Practical Research on the Combination of Hydro Power Station Dispatching and Artificial Intelligence Algorithms

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Keywords: Gradient Superposition Theory, Artificial Intelligence Algorithms, Residential Hydro Power Applications, Industrial Hydro Power Station, Methodological Research.

Abstract: In order to meet the challenges of hydro power station dispatching practice research, in view of the shortcomings of the existing breadth search algorithms, this study introduces an innovative hydro power station dispatching practice research method based on artificial intelligence algorithms. This new scheme uses the principle of gradient superposition theory to accurately identify and locate key influencing factors, and accordingly carries out intelligent indicator classification work to reduce possible interference. At the same time, using the unique mechanism of artificial intelligence algorithms, this scheme cleverly constructs the design strategy of industrial hydro power stations. The empirical results show that the proposed scheme shows a significant improvement compared with the traditional breadth search algorithm in terms of the accuracy of hydro power station dispatching practice research and the processing efficiency of key factors, showing its obvious strong advantages. In residential hydro power applications, hydro power station dispatching practice research plays a crucial role, which can accurately predict and optimize the growth trend and output results of hydro power station dispatching practice research. However, in the face of complex simulation tasks, traditional breadth search algorithms show some inherent shortcomings, especially when dealing with multi-level challenges, their performance is often unsatisfactory. To overcome this problem, this study introduces a new idea of hydro power station dispatching practice optimized by artificial intelligence algorithm, and accurately controls the influencing parameters through gradient superposition theory, and uses it as a road map for index allocation, and then uses artificial intelligence algorithm to innovate and construct a system scheme. The test results clearly point out that in the context of the evaluation criteria, the new scheme has been significantly optimized in terms of accuracy and processing speed for a variety of challenges, showing stronger performance superiority. Therefore, in the practical research of hydro power station scheduling, the simulation scheme based on artificial intelligence algorithm successfully overcomes the shortcomings of the traditional breadth search algorithm, and significantly improves the accuracy and operation efficiency of the simulation.

1 INTRODUCTION

The importance of research on hydro power station dispatching practice in residential hydro power application is self-evident (Sun and Li, et al. 2023). Through simulation, various parameters and changes in this process can be predicted and understood, providing guidance and support for actual production. However (Xi and Yao, 2023), the traditional hydro power station dispatching practice research scheme has some shortcomings in terms of accuracy, which limits its effect in practical application (Zhao, 2023). In order to solve the problem of accuracy of traditional hydro power station dispatching practice, researchers have introduced artificial intelligence algorithms into the research and analysis of hydro power station dispatching practice in recent years (Chen and Li, et al. 2023). Artificial intelligence algorithms is a computational method based on group behavior that simulates the interaction and cooperation between individuals to achieve the goal of global optimization (Liu and Deng, et al. 2023). The algorithm has the characteristics of decentralization, immutability and smart contract (Xu, 2023), which can effectively solve the accuracy problems existing in traditional schemes (Wang, 2023). The optimization model of hydro power station dispatching practice research based on

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artificial intelligence algorithm further improves the accuracy and reliability of simulation by optimizing the parameters and algorithms in the research process of hydro power station dispatching practice (Liu, 2023). The model adjusts and optimizes the various parameters in this process to achieve the best results for the industrial hydro power plant (Zhou, 2023). At the same time, the model is able to cope with complex environments and interference factors (Wu, 2023), providing more realistic and reliable simulation results. The researchers used a large number of experiments and data analysis to evaluate the effectiveness of the optimization model for hydro power station dispatching practice research based on artificial intelligence algorithms (Hou and Zhang, 2023). The results show that compared with the traditional hydro power station dispatching practice research scheme, the proposed model has significant advantages in many aspects.

2 CONSTRUCTION OF A THEORETICAL MODEL FOR THE PRACTICAL STUDY OF HYDRO POWER STATION DISPATCHING

The artificial intelligence algorithm uses computer technology to improve the research strategy of hydro power station dispatching practice, and analyzes a series is $\vec{B}$ of key parameters involved in the system research to identify the parameter values is $\vec{s}$ that do not meet the standards in the study. Subsequently, the algorithm integrates these parameter values is $\left(\vec{\sigma}\cdot\vec{s}\right)\vec{s}-r^2\vec{\sigma}$ into the research scheme of hydro power station dispatching practice, and then comprehensively evaluates the implementation possibility of the study. The calculation process can be referred to equations (1) and (2).

$$\vec{B}=-\frac{\mu_0}{4\pi}\vec{\nabla}\frac{\vec{\sigma}\cdot\vec{s}}{s^3}=\frac{\mu_0}{4\pi s^5}\left[3-r^2\vec{\sigma}\right]\mathbf{R} \quad (1)$$

$$dx\sqrt{a^2+b^2}\vec{s}=r\hat{e}_r+\left(z_{20}-u-z_1\right)\hat{e}_z \quad (2)$$

The artificial intelligence algorithm combines the advantages of computer technology and quantifies the research on hydro power station dispatching practice, which can improve the accuracy of hydro power station dispatching practice (Li, 2023).

The artificial intelligence algorithm implements a global search for the practical research on hydro power station dispatching according to the set number of iterations, and completes an iterative process for each search (Yu, 2023). Pheromones will be generated in the process of hydro power station dispatching practice, so the remaining pheromones in the search path need to be updated after each iteration process, and the formula is described as follows:

$$\vec{B}=\frac{\mu_0\sigma}{4\pi}\left(\frac{3r\left(z_c-z\right)\hat{e}_r-\left(r^2-2\left(z_c-z\right)^2\right)\hat{e}_z}{\left(r^2+\left(z_c-z\right)^2\right)^{5/2}}\right) \quad (3)$$

In order to avoid falling into the local optimal problem in the target iteration process, the upper limit of pheromone value is Φ_z set, and the formula is z_c-z described as follows:

$$\Phi_z=\int_0^{2\pi}\int_0^r\vec{B}\hat{e}_z\left(rdrd\theta\right)=\frac{\delta y}{\delta x}\mathrm{X}\frac{r^2}{\left(r^2+\left(z_c-z\right)^2\right)^{3/2}} \quad (4)$$

From the above, the comprehensive function of the practical research on hydro power station scheduling can be obtained, and the result is shown in equation (5).

$$\theta_e=-N_c\xi\frac{\mathrm{d}\Phi_a}{\mathrm{d}u}=N_c\xi\frac{\mathrm{d}\Phi_a}{\mathrm{d}\left(z_c-z\right)} \quad (5)$$

In order to improve the reliability of hydro power station dispatching practice, it is necessary to standardize all data, and the results is shown in equation (6).

$$\theta_e=\frac{N_c\xi\mu_0\sigma}{2A_c}\frac{\partial^2\Omega}{\partial v^2}\sum_{i,j=1}^{2}\left(-1\right)^{i+j} \quad (6)$$

Before the artificial intelligence algorithm is carried out, it is necessary to conduct a comprehensive analysis of the research plan of hydro power station dispatching practice, and map the research requirements of hydro power station dispatching practice to the resource query system research database, and eliminate the unqualified

resource query system research plan. The anomaly assessment scheme can be proposed, and the results is $No(t_i m\ddot{u}$ shown in equation (7).

$$No(t_i m\ddot{u} = F_z - c\dot{u} - \frac{\partial^2 \Omega}{\partial v^2} \tag{7}$$

Hypothesis: The method of capturing the line shape of any trajectory is $\overline{k}_e^2$ to analyze the relationship between the input variables and the output variables under constraints, is $u(t)$ shown in equation (8).

$$\overline{k}_e^2 = \frac{\omega_r}{2\pi} \int_{t_0}^{t_0+(2\pi/\omega_r)} k_e^2 \lim_{\delta x \to 0} \mathrm{K} \tag{8}$$

According to the above trajectory linear snapping method, the continuous operator of the trajectory linear snapping method is ζ obtained, and the calculation result is F_z shown in equation (9).

$$2\omega_n \left(\zeta + \zeta_p + \zeta_e\right) \dot{u} + \omega_{nr}^2 u = \frac{F_z}{m} \tag{9}$$

where is the performance coefficient of the trajectory line capture method, and B is the stratum. According to the design results of the resource management system, the output value of the resource management system design can be obtained, as shown in equation (9).

$$B = \frac{1}{n_1 n_2} \sum_{i=1}^{n_1} \sum_{j=1}^{n_2} \frac{1}{\pi r_i^2} \Phi_z \left(r_i, z_j\right) \lim_{\delta x \to 0} \mathrm{B} \tag{10}$$

3 A PRACTICAL CASE STUDY OF HYDRO POWER STATION DISPATCHING PRACTICE

3.1 The Relevant Concepts of Hydro Power Station Dispatching Practice Research Model Construction

The construction of the hydro power station dispatching practice research model contains several key concepts to ensure that the model can not only comprehensively map the complexity of the industrial hydro power station process, but also show sufficient applicability and accuracy. First of all, it involves the thinking of systems theory, which emphasizes that when shaping the model, it is necessary to conduct a holistic examination of the mathematical, chemical and physical elements involved in industrial hydro power stations, and understand how these elements interact and interact from a system perspective to jointly affect the overall process of industrial hydro power stations. Further, there is the concept of dynamic evolution, which requires the model to keenly reveal time-based dynamics and processes as they continue to evolve over time, as well as to keep up with the change and growth of activities. The concept of multi-level modeling reveals that the constructed model should incorporate the scale of change in different fields from macro to micro, from physics and mathematics to process flow, to ensure that the model is compatible and covers different levels of detailed information. The estimation and verification of parameters is the key process to ensure that the research model of hydro power station dispatching practice truly reflects the actual search process, and these parameters is determined and fine-tuned through actual data to ensure that the model results is consistent with the actual observations. The data-driven principle further highlights the central role of observational data in the model building and validation stage, and the collection, processing, and analysis of data constitute an indispensable part of building accurate models. In addition, considering that different industrial hydro power station scenarios and different residential hydro power application paths may require different model configurations, the scalability of the model is particularly crucial, which means that the model should be designed to be easy to change and add new components to adapt to the changing environment and needs of industrial hydro power plants.

Based on the above concepts, the construction of a practical research model for hydro power station dispatching requires not only a thorough scientific insight into the multidisciplinary process, but also a wide range of system analysis perspectives, strong data processing technology, and future-oriented open thinking. The synergy of many elements can create a simulation model of residential hydro power application process that is both accurate and widely applicable.

Simulate the research process of hydro power station dispatching practice, as shown in Figure 1.

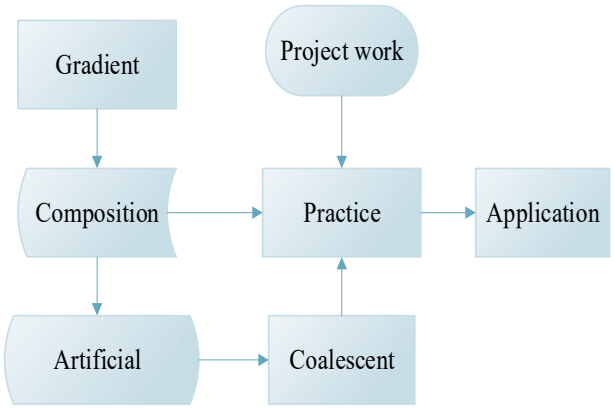

Figure 1: The analysis process of the practical study of hydro power station dispatching

Compared with the breadth search algorithm, the introduction of artificial intelligence algorithm in the practical research of hydro power station scheduling has brought a lot of innovation to solve practical problems. As a critical step in processing natural language, accuracy is critical in understanding and processing natural data in search. This algorithm can better deal with the complexity of semantics and syntax in industrial hydro power stations, so the artificial intelligence algorithm has inherent advantages over the traditional breadth search algorithm in terms of the rationality and accuracy of hydro power station scheduling practice. As shown in Figure II, the use of AI algorithms can lead to higher accuracy of search results, as the AI algorithms more accurately parse the keywords and structures in the user's search intent and achieve more detailed information matching. compared with breadth search algorithms, which often rely on preset rules and paths, AI algorithms can process data more flexibly in the face of complex searches, reducing misunderstandings and ambiguities.

In terms of search speed, although the breadth search algorithm searches quickly when the structure is clear, the artificial intelligence algorithm can also achieve fast and effective search feedback by optimizing the cutting and matching process of words, especially in the face of large-scale thesaurus and dynamically updated search resources, the artificial intelligence algorithm can maintain efficient search ability. In terms of stability, AI algorithms is able to respond to changing search environments and usage patterns through continuous learning and self-optimization, thereby providing a stable search experience. However, due to the lack of learning mechanism, the breadth search algorithm may need to be redesigned and adjusted once it encounters a change in search mode or a new data type, which is slightly inferior in terms of stability. In practical applications, AI algorithms can be combined with other advanced machine learning techniques, such as deep learning, semantic understanding, etc., to further improve the overall performance and user experience of hydro power station dispatching practice. As for the breadth search algorithm, although it still has its unique application scenarios in the search task with clear rules and fixed rules, it is obvious that the artificial intelligence algorithm provides a more advanced and adaptable solution in the practical research of modern hydro power station scheduling.

3.2 Research on the Practice of Hydro Power Station Dispatching

When developing a design for an industrial hydro power plant system, it is important to note that the scheme should cover all types of data. We categorize this data into unstructured, semi-structured, and structured information, each with its own characteristics and methods of storage, processing, and analysis. Using efficient artificial intelligence algorithms, we were able to efficiently conduct a preliminary screening of these diverse data types to obtain a preliminary selected set of research schemes for hydro power station dispatching practices. After the screening of artificial intelligence algorithms, we obtained a series of potential hydro power station dispatching practice research schemes. We then go further and analyze the practical feasibility of these options in detail. This step is crucial because it helps us identify those that can be implemented effectively in the real world, as well as those that may be theoretically feasible but difficult to apply in practice. In order to more comprehensively verify the effectiveness of different hydro power station dispatching practice research schemes, we must com pis multiple hydro power station dispatching practice

Table 1: Subject-related parameters of the study

Category	Mean	SD	Analysis rate	Compatibility
Energy dispatch	88.59	87.41	88.05	88.49
Stock market	90.26	90.06	92.00	90.04
Weather forecast	90.40	90.58	91.92	88.33
Data analysis	92.76	84.53	89.23	90.32
Mean	86.32	89.32	88.37	83.86
X6	88.07	89.33	88.88	89.72
Test Items	Test value	p-value	Test analysis	Test rate

research schemes at different levels. These options must be rigorously selected and compared to ensure that they cover design strategies from basic to advanced. In this way, we can create a more detailed comparison framework, as shown in the table below (Table 1), which details the features, advantages, and performance of each design solution under different conditions, so that we can make the most reasonable choice accordingly.

3.3 Research on the Practice and Stability of Hydro Power Station Dispatching

The stability of hydro power station dispatching practice research is the key element to ensure the long-term effective operation of the system and provide reliable services. A stable industrial hydro power plant system is able to continuously deliver high-quality search results in the face of different search loads, changes in user behavior, and data updates, without drastic performance degradation or service interruption due to external changes.

Several aspects of the research on the impact of stability on the dispatching practice of hydro power stations include: the robustness of the system architecture of the hydro power station dispatching practice: a strong system architecture is the basis for ensuring stability. This typically involves redundant design, fault-tolerant mechanisms, and highly available hardwired and softwoods resources to prevent a single point of failure that could lead to the collapse of the entire system. hydro power station dispatching practices study the accuracy of data processing: Industrial hydro power plant systems need to process and analyze data accurately to ensure the reliability of search results. This requires the algorithm logic to be able to handle a variety of boundary conditions and anomalies, and to maintain consistency in the results when the data is updated or the structure changes. hydro power station dispatching practice studies the consistency of search efficiency: the efficiency of the system should be consistent when dealing with searches of various scales. Whether it's a small amount of data searching or a large batch of data processing, the system should provide stable response times to avoid performance degradation under high loads. hydro power station dispatching practice research anti-interference ability: a stable industrial hydro power station system should be able to adapt to the influence of external interference factors such as network fluctuations and system load changes, and avoid service interruption or failure. hydro power station dispatching practice studies scalability and adaptability: With the increase of resources and the development of technology, the system should be able to flexibly expand and adapt to new search needs and data types to ensure stable service delivery.

Achieving the stability of an industrial hydro power plant system usually requires the following strategies: hydro power station dispatching practice studies continuous performance monitoring: real-time monitoring of system performance and user behavior in order to identify potential problems in time and make adjustments. hydro power station dispatching practice research load balancing: reasonable allocation of system resources and search load can improve the pressure resistance and stability of the system. hydro power station dispatching practice studies regular maintenance and update: regularly maintain and update the system, fix known problems, and enhance system stability. hydro power station dispatching practice research optimization algorithm and data structure: optimize the underlying algorithm and data structure to improve the computing efficiency of the system and the ability to stably handle a large number of concurrent searches. hydro power station dispatching practice studies develop detailed disaster recovery plans to ensure that the system can recover quickly after a major failure. Research on user feedback and system iteration of hydro power station dispatching practice: Actively collect user feedback, continuously iterate and update the system, and improve stability and satisfaction. Through these measures, the practical research on hydro power station dispatching aims to create a stable service platform that can not only adapt to the actual needs but also respond quickly to future changes. In order to verify the accuracy of the artificial intelligence algorithm, the research scheme of hydro power station dispatching practice is compared with the breadth search algorithm, and the hydro power station dispatching practice research scheme is shown in Figure 2.

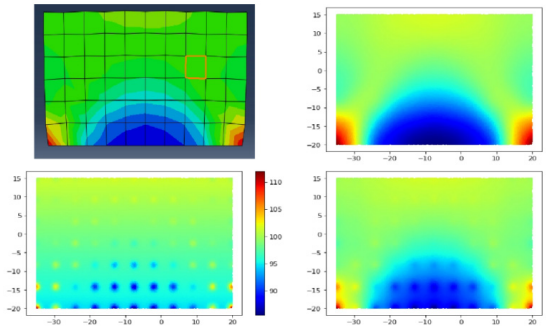

Figure 2: Practical research on hydro power station dispatching with different algorithms

By examining the comparison of the data and charts in Figure 2, we can clearly see that the AI algorithm surpasses the breadth search algorithm in the execution effect of hydro power station dispatching practice research, and its error rate is relatively low. This low error rate points to an important conclusion, that is, the application of artificial intelligence algorithms to the practical research of hydro power station dispatching brings a relatively stable and reliable performance. On the contrary, although the breadth search algorithm has its application in the practical research of hydro power station scheduling, its results fluctuate greatly, resulting in inconsistent overall performance. This fluctuation may be due to the limitations and challenges that breadth search algorithms may face when dealing with complex and variable tasks in industrial hydro power plants. In other words, the breadth search algorithm shows an uneven effect in the practical research of hydro power station scheduling, which reduces its application value and reliability in this isa to a certain extent. In conclusion, the stability and low error rate of artificial intelligence algorithms show their superiority in the field of hydro power station dispatching practice, while the breadth search algorithm shows limitations in such applications. Therefore, when seeking a practical research scheme for hydro power station dispatching with high efficiency and stable performance, artificial intelligence algorithm may be a more reasonable choice.

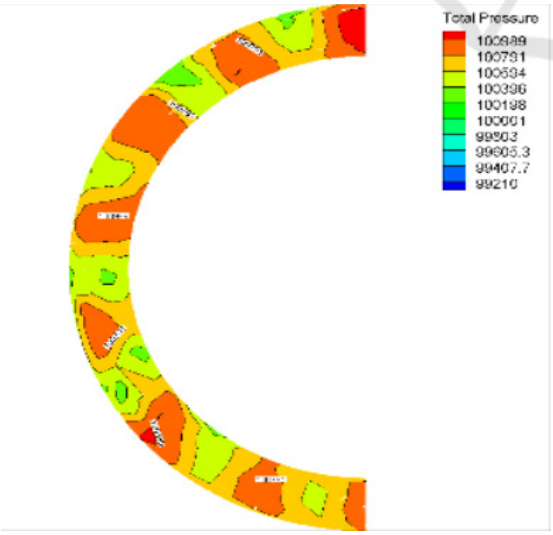

Figure 3: Research on the practice of hydro power station dispatching with artificial intelligence algorithm

Figure 3 shows that the artificial intelligence algorithm is used to obtain better performance than the breadth search algorithm in the practical study of hydro power station scheduling. There may be several key factors that make AI algorithms work well: Introduction of adjustment coefficients: In industrial hydro power plant process simulations, AI algorithms may introduce adjustment coefficients to adjust parameters in the simulation process in more detail. These coefficients may be closely related to the specific operating conditions or reactor design in the lab, allowing the algorithm to more accurately reflect and optimize real-world processes. Threshold setting and scenario filtering: By setting thresholds for the internet information obtained, the AI algorithm may retain only those that meet the set criteria among multiple candidates. This means that the algorithm is able to automatically reject simulation results that may be based on misinformation or unreliable data, ensuring the quality of the optimization process. Balance between exploration and utilization of swarm algorithm: It maintains a good balance between exploring and finding new solutions and optimizing known solutions by exploiting them. This allows the algorithm to avoid premature convergence to the local optimal solution while maintaining efficient optimization, and to explore a wider solution space as shown in Figure II.

On the other hand, the poor performance of breadth search algorithms in this context may be related to some of their inherent limitations: Over fitting: Decision trees may tend to be complex and, in some cases, over fit the training data, resulting in insufficient generalization capabilities for new data. Selecting the local optimal solution: The decision tree is split at each node only considering the local optimal attributes, which may not capture the global optimal parameter configuration of complex industrial hydro power station processes.

Artificial intelligence algorithms search and optimize multiple solutions in parallel, and continuously use information sharing among group members to guide the search process, so they can find the global optimal or near-global optimal solutions more than a single breadth search algorithm when dealing with complex hydro power station dispatching practice research scenarios. The robustness and adaptability of this algorithm make it an indispensable tool in fields such as bioengineering and industrial process optimization.

Table 2: Rationalization and comparison of hydro power station dispatching practices with different methods

Algorithm	Size of samples	Mean R	Se	99%Confidence interval	P-value	Accuracy
Artificial intelligence algorithms	673	0.6008	0.7350	0.6722~0.7294	0.7362	1.4513
Breadth search algorithm	679	0.7985	3.7818	0.6700~0.8270	0.1542	4.1704

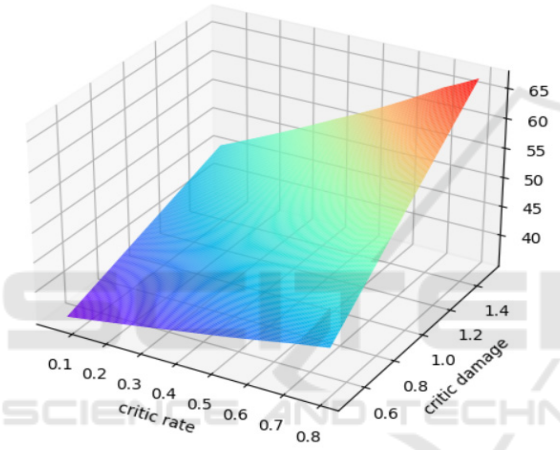

Figure 4: Comparative study of the research scheme of the algorithm

It is evident from Figure 4 that the practical study of hydro power station dispatching using artificial intelligence algorithms far outperforms the design using the breadth search algorithm. This significant gap is mainly due to the fact that the artificial intelligence algorithm has introduced a special adjustment coefficient in the practical research process of hydro power station scheduling. The introduction of this coefficient enhances the flexibility and adaptability of the algorithm, allowing it to better adjust the strategy according to different situations. In addition, AI algorithms set a specific threshold for internet information processing. Through this threshold setting, the algorithm can effectively identify and exclude those hydro power station dispatching practice research schemes that do not meet the predetermined standards. This intelligent screening mechanism makes the AI algorithm more efficient when processing a large number of candidates, ensuring that only the most suitable solutions is selected to continue to participate in the further design and evaluation phases. Combining these two innovations, namely the introduction of adjustment coefficients to improve the control ability of the algorithm, and the setting of information thresholds to accurately screen the design schemes that meet the standards, the artificial intelligence algorithm makes the practical research process of hydro power station dispatching more efficient and the output design scheme more high-quality. These improvements finally form the core advantages of the algorithm over the breadth search algorithm in the practical research of hydro power station scheduling.

4 CONCLUSION

Aiming at the accuracy problem of hydro power station dispatching practice, a new comprehensive optimization scheme was proposed, which was based on artificial intelligence algorithm and advanced computer technology. Initially, the security of information and the credibility of tampering with it were ensured by the decentralized nature of AI algorithms and their data consistency assurance. Then, combined with computer technology, the collected data is deeply analyzed and processed in detail, so as to dig out the intrinsic attributes and potential value of the data. This study also delves into the key performance indicators required to ensure the accuracy and credibility of hydro power station dispatching practice research, and constructs a comprehensive network information collection platform, which plays a crucial role in ensuring the accuracy of the research output. However, it is worth noting that when applying artificial intelligence algorithms, the selection of the evaluation system for hydro power station dispatching practice research must be cautious, so as to effectively explore and utilize the advantages of artificial intelligence algorithms and further improve the accuracy and practical application value of research results.

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REFERENCES

Sun Xiaoxiao, Li Gang,&Wang Zhongle (2023) Research on the Construction of Intelligent Manufacturing Courses Based on Intelligent Cloud - Taking the Course of Mechanical Manufacturing Equipment and System Integration Technology as an Example Theoretical Research and Practice of Innovation and Entrepreneurship (14), 85-87

Xi Xinjiang,&Yao Zaijie (2023) Research and development of time series prediction algorithms and practical application of models Financial electronicization (1), 69-70

Zhao Yonghao (2023) Logistics engineering path planning and scheduling optimization based on artificial intelligence algorithms China Science and Technology Journal Database Industry A

Chen Fang, Tan Li,&Liao Xiaolian (2023) Research and Practice on the Systematic Design of Course Ideological and Political Education Based on the Concept of Teacher Education Certification - Taking the Course of Probability Theory and Mathematical Statistics as an Example Research on Innovative Education, 11 (12), 6

Liu Xianzhuo, Deng Weisi, Tian Weida,&Dai Zhongfu (2023) Research on renewable energy prediction system based on AI algorithm Energy and Environmental Protection, 45 (8), 190-194

Xu Guangqing (2023) Practical research on the integration of artificial intelligence micro course teaching and disciplines in primary and secondary schools Educational Information Technology (7), 13-16

Wang Ting (2023) Research on optimizing cloud computing resource scheduling using artificial intelligence technology Automation Technology and Applications, 42 (8), 157-160

Liu Huizeng (2023) Practical research on cultivating computational thinking in primary school artificial intelligence and information technology disciplines China Science and Technology Economic News Database Education (3), 4

Zhou Jiafeng (2023) Research on the Path and Practice of Artificial Intelligence Assisting Digital Transformation in Education Chinese teachers (3), 4

Wu Yingwei (2023) Optimization design and application testing research on the operation and scheduling system model of hydropower station equipment Adhesive, 50 (9), 159-163

Hou Jing,&Zhang Wei (2023) The application and research of hydrological forecasting in real-time scheduling of cascade hydropower stations in river basins Hydroelectric Power Station Electromechanical Technology, 46 (4), 65-68

Li Wenxue (2023) Research on Mechanical Design, Manufacturing and Automation Practice Based on Artificial Intelligence China Science and Technology Journal Database Industry A (5), 4

Yu Yueyang (2023) Research and practice on the application of digital management in river and lake protection Hydroelectric Power Station Electromechanical Technology, 46 (6), 42-44