the need for human intervention and significantly improving operational efficiency and response times. On the other hand, compared to traditional models, AI-powered O&M systems are capable of handling more complex operational tasks, with a high degree of adaptability. They can autonomously optimize solutions when confronted with previously unknown faults. By integrating AI technologies into traditional O&M workflows, intelligent O&M systems not only enhance fault response speed but also ensure continuous system optimization and intelligent management, thus providing universities with more advanced and efficient operational support for their informatization initiatives.

4. Applications of AI-driven Intelligent Operation and Maintenance (O&M) Systems in Higher Education

4.1 Specific Application Scenarios of Intelligent O&M Systems in University Informatization

In the context of university informatization, intelligent operation and maintenance (O&M) systems, through automation and intelligent technologies, significantly enhance operational management efficiency while alleviating the pressures faced by informatization departments. One prominent application is within the monitoring and management of educational systems. On one hand, AI technologies enable real-time monitoring of platforms such as teaching systems and online educational resources, automatically detecting any anomalies within the system. For example, when a

teaching platform experiences access delays or operational failures, the AI system can immediately identify the issue and execute corrective measures. Moreover, the system can preemptively issue alerts based on historical data analysis, even before a fault occurs. On the other hand, intelligent O&M systems play a critical role in university network security management. By analyzing network traffic and user data access behavior, AI can identify potential security vulnerabilities or malicious attacks, automatically blocking abnormal access requests and thereby reducing the likelihood of cybersecurity incidents. Additionally, intelligent O&M systems are instrumental in administrative systems such as student enrollment management and financial administration. Through data mining and automated report generation, these systems assist managers in promptly identifying data anomalies, thus improving operational efficiency and decision-making quality. These specific application scenarios underscore the increasingly significant role of AI in university informatization, enhancing system stability, security, and optimizing resource allocation.

4.2 Practical Case Studies on Improving System Efficiency and O&M Quality

At a certain university, the informatization department introduced an AI-driven intelligent O&M system into its teaching resource management platform, achieving automated operations and significantly improving system efficiency and O&M quality. One aspect of this improvement is that the system employs deep learning algorithms to analyze platform usage patterns and operational data in real-time, identifying potential bottlenecks and issues, and automatically making optimization adjustments. For instance, the system can predict peak traffic periods based on students' online learning behaviors and preemptively allocate resources to ensure the platform operates efficiently even during surges in user activity. Additionally, the intelligent O&M system utilizes machine learning techniques to analyze historical maintenance data, enabling the precise identification and rectification of common faults, which in turn reduces the reliance on manual interventions. In terms of data storage and backup management, the system automates regular backups of teaching data, while intelligent data cleaning functionalities prevent wasteful consumption of storage resources, thereby enhancing system performance and resource utilization. This case study not only improved the stability and responsiveness of the platform but also effectively reduced manual O&M costs, offering a feasible technical solution for advancing university informatization.

4.3 Challenges and Solutions in Application

Despite the numerous advantages that AI-driven intelligent O&M systems bring to university informatization, several challenges remain in practical implementation. One significant issue is the problem of data quality and integration. University informatization systems typically consist of multiple subsystems, each with its own data formats and structures, creating substantial difficulties when attempting to integrate and analyze data. To address this challenge, several strategies can be employed. First, universities can adopt standardized data interfaces and formats, using data preprocessing technologies to ensure data consistency and usability. Second, the application of AI technology requires vast amounts of training data and high-quality algorithmic models, which may present challenges for university informatization departments with limited technical capabilities and resources. In this regard, universities can collaborate with AI technology vendors to leverage external technical support or establish internal AI research teams to cultivate technological talent and gradually enhance the system's self-reliant research and development capacity. Third, the implementation of intelligent O&M systems also faces adaptation challenges among faculty and students, with some individuals potentially exhibiting resistance to new technologies. To mitigate this issue, universities can implement comprehensive training and awareness campaigns to increase user understanding and acceptance of the new systems. Despite the challenges, with well-designed

strategies and robust technical support, AI-driven intelligent O&M systems hold immense potential in transforming university informatization, paving the way for higher levels of advancement in digital campus development.

5. The Future Development of AI-driven Intelligent Operation and Maintenance (O&M)

5.1 Future Application Trends of AI Technology in University Informatization

With the continuous advancement of AI technology, the future of university informatization systems will increasingly depend on intelligent operation and maintenance (O&M) solutions to enhance educational quality and management efficiency. On the one hand, AI will play an even more pivotal role in data processing, intelligent analysis, predictive analytics, and decision support. In the future, AI technologies are expected to be extensively applied in areas such as smart classrooms, personalized learning, and smart campus management. For example, by analyzing student learning data, AI can tailor individualized learning paths for each student, thereby improving the targeting and effectiveness of instruction. In the realm of educational resource management, AI can monitor and schedule network bandwidth, storage, and computational resources in real-time, ensuring the stability of teaching platforms even during periods of high traffic and concurrent access. On the other hand, with the integration of 5G and Internet of Things (IoT) technologies, AI will play a key role in the development of smart campuses, providing more efficient and secure operation and maintenance solutions through intelligent facility management and real-time environmental monitoring.

5.2 Innovations and Development Directions of Intelligent O&M Systems

The future trajectory of intelligent O&M systems will be towards higher levels of automation and intelligence. On one side, with advancements in deep learning and reinforcement learning technologies, intelligent O&M systems will possess greater self-adaptive capabilities, enabling them to recognize and address complex problems without human intervention. At the same time, AI will become more deeply embedded in areas such as fault prediction, diagnostic assessment, and autonomous repair, thereby improving the predictive capabilities and response speeds of O&M systems. With the integration of cloud computing and big data technologies, intelligent O&M systems will be able to perform more precise resource scheduling and optimization, offering flexible, scalable solutions for university informatization systems. Moreover, innovation in intelligent O&M will also manifest in the systems' ability to self-learn and self-optimize. Drawing upon historical data and real-time feedback, these systems will continuously refine their decision-making and operational strategies, leading to improved overall efficiency and system stability.

5.3 The Vision of Deep Integration Between University Informatization and Intelligent O&M Systems

In the future, university informatization and intelligent O&M systems will undergo a deeper integration, driving the comprehensive smart evolution of university management. On one hand, AI will no longer serve merely as a technological support tool, but will become a core component of decision-making and management processes, comprehensively enhancing the efficiency and quality of various university activities, including teaching, research, and administration. Through intelligent O&M systems, university informatization platforms will achieve round-the-clock, autonomous management and optimization, significantly reducing the workload of informatization departments while improving operational quality and response times. On the other hand, intelligent O&M will deeply integrate with the university's overall informatization infrastructure, creating an

interconnected, collaborative system ecosystem that ensures seamless connections and resource sharing between systems. This deep integration will enable universities to provide smarter, more efficient, and secure environments for learning and work, driving sustained innovation and development in the smart age.

6. Conclusions

AI-driven intelligent O&M systems provide innovative solutions for the informatization of universities, greatly enhancing the management efficiency and security of information systems. Through intelligent monitoring, fault prediction, and autonomous repair functionalities, AI not only reduces the need for human intervention but also optimizes system operation efficiency. While challenges related to data integration, technical support, and user acceptance still persist in practical applications, the continuous development of technology and the accumulation of application experience will ensure that intelligent O&M systems play an increasingly significant role in university informatization. As AI and university informatization become more deeply integrated, they will drive the intelligent upgrading of educational management and teaching models, providing robust support for the long-term development of universities.

References

- [1] Ren, Y., Liu, Y., Jie, L., et al. (2023). Substation safety operation and maintenance system based on AI and intelligent video analysis technology. *Automation Technology and Applications*, 42(7), 174-178.
- [2] Sun, Y. (2023). Research and application of the AI-based intelligent operation and maintenance (AIOps) alarm model. In *Proceedings of the 2022 Annual Academic Conference of the Inner Mongolia Communication Society* (pp. 100-105). Inner Mongolia Communication Society.
- [3] Sun, Y. (2023). Research and application of the AI-based intelligent operation and maintenance (AIOps) alarm model. In *Proceedings of the 17th Annual Academic Conference of Inner Mongolia Natural Science, Subsession and the 2022 Annual Academic Conference of Inner Mongolia Communication Society* (pp. 112-117). China Telecom Inner Mongolia Branch, Big Data and AI Center.
- [4] Ye, Y., Li, X., Li, Q., et al. (2023). Exploration of the application of deep learning-based artificial intelligence system (endoscope genie) in the gastroenterology graduate student gastroscopy learning. *Modern Digestive and Interventional Therapy*, 28(2), 216-220.
- [5] Peng, Y., Chen, Y., & Zhang, F. (2023). Intelligent operation and maintenance and security system of substations based on information fusion technology. *Manufacturing Automation*, 45(9), 84-88.