

Retraction

Retracted: Mobile Communication Network Optimization System Based on Artificial Intelligence

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] C. Duan and J. Luo, "Mobile Communication Network Optimization System Based on Artificial Intelligence," *Wireless Communications and Mobile Computing*, vol. 2021, Article ID 9999873, 5 pages, 2021.

Research Article

Mobile Communication Network Optimization System Based on Artificial Intelligence

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The objective of this paper is to study the key technology of the mobile communication network optimization system based on artificial intelligence technology. *Specific Content.* This paper designs the artificial intelligence agent- (IA-) type mobile communication network optimization tool iOS2CMCN, analyzes the relevant intelligent technology introduced into the system, and analyzes the feasibility and practicability of iOS2CMCN through application examples. The results show that the optimization of mobile communication networks is one of the important links in the construction of communication networks and ensuring the quality of network service. In the form of an artificial intelligence agent, iOS2CMCN absorbs the experience and knowledge of a large number of network optimization engineers and experts and realizes the intelligence and automation of mobile communication network optimization. It is proven that the fuzzy technology is introduced in theory, the practical problem is reasonably modeled, and the rule and case reasoning are used to simulate the thinking mode of a human being when solving the problem. It reduces the dependence of network optimization on humans, improves the efficiency of network optimization, and provides a new idea for practical mobile communication network optimization.

1. Introduction

Artificial intelligence (AI) was first proposed at the Dartmouth Society in 1956. At this conference, McCarthy, Minsky, Rochester, and Shannon created the discipline of artificial intelligence by using machines to simulate human intelligence. Since then, artificial intelligence technology has had a spiraling development, has become a hot field of computer science many times, and has produced many schools, such as reasoning and knowledge-centered symbolism, bionics-based connectionism, and data-centered machine learning science. At the beginning of the 21st century, with the emergence of big data technology, the existing data analysis ability has been greatly improved. The rich data resources accumulated in social production and life have further promoted the breakthrough of artificial intelligence technology. The AI craze is here again. To date, artificial intelligence has achieved great success in many fields.

The optimization of the mobile communication network requires “intelligence” of the optimization tools of the

mobile communication network, and expert system theory makes the domain tools that allow them to have the ability of domain experts—“intelligence.” Guo summarized the Internet technology under 5G mobile communication, analyzed the connotation of the Internet of Things, studied the integration of 5G mobile communication and the Internet of Things technology, and analyzed and discussed the new possibilities of the Internet of Things era under 5G mobile communication technology [1]. Chu et al. gave a general overview of AI algorithms based on artificial intelligence technology, mainly focusing on their use in network intrusion detection [2]. Das et al. help information and communication technology (ICT) practitioners use AI tools and methods to effectively manage their platforms and provide them with sufficient AI background to deal with real-life problems [3]. The combination of the two, that is, applying the expert system theory to the optimization of the mobile communication network, is an effective way to realize the “intellectualization” of the optimization of the mobile communication network. There are many existing network

optimization tools, but they have a common feature of strong pertinence. These types of software all focus on completing certain functions, but lack the thinking mode of “why do you do this?” Due to the “mobile” characteristics of the mobile communication network, the structure and operation process of the whole network are very complex, and problems arising in the maintenance process also involve many aspects, requiring a large number of personnel with specialized knowledge to carry out maintenance and optimization [4, 5].

2. Materials and Methods

2.1. BP Neural Network. Assume that the input data of BP neural network is $X = (X_1, X_2, \dots, X_n)^T$, n represents the number of nodes of neurons in the input layer, the corresponding output data is $O = (O_1, O_2, \dots, O_m)^T$, m represents the number of nodes of neurons in the output layer, and W_{ij} and W_{ik} are the connection weights of the hidden layer and the output layer, respectively, for input component X_i in layer i ; the corresponding output of the hidden layer and the output layer can be expressed as shown in formula (1).

The training steps of BP neural network are as follows:

Randomly initialize weights W_{ij} and W_{ik} , their values must not be the same, the usual range is (-1.0, 1.0), and for the sample (X_p, Y_p) , its output value is O_p .

Calculate the error between O_p and Y_p and adjust the weight matrix according to the error; for the p sample, we can get as shown in formula (2).

The neural network error calculation formula of all samples is as shown in formula (3), where s is the number of samples.

The process of minimizing E can be regarded as an optimization problem. The steepest descent method is adopted to adjust the weight matrix, namely, as shown in formulas (4) and (5).

In the formula, α represents the learning rate.

The initial values of W_{ij} and W_{ik} of a traditional BP neural network are determined by the random method, which makes the performance of the BP neural network unstable; the solution of the problem cannot get the optimal result, so the particle swarm optimization algorithm of artificial intelligence algorithm is introduced to optimize the initial values of W_{ij} and W_{ik} .

2.2. Artificial Intelligence Algorithm. The position vector of the particle is $x_i = (x_{i1}, x_{i2}, \dots, x_{iD})$; it represents a set of initial values of W_{ij} and W_{ik} , and we also have a velocity vector $v_i = (v_{i1}, v_{i2}, \dots, v_{iD})$. Particles adjust their flight direction by tracking the optimal positions of individuals and groups, as shown in formulas (6) and (7), where t is the number of iterations and ω is the inertia weight.

2.3. Intelligent Optimization Agent. Mobile communication network optimization has a high level of maintenance work, is involved in the process of optimization of network software and hardware components, and is applied to various knowledge and skills, such as the redistribution of the net-

work resources and network parameters for readjustment, including antenna position, antenna pitching angle, frequency, handoff parameters, and base stations receiving the threshold adjustment. Since the equipment parameters provided by different manufacturers and the network element performance data collected are different, the characteristics of equipment and system of different manufacturers should be taken into account in network optimization work [6]. The complexity of the mobile communication network determines the specific network optimization work with no fixed rules to follow, in order to improve network performance in time, improve the quality of network services, and avoid a lot of unnecessary repetitive work; making full use of network optimization engineers' and experts' experience knowledge is an effective method to realize network optimization. Using IA technology which takes knowledge utilization as the core and combining with actual network optimization work, an intelligent optimization system of mobile communication network is designed. iOS2CMCN is a self-learning closed-loop intelligent system. The system is driven by network performance monitoring and user reporting information data, using four kinds of intelligent technologies: data analysis tools, fuzzy quantification rules, model analysis, and information reasoning. Using the optimized log base and the comprehensive knowledge base of historical events and experience knowledge, supplemented by man-machine information interaction, the optimization agent provides the corresponding optimization scheme and suggestion for the network optimizer. The network operation proves that the reasonable optimization scheme is kept as the optimization log. If the scheme cannot effectively improve the network performance, after the network model is modified, the intelligent optimization will be carried out again in the form of self-learning until an effective optimization scheme or suggestion is found. For some recurring problems in the network, the system can directly extract the optimization scheme from the optimization log database memory to improve the network optimization efficiency of the system [7, 8].

2.4. Artificial Intelligence Technology. The intelligence of iOS2CMCN runs through the whole process of network optimization, which is mainly embodied in three aspects: the establishment of the network model, the analysis of the network model, and the information reasoning of obtaining the network optimization scheme. Combined with fuzzy quantization, fuzzy evaluation matrix, and fuzzy reasoning in artificial intelligence technology, the intelligent optimization of the mobile communication network is realized by using the knowledge base including wireless network theory [9, 10] and the experience of network optimization experts, as well as the optimization log database containing a large number of network events and optimization schemes.

2.4.1. Intelligent Modeling. The characteristics of the mobile communication network are characterized by a large number of data collected from the manufacturer OMC. In order to realize network optimization based on network performance evaluation, it is necessary to analyze these data and

TABLE 1: Network performance statistics.

Parameter	Plot no.	Number of carrier frequency	Traffic	SD congestion	TCH congestion rate	TCH dropped	Handover success rate	The RF dropped	RF switch drop rate
The original data	86	4	20.67	0.07	11.88	10.78	80	8.23	2.1
	87	4	3.97	70.25	0	87.88	53	1.5	85.22
Quantitative model	86	Quantitative values	0.8	0	0.75	0.72	0.7	0.72	0.17
		The fuzzy degree	Normal	No	High	High	High	High	High
		Quantitative values	0.9	0.85	0	0.87	0.7	0.1	0.8
	87	The fuzzy degree	Low	High	No	Very high	Low	High	Very high

judge network operation conditions (such as congestion of SDCCH and high drop rate of TCH). iOS2CMCN, quoting the fuzzy membership degree method, the fuzzy network performance data, including SDCCH congestion rate, each channel traffic and dropped, described it as like “village high traffic,” “residential dropped the high,” and “village TCH congestion” natural language, establish reasonable quantitative network model for describing the network operation status [11]. Based on the communication with network optimization experts and the fuzzy function theory, the network performance parameters can be described by the adaptive Gaussian function network, in which each fuzzy subset has adaptive factors.

2.4.2. Fuzzy Knowledge Base. Mobile communication network integrates complex systems by collecting various communication technologies and multivendor equipment. The key to network optimization is the factors affecting network performance, diversity, uncertain knowledge, technology, and application experience. Knowledge is an important part of developing an intelligent network optimization system. In iOS2CMCN, fuzzy knowledge expression based on rules and cases is adopted. The rule expression is to summarize the experience of network excellence into the form of “premise and conclusion” and introduce fuzzy factors to reflect the fuzzy uncertainty of knowledge. This expression is suitable for the knowledge used in human brain logical thinking. Rule expression is a “case attribute” event, which uses a fuzzy quantity to describe the network optimization case in the form of synthesis. This fuzzification quantity includes, for example, the description of each state attribute in the language set after entering the numerical set and the weight of the given factor of each attribute. From the practical application point of view, the fuzzy knowledge representation in iOS2CMCN can effectively describe the network optimization knowledge used by network optimization engineers in specific network optimization work.

3. Results and Discussion

3.1. Information Reasoning. Information reasoning is the process of using real-time information and empirical knowledge to solve problems. In the optimization of mobile communication network, network optimization experts use real-time network performance statistics data, the operation status of hardware equipment, and rich experience and

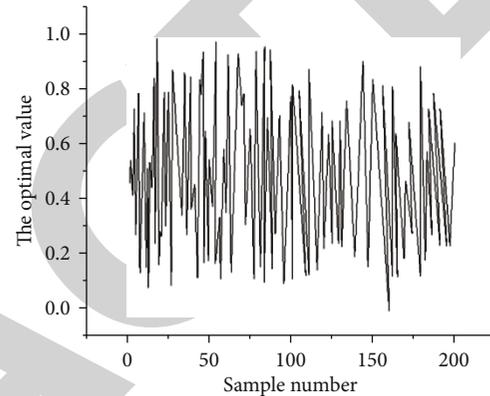


FIGURE 1: Optimized risk value of wireless mobile communication system. In this figure, the original value of the wireless mobile communication system optimization analysis can clearly show that the uncertainty of the wireless mobile communication system has strong randomness but also has certain regularity change characteristics; choosing a village as the validation sample, the optimized plan for the 86 other districts as a wireless mobile communication system optimizes the training sample.

knowledge of network optimization to come up with reasonable and effective optimization schemes. After automatically identifying the network optimization event model, the inference machine enters rule or case reasoning. When rule reasoning is adopted to solve problems, the information inference machine is driven by current network operation events and uses fuzzy rules in fuzzy knowledge base to simulate and realize the logical thinking process of network optimization experts [12]. The characteristics of network events are analyzed by case-based reasoning. According to the typical examples of fuzzy knowledge base, the network optimization is carried out on the basis of correlation and analogy event processing. At the same time, new events are saved and modified in case to simulate the analogy learning ideas of network optimization experts in the form of real-time analysis and memory.

3.2. Simulation Test. The author studies and analyzes the practicability of iOS2CMCN based on the work and experience of mobile communication network optimization in a city. Table 1 shows the fuzzy quantization model of the performance statistics of the two cells collected by OMC and the corresponding network optimization events. Under the function of the above information on the inference machine, the

fuzzy knowledge is used to optimize the two plots. Using the fuzzy rule reasoning method, according to rules A2, A4, B3, and B4, the optimization scheme of cell 87 is obtained. Using the fuzzy case reasoning method, the events of plot 86 are compared with the related cases in the fuzzy case database. According to the calculation method of similarity between the related cases, plot 86 is similar to the fuzzy case D015.

In order to test the design of wireless mobile communication system optimization based on artificial intelligence algorithm, the risk historical data of wireless mobile communication system in a period of time is selected as the research object. Firstly, the data of wireless mobile communication system optimization is collected, and some preprocessing is carried out. Then, the corresponding optimization level value of wireless mobile communication system is obtained. Due to the limited space, only the optimization value of wireless mobile communication is displayed, as shown in Figure 1. In Figure 1, the original value of the wireless mobile communication system optimization analysis can clearly show that the uncertainty of the wireless mobile communication system has strong randomness but also has certain regularity change characteristics; choosing a village as the validation sample, the optimized plan for the 86 other districts as a wireless mobile communication system optimizes the training sample.

3.3. Analysis of Optimization Results of Wireless Mobile Communication System Based on the Model in This Paper. The optimization results of the wireless mobile communication system of the model are divided into a particle swarm optimization algorithm to determine the initial connection weight of the BP neural network, and then, the optimization results of the wireless mobile communication system of the model in this paper are obtained as shown in Figure 2. It can be seen from the analysis of the optimization results of the wireless mobile communication system in Figure 2 that the optimization deviation of the wireless mobile communication system in this model is quite small and can be ignored. The optimization accuracy of the wireless mobile communication system is high, and the reliability of the evaluation results is high. It is a feasible wireless mobile communication system optimization model.

In order to test the superiority of the optimization model of wireless mobile communication system based on artificial intelligence algorithm, gray model, cluster analysis, and standard BP neural network were used to carry out comparative experiments on the same data set in the same simulation environment, and the optimization accuracy and training time of wireless mobile communication system were calculated, as shown in Table 2. It can be found from Table 2, in this paper, that the wireless mobile communication system based on artificial intelligence algorithm optimization model of efficiency is more than 95%, the classic efficiency of the wireless mobile communication system optimization model is less than 95%, and the model of short training time in classical optimization model for wireless mobile communication system, to speed up the wireless mobile communication system optimization, is presented. Therefore, the optimization result of the wireless mobile

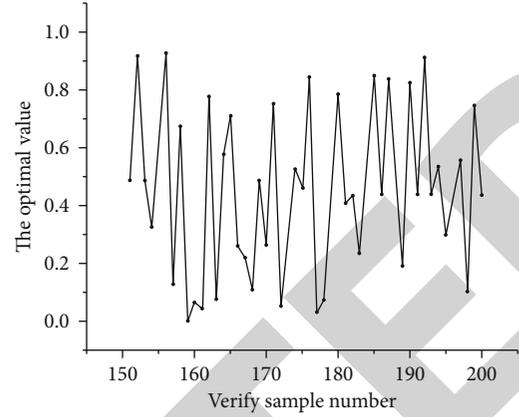


FIGURE 2: The optimization results of the wireless mobile communication system of this model. It can be seen from the analysis of the optimization results of the wireless mobile communication system in this figure that the optimization deviation of the wireless mobile communication system in this model is quite small and can be ignored.

TABLE 2: Comparison of the optimization results of wireless mobile communication system with the classical model.

Optimization model of wireless mobile communication system	Optimize the efficiency	Optimization of time
Grey model	89.95	11.61
Clustering analysis	87.73	12.38
Standard BP neural network	93.26	7.83
Model	96.78	4.49

communication system based on the model in this paper is more ideal.

$$Y_o = f(X_i W), \quad (1)$$

$$E_p = \frac{1}{2} \sum_{j=1}^m (y_{pj} - o_{pj})^2, \quad (2)$$

$$E = \sum_{l=1}^s E_{pl}, \quad (3)$$

$$W_{jk} = W_{jk} + \Delta W_{jk} = W_{jk} + \alpha O_j (1 - O_k) (Y_k - O_k) O_j, \quad (4)$$

$$W_{ij} = W_{ij} + \Delta W_{ij} = W_{ij} + \alpha O_j (1 - O_j) O_i \cdot \sum_{k_1=1}^h \sum_{k_2=1}^m W_{k_1 k_2} O_{j+1, k_2} (1 - O_{j+1, k_2}) (Y_{j+1, k_2} - O_{j+1, k_2}), \quad (5)$$

$$v_{id}(t+1) = \omega v_{id}(t) + c_1 r_1 (p_{id} - x_{id}(t)) + c_2 r_2 (p_{gd} - x_{id}(t)), \quad (6)$$

$$x_{id}(t+1) = x_{id}(t) + v_{id}(t+1). \quad (7)$$

4. Conclusions

The key technology research and implementation of a mobile communication network optimization system based on artificial intelligence technology are presented. The

concrete content of this method is to design the artificial intelligence agent- (IA-) type mobile communication network optimization tool iOS2CMCN, analyze the relevant intelligent technology introduced into the system, and analyze the feasibility and practicability of iOS2CMCN through application examples. Observed through the experiment in this paper, the wireless mobile communication system based on artificial intelligence algorithm optimization model of efficiency is more than 95%, the classic the efficiency of wireless mobile communication system optimization model is less than 95%, and the model of short training time in classical optimization model for wireless mobile communication system, to speed up the wireless mobile communication system optimization, is presented. Therefore, the optimization result of the model is more ideal. It is proven that the fuzzy technology is introduced in theory, the practical problem is reasonably modeled, and the rule and case reasoning are used to simulate the thinking mode of human being when solving the problem. It reduces the dependence of the network optimization on human, improves the efficiency of network optimization, and provides a new idea for practical mobile communication network optimization. It is proven that the fuzzy technology is introduced in theory, the practical problem is reasonably modeled, and the rule and case reasoning are used to simulate the thinking mode of human being when solving the problem. It reduces the dependence of network optimization on human, improves the efficiency of network optimization, and provides a new idea for practical mobile communication network optimization.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

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