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# Chemical Production Information Management System Based on Artificial Intelligence Neural Network Algorithm

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To study the Chemical Production Information Management System. The artificial intelligence neural network evolutionary computation was introduced. Based on this, the EPNNA evolutionary algorithm was described. Then the resource management engine was established and operated. The operation result was used to confirm whether the design was effective. A study was conducted for the generated management information system and the generated procurement management information system. The results showed that the design was effective. The design breaks through the limitations of traditional development and has good results.

## 1. Introduction

This paper studied the learning ability, adaptability, and large-scale parallel processing capabilities of artificial neural networks, so as to deal with non-linear and non-structured complex problems in management information systems in chemical production. A management information system development platform based on artificial neural network is built with strong adaptability and scalability, meeting the needs of dynamic development of enterprises: featuring good openness, integrating with other existing systems, low input costs, short development cycle and high reuse. The writing of source codes is not required during the design process, and the management information system can be directly generated, not subject to industry restrictions.

## 2. Literature review

Information management system is a system composed of computers, which can collect, transmit, store, process, maintain and use information. The information management system can measure the various circumstances of the enterprise, use the past data to predict the future, assist the decision-making from the overall situation of the enterprise, apply the information to control the behavior of the enterprise, and help the enterprise realize its planning goal. The management information system is mainly implemented the following several functions: preparing and providing unified format information, simplifying various statistical work and reducing the cost, providing a large number of information with different requirements in a timely and comprehensive way, so as to analyze and explain the problem quickly and produce the correct decision in time; saving a large amount of information in a comprehensive and systematic way; quickly realizing the query and synthesis to provide information support for the decision-making of the organization; applying the mathematical methods and various models to process the information to predict the future and make scientific decision. The information management system is often divided into four systems: market, production, finance and personnel according to their functions. Different functions have different application systems. The main contents of the market management information system include: advertising, promotion, product management, pricing, sales forecast, sales automation and sales management.
Yin and others, in their study, pointed out that, at present, the most widely used in domestic enterprises was the MRP (Material Requirement Planning) system, which was an early used production management system, and some enterprises were using a more advanced ERP system (Yin et al., 2015). For the large production and manufacturing enterprises in China, the scale is larger and the development is very fast, so the related

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information construction is carried out, and the production management system suitable for the development of the enterprise is basically established.

Lee and others pointed out that no matter it is MRP system or ERP system, because they are all the relevant resources in the enterprise to centralized control, it lacks precise management of part of the links and there is still some gap with flexible production management (Lee et al., 2014). At present, when enterprises use MRP and ERP systems for production management, there are mainly the following deficiencies:

For each enterprise, the demand for orders received is different, and some manufacturers may need products in the short term after a list of orders, while some manufacturers are in the medium and long term demand. As a result, the time is relatively loose. There is another case of temporary order, some enterprises suddenly need products, and it will make the production plan arranged in advance in a mess, leading to a difficult balance between planned and actual production needs. Therefore, in order to solve this temporary demand problem, enterprises often use large inventory, or advance the production date of the products, leaving spare time to cope with the time needs. Ngai stated that, in MRP and ERP systems, a fixed lead time was often used, and managers would be advanced again on the basis of lead time, which suggested that the actual production time of the product was earlier than the fixed lead time, which inevitably led to excessive inventory and the amount of work (Ngai et al., 2014).

Ali described that, in MRP and ERP systems, in order to solve the problem of balance between plan and demand, the method of increasing inventory was adopted. However, too much inventory took up a large amount of material. If the purchase was not timely, too few materials would cause the production process to be blocked and the manufacturing cycle of the product is extended (Ali et al., 2015).

In the production process of some enterprises, some problems often occur, such as the lack of production capacity of some workshops, or the high rate of production waste products, which leads to low production capacity and cannot meet the normal production demand. Because the actual situation is not taken into account completely, the production plan is carried out only according to the demand of the order, which often leads to the situation that the production is not timely and cannot be delivered. After the error occurs, it needs to be calculated and checked repeatedly, so as to find out the cause of the problem, which is a complex process.

When the demand for material is calculated, such as the demand for parts and raw materials in the production workshop, it is usually calculated according to the bill of material. If the actual bill of material is too complex, it will be complex when the manager inputs the data into the system. The storage and processing of the data will result in a large amount of work, resulting in the calculation result not consistent with the actual result, which is contrary to the requirements of MRP and ERP system for accurate accounting lead time.

With regard to artificial neural network algorithm, Nabavi-Pelesaraei and others put forward a Boltzman model in the literature. The model introduced the relevant knowledge of statistical physics, first proposed a multi-level network, and introduced the simulated annealing technology into the learning process (Nabavi-Pelesaraei et al., 2016). Khorasani and Yazdi combined particle swarm optimization with artificial neural network algorithm to propose a new algorithm - PSO-BP algorithm, and applied it to the training process of learning and successfully applied to a game (Khorasani and Yazd, 2017). Moldes et al. successfully applied artificial neural network to map edge detection and used it in war strategy games, which provided a new mechanism for generating new maps (Moldes et al., 2017). Jalal and so on, on the basis of three big neuron excitation functions linear, sigmoid and tansig, proposed a new excitation function, and applied it to the loop search of the game, which brought a good incentive method and increased the playability of the game (Jalal et al., 2016).

## 3. Method

### 3.1 Features of evolutionary computation

The features of evolutionary computation include two aspects: first, the evolutionary search of the population, the search process is random and biased; second, the exchange of information between individuals in the population. Based on such a mechanism, the superiority and the advantages of evolutionary computation are:

(1) Strong robust optimization search algorithm, suitable for large-scale complex problems, and can solve problems without any known solution;

(2) Strong parallelism, suitable for giant parallel implementation;

(3) Concise computation, easy to understand and apply;

(4) Wide range of applicability, easy combination with other technologies.

### 3.2 Evolutionary neural networks

The learning network obtained combining genetic algorithm with neural network learning is called Genetic Neural Network (CNN). The learning network obtained combining evolutionary algorithm with neural network learning is called Evolutionary Neural Network (ENN). Broadly speaking, the learning networks obtained by the above two methods are collectively referred to as ENN, featuring structural parallelism of neural networks and giant parallelism of evolutionary algorithms. The ANN design is to search for satisfactory solution networks in the problem solution space.

Since the problems that ANNs are trying to solve are often problems that are difficult to solve with traditional methods, such as complicated input/output mapping problems, speech recognition problems, and complex control problems, the problem solution space may be uneven and intermittent. It is a complex combined optimization search problem to find the satisfactory solution of the problem. The problems existing in previous ANN designs mainly include the following two aspects:

First, the learning of the network connection right of a fixed structure (single track search or learning) is strongly dependent on the initial conditions and easily falls into local extreme points.

Second, there are three common methods of network structures learning:

The trial method is widely used in engineering. In order to solve the problem, the designer uses existing knowledge to construct several networks of different structures and sizes to learn connection rights; through repeated trial, the designer can obtain a satisfactory learning network. This method relies on the designer's experience and is suitable for small-scale network design.

The construction method (growth method) starts from learning of a small-scale network, and gradually increases the size or complexity of the network structure, depending on the network performance during the training process, until it is satisfactorily resolved. The problem with this method is that if you do not properly control the scale of network, you will get an oversized learning network. Although training requirements can be met, other performance of the learning network may be poor.

The pruning method starts learning from an initial network with a larger scale than the minimum size of the solution network. In the network training process, the obtained satisfactory network is gradually reduced in structure according to certain performance criteria, and unnecessary links or nodes are deleted, until the network performance deteriorates, then the training is stopped, and a satisfactory learning network is obtained. The learning network obtained by the pruning method has brief structure and good performance. The existing problems are: First, the size of initial network is difficult to select. To get a proper initial network, the trial method is used. In addition, the same problem as the construction method is that the obtained learning network is likely to be a local optimal solution.

### 3.3 EPNNA evolutionary algorithm

Figure 1 shows a fully connected structure of a typical forward network structure. Consider a fully connected multi-layer forward network. Assume that X and Y represent the input and output vectors of the network, respectively, Y represents the actual output of the network, and m, N, and n represent the number of allowed network input units, hidden units, and output units, respectively.

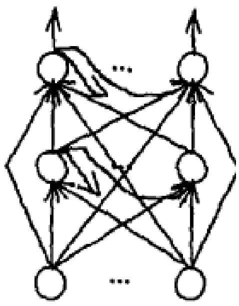

*Figure 1: Fully connected structure of a typical forward network structure*

For a fully connected forward network, suppose that m and n indicate the number of input and output of the network respectively, and N indicates the number of hidden units. With direct coding, the connection rights of the network structure are expressed in an individual. The representation of an individual includes the detailed parameters that make up a network: the input units, hidden units, and output units of the network, the status of each unit (1: present, 0: not present), unit function, connection and connection rights. Figure 2 is a block diagram of video signal acquisition, processing and communication system. For convenience, we describe the m+N units comprehensively, indicating the status of m+N units, and the action function features represent the connection and connection rights of units i and j. The length of each individual is the same, and the number of hidden units contained in the corresponding neural network may be the same or different. This is determined by the state of each hidden unit in the individual representation.

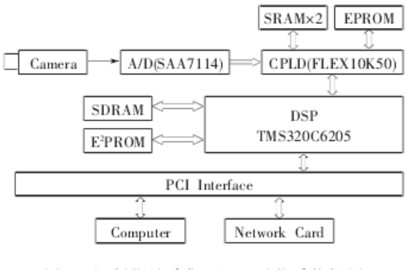


*Figure 2: Block diagram of video signal acquisition, processing and communication system*

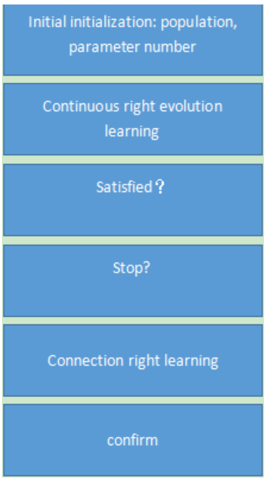


*Figure 3: EPNNA evolutionary algorithm flow*

The EPNNA evolutionary learning process includes two parts: evolutionary learning of connection rights and structural evolution learning in fixed-structure-scale individual networks. The basic idea of the algorithm: First, the scale of the structure is fixed, and the evolutionary learning of the connection right of the population is achieved. Only when the evolution of the population stops or the solution is satisfactory, the connection right learning ends, transferring to the structure evolutionary learning process. In the process of structural evolution learning, different structural variations are taken according to whether or not a satisfactory solution is obtained. When a satisfactory solution is obtained, structural pruning variation is performed, and then connection right evolutionary learning is performed to the network population with pruned structure; When no satisfactory solution is obtained and evolution ends, structure growth variability is performed, and then connection right evolutionary learning is performed to the network population with new structural-scale; When the structure pruning evolution ends, stop the evolutionary learning process, and determine satisfactorily optimal obtained via the evolutionary learning. Figure 3 shows the EPNNA evolutionary algorithm flow.

### 3.4 Resource management engine

Independent allocation of information resources is achieved through the resource management engine, to establish a mapping relationship between background data and foreground applications, and build data mapping channels. Writing of codes or development of the database is not required, and you can customize the resources through data mapping channels.

The resource management engine adopts an open data architecture that accommodates multiple industry data sources and combines them to form an industry data model. It not only reduces the need for customization, but also reduces individual needs. The established collaborative relationships with other engines are used to pass data resources to each other, and customize information resources. The resource engine can customize the content of resources, statistical functions, summary modes, resource reports, and display and print styles.

## 4. Results and analysis

### 4.1 Generate accounting management information system

The accounting management includes accounting management of raw material procurement, raw material audits, distribution of raw material, chemical production, product audits and emissions statistics. Figure 4 shows the business process.

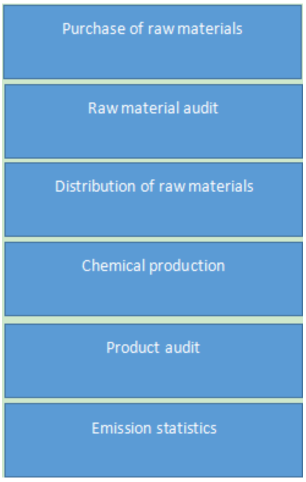


*Figure 4: Business process*

The workflow is defined according to the actual business process of the accounting management using the workflow definition engine. The defined work component carries the personalization information of account management, and combines the resource engine, report engine etc. to define the cooperative relationship between the various components of the accounting management system. The cash management, bank account management, accounts receivable management, payables management, fixed asset management, payroll management, cost accounting management and other components are generated, which together constitute the accounting management component, completing the development process of the accounting management component, which is the genetic process of the parent to the child in the artificial neural network, as shown in Figure 5.

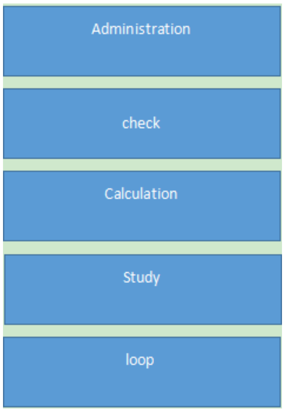


*Figure 5: Cooperative relationship*

### 4.2 Generate purchase management information system

The procurement is to provide raw materials (or outsourcing parts) needed by the production department in a timely and appropriate manner with quality, quantity and proper price. Procurement management is the process of organizing, implementing and controlling the procurement business process. The workflow is defined according to the actual business process of the procurement management using the workflow definition engine, and combines the resource engine, report engine etc. to define the cooperative relationship between the various components of the procurement management system, as shown in Figure 6.


*Figure 6: Business flow chart of the purchase component*

## 5. Conclusion

This paper establishes an information management system development platform based on artificial neural network, so that the information management systems can be developed without using the traditional development methods, avoiding complicated code writing work in the traditional development methods, reducing the difficulty of the development and shortening the development time. This platform breaks through the industry restrictions of traditional platforms, and can be applied to a variety of industry areas, increasing the reusability of the software and avoiding duplication of work. Through the application description of this platform, the platform development information management system meets the dynamic requirements of the continuous development of the chemical industry, convenient for expansion of the chemical industry, information integration, or secondary development. However, the study in this paper is not enough due to the limited research.

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