Lecture Notes in Electrical Engineering 1216

Yan Pei
Hao Shang Ma
Yu-Wei Chan
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# Proceedings of Innovative Computing 2024, Vol. 3

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# Lecture Notes in Electrical Engineering 1216

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Yan Pei · Hao Shang Ma · Yu-Wei Chan ·
Hwa-Young Jeong
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Springer

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# Design of Noise Reduction Structure of Porous Muffler Based on Ant Colony Algorithm

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**Abstract.** The design of noise reduction structure plays an important role in porous mufflers, but there is the problem of inaccurate noise reduction positioning. The traditional decision tree algorithm cannot solve the problem of noise reduction structure design in porous muffler, and the effect is not ideal. Therefore, this paper proposes a design of porous muffler noise reduction structure based on ant colony algorithm and analyzes the noise reduction structure design of porous muffler. Firstly, the ant colony optimization behavior theory is used to locate the influencing factors, and the indicators is divided according to the requirements of noise reduction structure design to reduce the interference factors in noise reduction structure design. Then, the ant colony optimization behavior theory is used to form the noise reduction structure design scheme of ant colony algorithm, and the noise reduction structure design results is comprehensively analyzed. The MATLAB simulation results show that under certain evaluation criteria, the ant colony algorithm is better than the traditional decision tree algorithm in terms of noise reduction structure design accuracy and noise reduction structure design influencing factor time.

**Keywords:** Ant colony optimization behavior theory · ant colony algorithm · Noise reduction structure design · Porous · Silencer

## 1 Introduction

In noise control engineering, muffler is one of the key equipments used to eliminate or reduce noise. Porous muffler is one of them [1–5]. Its principle is to transform sound energy into heat energy by using the friction and resistance generated when sound waves propagate in sound-absorbing materials, so as to achieve the purpose of noise reduction [6, 7]. The structural design and the selection of sound-absorbing materials of the porous muffler have a vital influence on its noise reduction effect. In this paper, the noise reduction structure design of porous muffler will be introduced in detail [8].

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## 2 Related Concepts

### 2.1 Mathematical Description of the Ant Colony Algorithm

The core of porous muffler is sound-absorbing material, and its performance directly affects the muffling effect. Commonly used sound-absorbing materials are glass fiber, mineral wool, artificial leather, rubber and so on is shown in Eq. (1).

$$\lim_{x\to\infty}(y_i \cdot t_{ij}) = \lim_{x\to\infty} y_{ij} \geq \max(t_{ij} \div 2) \tag{1}$$

The selection of sound absorbing materials should be based on the use environment of muffler and the requirements of noise reduction is shown in Eq. (2).

$$\max(t_{ij}) = \partial(t_{ij}^2 + 2 \cdot t_{ij}) \succ mean(\sum t_{ij} + 4)\mathfrak{M} \tag{2}$$

The performance parameters of sound-absorbing materials include density, thermal conductivity, sound absorption coefficient, etc. Among them, sound absorption coefficient is an important index to measure the performance of sound-absorbing materials.

Suppose I When selecting sound absorption materials, we should choose materials with high sound absorption coefficient, and consider its durability, flame retardancy, environmental protection and other factors is as shown in Eq. (3).

$$F(d_i) = \mathbb{R}\lim_{x\to\infty}\sum t_i \bigcap \xi \cdot \sqrt{2} \to \oint y_i \cdot 7 \tag{3}$$

### 2.2 Selection of Noise Reduction Structure Design Scheme

Hypothesis II There are many kinds of structure forms of porous muffler, such as straight tube type, expandable type, resonant type and so on as shown in Eq. (4).

$$g(t_i) = \ddot{x} \cdot z_i \prod F(d_i)\frac{dy}{dx} - w_i \tag{4}$$

Based on assumptions I and II, a comprehensive function of the noise reduction structure design can be obtained, as shown in Eq. (5).

$$\lim_{x\to\infty} g(t_i) + F(d_i) \leq \bigcap \max(t_{ij}) \tag{5}$$

The propagation law of sound waves and the performance characteristics of sound-absorbing materials should be considered in structural design. Straight tube multi-hole muffler has simple structure and good noise reduction effect, which is suitable for medium and low frequency noise control is shown in Eq. (6).

$$\widetilde{g(t_i) + F(d_i)} \leftrightarrow mean(\sum t_{ij} + 4) \tag{6}$$

### 2.3 Analysis of Noise Reduction Structure Design Scheme

Expandable porous muffler is suitable for medium and high frequency noise control by using expansion cavity to reduce noise is shown in Eq. (7).

$$No(t_i) = \frac{\widetilde{g(t_i) + F(d_i)}}{mean(\sum t_{ij} + 4)} \tag{7}$$

Resonant multi-hole muffler uses resonance principle to eliminate noise of specific frequency is shown in Eq. (8).

$$Zh(t_i) = \bigcap [\sum \widetilde{g(t_i) + F(d_i)}] \tag{8}$$

Porous muffler is usually used in airflow channel, so airflow organization design is also an important part of muffler structure design is shown in Eq. (9).

$$accur(t_i) = \frac{\min[\sum \widetilde{g(t_i) + F(d_i)}]}{\mathfrak{MA} \sum \widetilde{g(t_i) + F(d_i)}} \times 100\% \tag{9}$$

The flow characteristics and pressure loss of the airflow should be fully considered in the design to avoid the eddy and turbulent phenomena when the airflow flows through the muffler, which will affect the noise reduction effect as Eq. (10).

$$accur(t_i) = \frac{\min[\sum \widetilde{g(t_i) + F(d_i)}]}{\lim\limits_{x \to \infty} \sum \widetilde{g(t_i) + F(d_i)}} + randon(t_i) \tag{10}$$

## 3 Practical Examples of Noise Reduction Structure Design

### 3.1 Introduction to the Design of Noise Reduction Structure

The performance of sound absorbing materials is the key factor of noise reduction effect of porous muffler. Different materials have different sound absorption coefficients and frequency characteristics, so when selecting sound absorption materials, they should be comprehensively considered according to the requirements of noise reduction and the use environment is shown in Table 1.

The noise reduction structure design process in Table 1. is shown in Fig. 1.

The laying thickness and density of sound-absorbing materials will also affect its noise reduction effect, so it should be designed reasonably.

### 3.2 Noise Reduction Structure Design

Airflow velocity and pressure loss also have important influence on noise reduction effect of porous muffler. When the airflow speed is too high, it will produce large noise, thus affecting the silencing effect; However, if the pressure loss is too large, the energy consumption of equipment will increase is shown in Table 2.

**Table 1.** Noise Reduction Structure Design Requirements

| Scope of application | Grade | Accuracy | Noise reduction structure design |
|---|---|---|---|
| Piping design | I | 85.00 | 78.86 |
| | II | 81.97 | 78.45 |
| Air conditioning units | I | 83.81 | 81.31 |
| | II | 83.34 | 78.19 |
| Audio devices | I | 79.56 | 81.99 |
| | II | 79.10 | 80.11 |

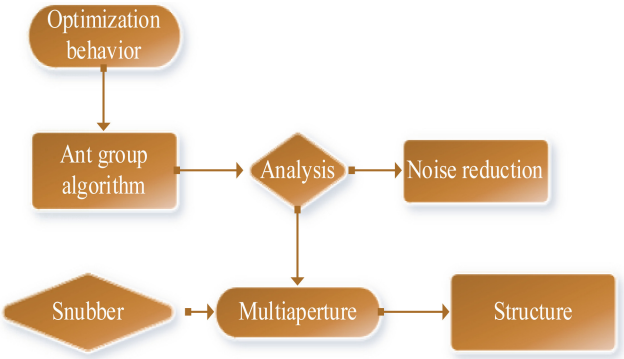


**Fig. 1.** The Analysis Process of Noise Reduction Structure Design

**Table 2.** The Overall Situation of the Noise Reduction Structure Design Scheme

| Category | Random data | Reliability | Analysis rate |
|---|---|---|---|
| Piping design | 85.32 | 85.90 | 83.95 |
| Air conditioning units | 86.36 | 82.51 | 84.29 |
| Audio devices | 84.16 | 84.92 | 83.68 |
| Mean | 86.84 | 84.85 | 84.40 |
| X6 | 83.04 | 86.03 | 84.32 |
| | $P = 1.249$ | | |

### 3.3 Noise Reduction Structure Design and Stability

While ensuring the noise reduction effect, the airflow velocity and pressure loss should be reduced as much as possible is shown in Fig. 2.

Unreasonable structural design or improper installation of porous muffler may affect its noise reduction effect is shown in Table 3.

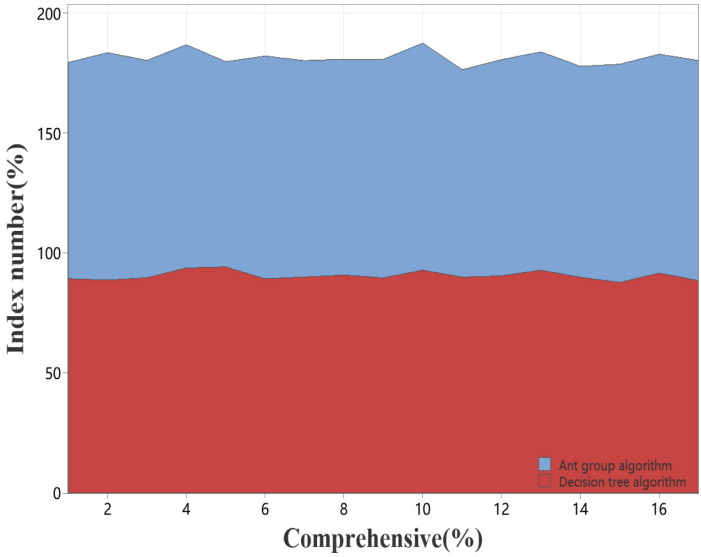


**Fig. 2.** Noise Reduction Structure Design of Different Algorithms

**Table 3.** Comparison of Noise Reduction Structure Design Accuracy of Different Methods

| Algorithm | Survey data | Noise reduction structure design | Magnitude of change | Error |
|---|---|---|---|---|
| Ant colony algorithm | 85.33 | 85.15 | 82.88 | 84.95 |
| Decision tree algorithm | 85.20 | 83.41 | 86.01 | 85.75 |
| P | 87.17 | 87.62 | 84.48 | 86.97 |

Improper selection of parameters such as expansion ratio and length may affect the noise reduction performance of expandable porous muffler, Fig. 3 shown.

If the air distribution is not considered during installation, it may lead to poor noise reduction effect.

### 3.4 Rationality of Noise Reduction Structure Design

In the process of design and installation, various factors should be fully considered to ensure the rationality of muffler structure and the correctness of installation mode is shown in Fig. 4.

In air conditioning systems, porous mufflers are often used to eliminate the noise generated by fans. During the design, the operating conditions and noise reduction requirements of the fan should be considered, and the appropriate sound-absorbing materials and structural forms should be selected.

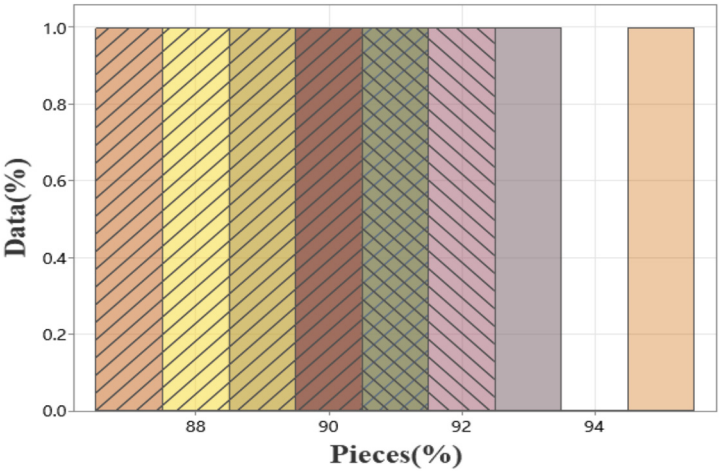


**Fig. 3.** Noise Reduction Structure Design of Ant Colony Algorithm

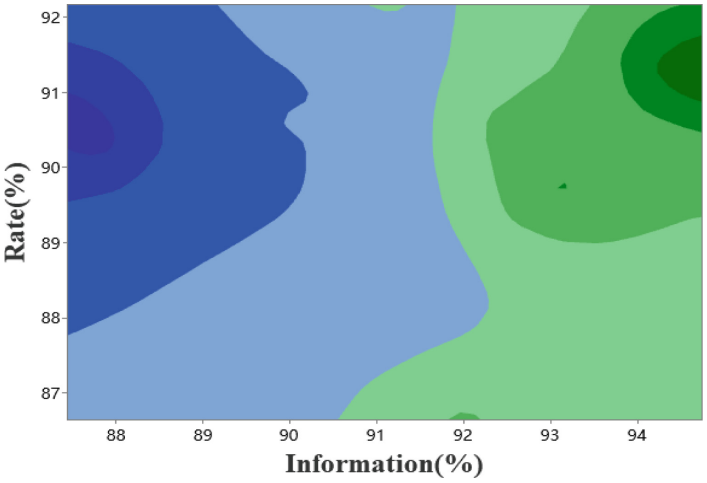


**Fig. 4.** Noise Reduction Structure Design of Different Algorithms

### 3.5 The Effectiveness of Noise Reduction Structure Design

The medium and low frequency noise can be effectively reduced by using straight tube porous muffler; For high frequency noise, expandable or multi-layer composite porous muffler can be selected. Through reasonable design and material selection, the noise pollution in air conditioning system can be effectively reduced is shown in Fig. 5 shown.

The noise in engine exhaust system is one of the main sources of automobile noise. In order to reduce the exhaust noise, a porous muffler can be installed in the exhaust pipe is shown in Table 4.

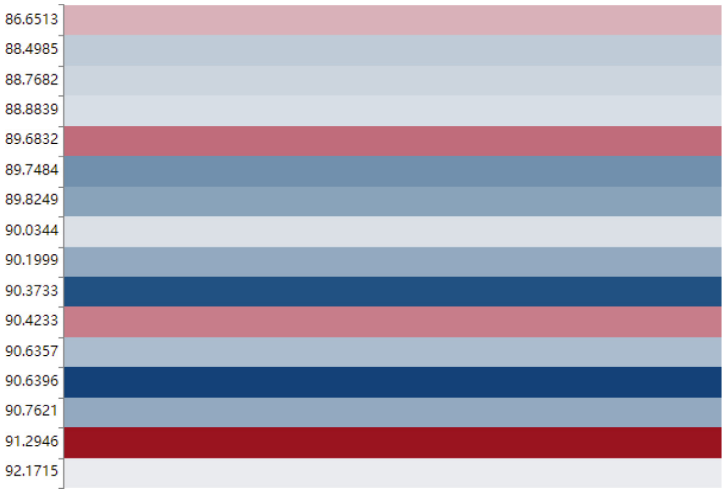


**Fig. 5.** Noise Reduction Structure Design of Different Algorithms

**Table 4.** Comparison of the Effectiveness of Noise Reduction Structure Design of Different Methods

| Algorithm | Survey data | Noise reduction structure design | Magnitude of change | Error |
|---|---|---|---|---|
| Ant colony algorithm | 82.21 | 85.92 | 84.59 | 82.85 |
| Decision tree algorithm | 83.73 | 84.23 | 84.41 | 83.55 |
| P | 84.20 | 87.39 | 84.76 | 83.90 |

When designing, it is necessary to consider the structure of exhaust system and the characteristics of airflow, and select sound-absorbing materials with high temperature resistance and corrosion resistance, such as ceramic fibers. At the same time, it is necessary to reasonably design the muffler structure and air distribution form to achieve efficient noise reduction effect, Fig. 6 shown.

Through the application of porous muffler, the noise pollution in engine exhaust system can be significantly reduced.

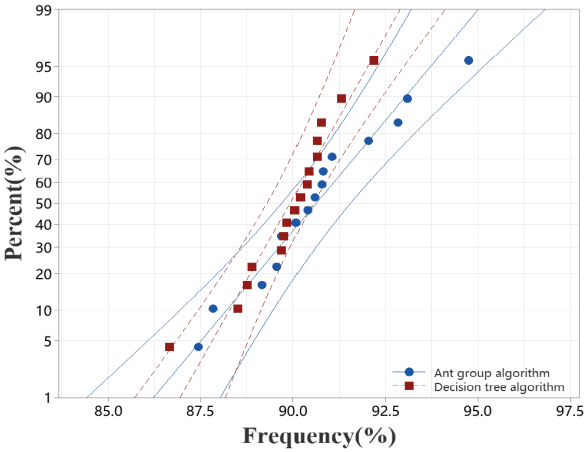


**Fig. 6.** Noise Reduction Structure Design of Ant Colony Algorithm

## 4 Conclusion

As a common noise reduction equipment, porous muffler has a wide application prospect in industrial production, transportation and other fields. Through reasonable structure design and selection of sound-absorbing materials, the intensity and influence range of noise can be effectively reduced. However, there are still some deficiencies in the current research of multi-hole muffler, such as the stability and adjustability of noise reduction effect, which need to be further improved. In the future, with the development of new materials and new technologies, the structural design and noise reduction performance of porous muffler will be more optimized and improved, which will make greater contributions to creating a quieter and more comfortable living environment for human beings.

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# Development and Application of BP Neural Network in the Modern Economic Management System

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**Abstract.** The requirement of modern economic management is getting higher and higher, which makes the traditional management mode not applicable, so it needs to be improved. Under this background, this paper will study the application of information technology in modern economic management under BP neural network. This paper introduces the basic concept of BP neural network informatization, and puts forward the application strategy of informatization in view of the main problems of modern economic management. Through the research, the strategy in this paper can play the role of BP neural network information, improve the modern economic management, solve the existing problems, and make the economic management more standardized, reasonable and effective.

**Keywords:** BP neural network · Informatization · Modern economic management

## 1 Introduction

Modern economic management is evolved from the traditional economic management of a kind of economic management system, which contains a lot of experience and therefore are not objective enough, there are many unreasonable place, will bring a lot of problems in practice, but the problems in the modern economic management system forming early did not get the attention of people, the reason is that the social economic operation is simpler, many problems are intuitive or haven't happened yet, so people can control them after they happen, or at least minimize their impact. And today, because our country's development in line with international standards gradually in recent years, so the internal market environment and other related economic environment has changed dramatically, become more complex, has brought the higher economic management requirements, problems in the management system of the modern economy deteriorated due to the impact of changes in, degree, controllable toward bad direction development, at this time, people began to pay attention to the relevant problems of modern economic management, hoping to improve the existing system in order to solve the problems. For this claim, the emergence of the BP neural network has brought the opportunity and related areas combined with BP neural network proposed the idea to information

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technology application, namely on the BP neural network informatization reform of the management of modern economy, prompting information function more rich, and give full play, thus solve the problem, complete the system improvement, however, how to do this is still an urgent problem, and it is necessary to carry out relevant research.

## 2 Basic Concept of BP Neural Network Informatization

With BP neural network informatization in the traditional sense of the information is different in concept, namely in the traditional sense of the information technology, refers to the activities of some of the use of information technology help artificial function, make work efficiency, quality improvement of a way of information technology application, because this way high popularity in the job, so become the informatization [1, 2]. Although this kind of information can provide a lot of help to people, its value is only reflected in the breadth, and there are many defects in the depth. The most important defect is that it cannot provide help in the key links such as judgment and decision making, and can only be used in the non-key links such as information preservation and scheduling in most cases. And BP neural network informationization is based on the traditional information, rely on the combination of BP neural network and information technology evolved a way of information technology application, it has all the function of the traditional information, so breadth as well, and with the help of the BP neural network role breadth, at the same time, BP neural network also improves the depth of function, so that information technology can provide help in the judgment and decision link, and even can replace manual directly to make judgment and decision. It can be seen that BP neural network information has higher application value [3, 4].

The core of BP neural network informatization is BP neural network, which is a logical model that imitates the structure of human neurons. The basic form is shown in Fig. 1.

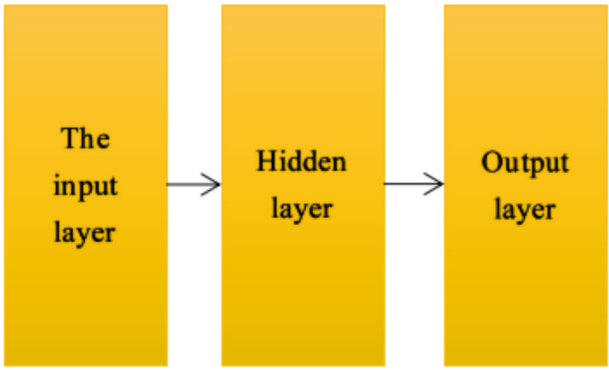


**Fig. 1.** Basic form of BP neural network

According to Fig. 1, BP neural network is composed of three parts: input layer, hidden layer and output layer. There are several neurons in the input layer and hidden

layer, which are called input and hidden neurons respectively. The output layer is mainly responsible for output results, and the results come from the activities of neurons in the hidden layer. Therefore, as a kind of imitating human neuron structure logic model, it can work by three layer neuron activity to activity data analysis, such as mining, find all the characteristics of each data, and to establish the connection relationship between data, data model can be represented through understand the essence, so will the model combined with information technology systems, it can give the system a function similar to human intelligence (human intelligence comes from brain neurons), and has stronger independent judgment and decision-making ability, which is not possessed by traditional information technology [5].

BP neural network has many forms, the more common ones are feedforward neural network (Fig. 1 is the feedforward neural network), feedback neural network (see Fig. 2), etc. The characteristic that distinguishes different neural networks is the connection relationship between neurons at different levels. For example, each layer of feedforward neural network is continuously unidirectional connected, in which there is no connection between neurons in the input layer, but there is a comprehensive connection between neurons in the hidden layer, which has direct and indirect relationship forms [6–8]. Each layer of the feedback neural network is connected with each other, and there is a comprehensive connection between the input layer and the hidden layer neurons. Different forms of the BP neural network has the function of different application condition is different, namely type feedforward neural network is suitable for the unidirectional logic problem, can give the best judgment or decision results, and feedback type neural network is suitable for the complex logic problem, can better mining problem essence, help make accurate judgment or decision, therefore, in the application of BP neural network information need to pay attention to the selection of neural network, focusing on modern economic management, it is generally recommended to choose the feedforward type.

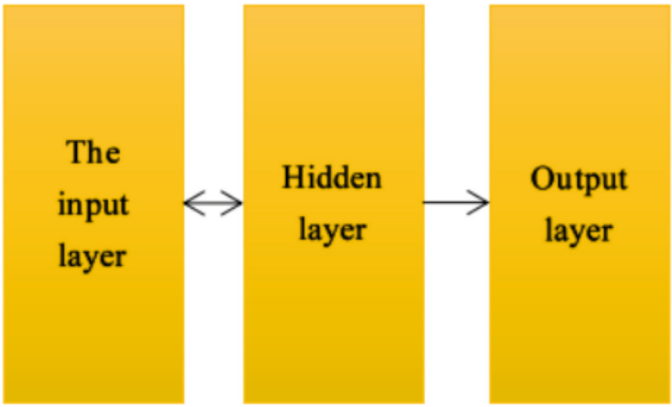


**Fig. 2.** Feedback neural network

In addition, the BP neural network informatization itself although have analysis data, to understand the nature of the problem, but to play a role, also need to be prepared for

a series, such as extracting data characteristics, and these preparations are beyond the capability of BP neural network, so you need to get help from outside algorithm, compare common algorithms such as K-means algorithm. K-means algorithm, for example, it belongs to the clustering algorithm, we can extract data characteristics, a data to calculate arbitrary characteristics and the distance between the clustering center, if the distance is lower than the standard size, means data belong to the cluster center, thus completing data classification, also set up the data and the connection between the data, classification and classification, then it can be analyzed by BP neural network, and then drive information technology to provide services for people. The expression of K-means algorithm is shown in Eq. (1).

$$SEE = \sum_{i=1}^{k} \sum_{X \in C_i} (C_i - X)^2 \tag{1}$$

where k is the K-mean, i is the feature of the cluster center, X is the data point in the cluster, and C is the cluster center.

## 3 Application Strategy of Modern Economic Management Based on BP Neural Network Information

### 3.1 Application Roadmap

The basic application of BP neural network information in modern economic management is divided into five steps, as shown in Fig. 3.

According to Fig. 3, the specific contents of each step are as follows: first, collect relevant data and information of economic management projects; Secondly, the data information is imported into the computer system, and then the system is input into the input layer of BP neural network to form several input neuron nodes. Thirdly, taking the feedback neural network as an example, the input neuron nodes in the input layer will be associated with each other and input to the hidden layer synchronously to form the hidden layer neuron nodes. After the node is generated, the association will also be generated, so as to establish the data relationship model. Fourthly, the data feature extraction and classification are carried out by the algorithm, and the analysis results are obtained. Fifth, the calculation results are transmitted to the manual end through the output layer, and judgments and decisions can be made after manual reference [9, 10].

### 3.2 Application Policy

According to the application thought, the application strategy of BP neural network information in modern economic management is as follows.

#### 3.2.1 Build an Economic Management Information Platform

Because all the management projects involved in economic management have dynamic characteristics, a large number of different types of data information will be constantly generated in the management process, and these data information are generally dispersed in the original management system, distributed in different computer terminals, difficult

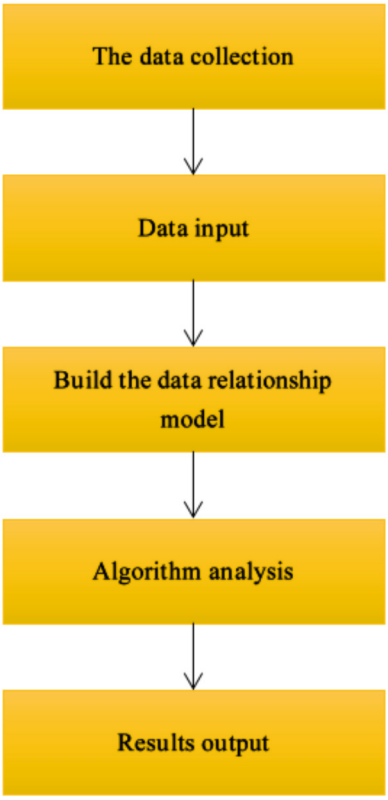


**Fig. 3.** Application ideas of BP neural network information

to centralized management and collection. In the face of such situation, related organizations should be set up in the BP neural network informatization economic management information platform, the change in the past simple auxiliary artificial using information technology to carry out the work, this can through the platform to different computers are connected together, each client computer contains, add on all data and information related to the economic management project, In the form of backup will be stored in the economic management information platform for the first time, to achieve information collection.

Economic management information platform construction is mainly focus on two points: one is the database capacity, namely the platform to store all data and information related to the economic management project, the large scale data information, therefore, if the database capacity lack cannot be stored, to avoid this kind of circumstance happening, advised to choose a large database, and to be prepared for further expansion. At the same time, if conditions permit, it is recommended to choose cloud database, which has the characteristics of unlimited data capacity and can meet the needs of data storage. Secondly, working model transformation, that is, if the economy management of the project management related to platform, only in offline, they cannot collect data

information platform, so the relevant organizations to consider in the platform to the job requirements, set out to develop platform function, to ensure that the platform function can meet the demand of all the work, so you can make platform management tools, the working mode is transformed from offline to online to facilitate data information collection.

### 3.2.2 Computer System Design

Computer system generally refers to business system in modern economic management, which is closely connected with the economic management information platform and has interworking relations. For example, the relevant functions of the platform are displayed on the computer system for users to apply, and the operation of users in the computer system will be fed back to the platform. The relationship, the computer system design should consider mainly business coverage, must achieve universal coverage, so relevant organization have to be in-depth analysis to its business project, establishing the project list, and expand the system design, the security system has a business project in the process of (the business project is economic management projects) to create, and other functions, in this way, from the perspective of economic management, management projects can be clearly found, and then management work can be carried out in combination with the functions of the platform.

### 3.2.3 Construct the Neural Network Model

The construction of neural network model focuses on two key points: the first is the selection of neural network. As mentioned above, it is generally recommended to choose feedback neural network in modern economic management. But it is worth mentioning that in general the feedback type neural network can meet the demand of economic management, but the current environment of economic management problem is increasingly complex, there are some special circumstances, the feedback type neural network is then may not be able to fully meet the demand of work, it is recommended that creates all the neural network model, sent staff to choose according to the reality; The second is the neural network configuration, that is, although the neural network is a model in essence, but to make it applied in practical work, we must do a good job of neural network configuration, to ensure the complete cooperation between the constructed neural network and the work logic. Table 1 describes the main configuration items. The specific configuration parameters depend on the actual situation.

**Table 1.** Main configuration of neural network

| Configure the content | meaning |
|---|---|
| Maximum running value | Prevent analysis results from being too small |
| Operating minimum value | Prevent analysis results from being too large |
| Special termination condition | Termination is carried out under special circumstances to prevent inaccurate results |

### 3.2.4 Algorithm Module Development

Algorithm module development also needs to go through the algorithm selection stage, this paper will take K-means algorithm as an example for module development. Because the algorithm module itself is a system program, programming language will be used in the development of the algorithm logic, logic reference formula (1). After the development, the algorithm module should be tested. The test results in this paper are correct, which means that the algorithm module is successfully developed, and then the module can be installed into the computer system.

### 3.2.5 Human-Machine Interaction Interface Design

Although BP neural network informatization can replace human to make judgment and decision in economic management, the final decision-making power is still held in the artificial audience, so in order to reflect this point, and to maintain the dominant position of human in the work, it is necessary to carry out human-computer interaction interface design. The interface design relies on the communication network, that is, the communication network can connect the system platform with the artificial equipment end together, and promote the BP neural network information judgment, decision results transmitted to the artificial end, so that the human can consult and make the final decision. Under this idea, the design of human-computer interaction interface focuses on the selection of communication network, generally, Wifi and TCP can be considered.

## 4 Conclusion

In conclusion, the BP neural network information technology can solve many problems in the modern economic management, make the management work fully optimized, so the related organizations to master the BP neural network informatization strategy, construct the platform, system and other necessary facilities, and then through the model, the informatization of the BP neural network module and communication network and economic management work, promote the BP neural network information to get a reasonable application.

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# Dynamic Resource Scheduling Strategy for 5G Network Slicing Based on SDN and NFV Convergence

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**Abstract.** The role of resource allocation in 5G networks is very important, but there is a problem of poor dynamic adjustment. The SDN method does not solve the resource allocation problem in 5G networks, and the scheduling capability is low. Therefore, this paper proposes an SDN and NFV fusion method for 5G network communication regulation analysis. Firstly, the dynamic slicing theory is used to evaluate the communication regulation, and it is divided according to the resource allocation requirements to reduce the interference factors in resource allocation. Then, dynamic slicing theory requires 5G networks to form a resource allocation scheme and resource allocation requirements Comprehensive deployment. MATLAB simulation shows that the SDN and NFV fusion method is superior in resource allocation accuracy and resource allocation time under the condition of stable power flow of the power grid SDN mode.

**Keywords:** dynamic slice theory · SDN and NFV fusion methods · 5G network · Communication conditioning

## 1 Introduction

With the rapid development and wide application of 5G technology [1–5], [6], network slicing technology has become an important means to realize flexible and efficient network resource management [7–10]. Network slicing technology can divide network resources into multiple virtual "slices" according to different business requirements, and each slice runs independently to meet the needs of various businesses such as enhanced mobile broadband (eMBB), massive machine communication (mMTC) and low latency and high reliability communication (uRLLC). However, how to implement a dynamic and efficient resource scheduling strategy is the core challenge of network slicing technology [11–12].

## 2 Related Concepts

### 2.1 Mathematical Description of SDN and NFV Fusion Methods

The core goal of dynamic resource scheduling strategy is to maximize the utilization of network resources while meeting business requirements.

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Hypothesis 1: Policies need to dynamically allocate and adjust resources according to real-time network load, business requirements and other factors As shown in Eq. (1).

$$F(d_i) = \sum x_i \exists \oint y_i \cup \xi \tag{1}$$

### 2.2 Selection of Scheduling and Deployment Scheme

Assume 2: In the 5G network slicing environment, the implementation of this strategy is more complicated, because each slicing has its own unique requirements and performance indicators are shown in Eq. (2).

$$z(x_i) = \frac{z_i \cdot F(d_i, 1 - y_i) - w_i^2}{\xi} \tag{2}$$

### 2.3 Provisioning of Resource Provisioning Schemes

Data collection: Collect and analyze data related to network status, business requirements, user behavior, and more.

Decision-making: Make resource allocation decisions based on data analysis and forecasting.

Resource adjustment: Dynamically adjusts the resource allocation of network slices based on the decision-making results.

Feedback mechanism: Establish an effective feedback mechanism to monitor the effect of resource scheduling in real time, and adjust the strategy according to the actual effect is shown in Fig. 1.

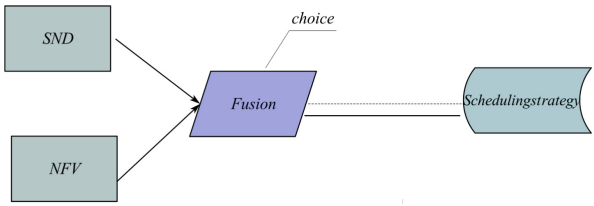


**Fig. 1.** The selection result of the scheduling policy

## 3 Optimized Communication Data for 5G Networks

Service features: Different services have their own unique performance requirements, such as bandwidth, latency, and reliability. A resource scheduling strategy should recognize and adapt to these characteristics.

Network load: Real-time network load status is an important basis for resource scheduling. When the load is light, you can allocate more resources to improve performance, and when the load is heavier, you need to allocate resources carefully to avoid congestion.

User behavior: User behavior patterns, such as traffic usage Xi and service usage frequency, also have an important impact on the design of resource scheduling policies.

## 4 Practical Examples of 4.5G Networks

### 4.1 Introduction to Power Grid Resource Allocation

The key of dynamic resource scheduling strategy is to improve the accuracy of prediction and the timeliness of response. This requires continuous collection and analysis of data, adjustment and optimization of algorithms to achieve finer and more efficient resource scheduling is shown in Table 1.

**Table 1.** Requirements for power grid resource allocation

| Scope of application | content | Dynamic scheduling effects | Resource scheduling capabilities |
|---|---|---|---|
| 5G network | Base station selection | 96.9815 | 87.7623 |
| | Communication positioning | 95.7360 | 84.7311 |
| 5G+ network | Base station selection | 35.3505 | 34.6885 |
| | Communication positioning | 98.2473 | 36.1839 |
| Transition Network | Base station selection | 34.3509 | 34.5240 |
| | Communication positioning | 36.9815 | 37.7623 |

The provisioning process in Table 1 is shown in Fig. 2.

### 4.2 5G Network Situation

Performance indicators: By comparing the network performance indicators (such as throughput, delay, packet loss rate, etc.) before and after the implementation of the strategy, the effectiveness of the strategy is evaluated as shown in Table 2.

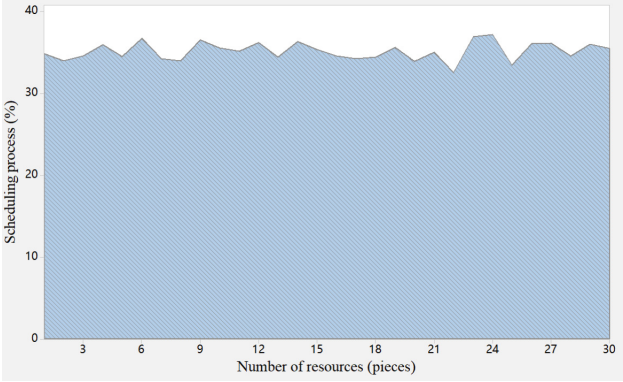


**Fig. 2.** The provisioning process of the 5G network

**Table 2.** Scheduling the transition network for provisioning communication data

| category | Signal strength | Communication compliance rate |
|---|---|---|
| 5G+ network | 84.9 | 94.81 |
| 5G network | 86.51 | 93.86 |
| Transition Network | 86.17 | 96.13 |
| mean | 86.12 | 96.12 |
| $X^6$ | 36.115 | 5.526 |
| P = 0.012 | | |

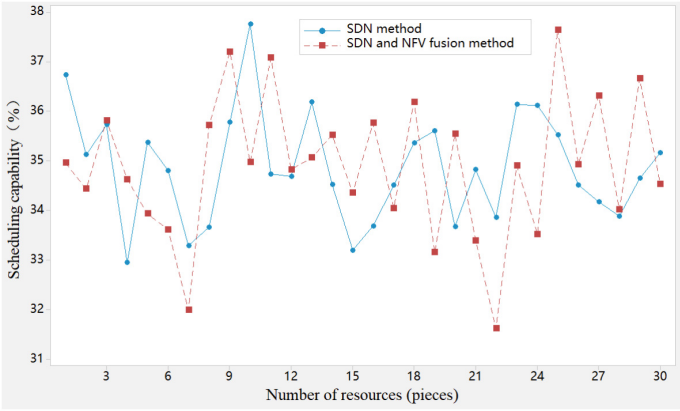


**Fig. 3.** Scheduling capabilities of different algorithms