

Research and application of key technologies of information processing based on Artificial Intelligence

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Abstract. With the development of computer technology, information processing is becoming more and more intelligent. Information processing technology based on artificial intelligence is also very powerful. Aiming at the key technology of information processing in artificial intelligence research, this paper analyzes the basic characteristics and information processing mechanism of artificial intelligence information processing based on neural network algorithm which is the most commonly used in the field of artificial intelligence. On this basis, the author established the mathematical model of artificial neural network, and artificial neural network is applied in the intelligent information database as an example to verify that artificial intelligence has more intelligence, high efficiency and accuracy to process information, which is of great significance and value for the processing of information in the future.

Key words. Artificial intelligence, information processing, technology research.

1. Introduction

Artificial intelligence is abbreviated to AI. It is a new science and technology for the research, development and extension of the theory, method, technology and application system of human intelligence. Artificial intelligence is a branch of computer science; it attempts to understand the essence of the intelligent, and produces a new kind of intelligent machines that can react in a similar way to human intelligence. Research in this area includes robotics, language recognition, image recognition, natural language processing and expert systems [1].

Information processing tools have to deal with noisy, cluttered, non-linear data, while dealing with these problems is the advantage of neural network. This article is a comprehensive analysis based on the application of artificial neural network algorithm in information processing technology [3]. In view of the great advantages of the intelligent algorithm based on neural network for the processing of information,

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the author makes a detailed study on its specific application methods and technical features [4-5].

2. Research on information processing and transmission mechanism of artificial intelligence neural network

2.1. Reach on the information processing and transmission characteristics of artificial neuron

Artificial neural network is used to simulate the excitation and inhibition of neurons. Therefore, we should first understand the state of excitatory and inhibitory neurons [6-7]. The two states of excitatory and inhibitory neurons are characterized by different potential differences between the inner and outer membranes. In the inhibitory state, there is an internal negative external potential difference between the inner and outer membrane, which is about -5-100mv. In the excited state, there is an external negative internal potential difference, which is about 60-100mv of the electric pulse. The potential difference between the inner and outer membrane is caused by the different concentration of ions in and out of the membrane. The electric pulse width of the cell is generally about 1ms. The changes of the excitability of neurons are shown in figure 1.

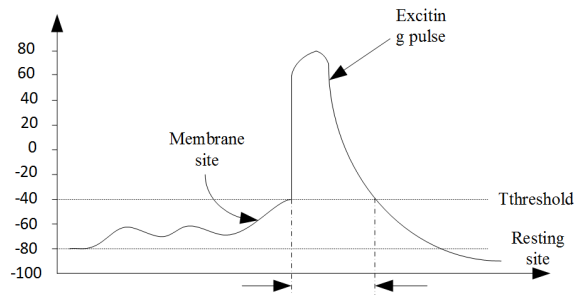


Fig. 1. The change of potential information in the process of neuronal excitation

It can be seen from Figure 1, the neuron electric pulse signal comes to the axon terminals through the axon, then the vesicles change and neurotransmitter is released, the neurotransmitters come into other dendrites in neuron. The receptors on the dendrites can accept the neurotransmitter to change the permeability of the membrane ions, so that the difference in the concentration of ions inside and outside has changed, then the potential changes. In this way, the information is transmitted from one neuron to another. The neuron receives information from other neurons, the membrane potential changes gradually from time to time. When the membrane potential changes beyond a certain value, it will produce a pulse of mutation, which is then transmitted along the axon.

2.2. The establishment of artificial neuron model

Neurons have temporal and spatial characteristics of information from other neurons [8]. In the structure of neural network, the axon terminals of a large number of different neurons can reach the same neuron dendrites and form a large number of synapses. The neurotransmitters released from different sources can play a role in the changes of the membrane potential of the same neuron. Therefore, on the dendrites, neurons can integrate input information from different sources. For information from the same synapse, neurons can also integrate the information at different times. Figure 2 is the transfer model of artificial neuron information.

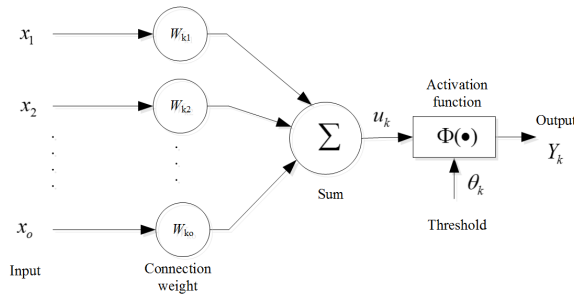


Fig. 2. transfer model of artificial neuron information

The information transmission of artificial neural network consists of a set of connections, a summation unit and a nonlinear activation function. The connection strength is indicated by the connection of the weights. When the value is positive, it indicates activation; when the value is negative, it indicates inhibition. Summation unit is used to calculate weighted sum of input information; the nonlinear activation function, which acts as a nonlinear mapping and limits the amplitude of the neuron output to a certain extent, it is usually limited to $(0, 1)$ or $(-1, +1)$. The above action is shown by the mathematical expression (1):

$$\mu_k = \sum_{j=1}^p \varpi_{kj} x_j, \nu_k = net_k = u_k - \theta_k, y_k = \varphi(\nu_k) \quad (1)$$

In the formula, x_1, x_2, \dots, x_k is the input signal, $\varpi_{k1}, \varpi_{k2}, \dots, \varpi_{kp}$ is the right of the neuron K, u_k is the result of linear combination, θ_k is the threshold, φ is the activation function, y_k is the output of the neuron K.

3. Examples analysis of artificial intelligence neural network in information processing

In this paper, the information processing technology of artificial intelligence neural network is studied, and the author analyzes the application of neural network algorithm in data mining.

3.1. Construction of classification decision tree of artificial intelligence neural network

The process of algorithm and decision based on artificial intelligence neural network are as follows:

Data preprocessing. Data preprocessing includes data selection, discretization, coding of attribute values, quantization of attribute values and classification results. In the quantization process, the attributes and the classification results are set in the range (0, 1), so as to form a specific sample of neural network training. In essence, the main purpose of the training is to identify the order of each attribute to determine the intensity of the classification results, but do not care the accuracy of the output data. The order of each attribute to the classification result reflects the relationship between the input and output of the network. When the sample data is more, the relationship between output and input is easier to identify. Therefore, the training speed should be allowed to take more training samples.

Construction algorithm. The core of the algorithm is to select the attribute with the greatest strength as the extended attribute. Specific algorithms are as follows:

(1) For the current example collection, select the A1 with the greatest strength as the extended attribute.

(2) Assign the same value to A1 in the same subset, what A1 takes a few values, it will have several subsets.

(3) For subsets containing different classes, if the classification accuracy is lower than the predetermined precision, the recursive algorithm is used for the subset of different classes;

(4) If the subset is of the same type, corresponding to the specific type of the branch mark, return the adjustment.

3.2. Introduction and modeling of reinforcement constraint

According to the nature of the relationship between the constraints, these are essentially inductive constraints, so the introduction of constraints using the following introduction:

$$E(X) = e(X) + \sum_i w_i L_i(X) \quad (2)$$

Among them, X is a training solution of specific grid structure; $e(X)$ is the output error of the network; $L_i(X)$ is i constraint error of relational reinforcement constraint; w_i is the induced weight of the i relation reinforcement constraint, and its value depends on the degree of importance of the relationship and the difference between $e(X)$ and $L_i(X)$, and $e(X)$ is the total error of network training.

(1) Weight constraint. From the calculation of partial derivative neural network type can be seen, in these formulas include weighted product term. In order to limit unnecessary changes in weight, improve the accuracy of the network cable relationship, we should introduce the limiting factors to the weight change, specific constraints are as follows:

$$I_w(X) = \sum_i |W_i(X)| \quad (3)$$

Among them, $I_w(X)$ is the weight constraint error; $W_i(X)$ is the link weight of the network;

3.3. Application example analysis

An example is given to illustrate how the database information is processed by the artificial intelligence neural network. There are 21 types of reservoirs in this reservoir, which are mainly about the relationship between the evaluation of reservoir properties and the relationship between the nine factors which may influence the evaluation. The eleven field corresponds to eleven group (including oil group, reservoir properties group and 9 specific reservoir characteristics, group) each group corresponds to a field name, i.e. A group contains all possible values of the field. These processing units are visible units that can receive external inputs. In addition, there is a hidden group of oil reservoirs, in which there are 21 hidden units, which represent 21 types of reservoirs, and they are related to the values of the other eleven groups. In the same group, each processing unit represents the same nature of the content. For example, in the reservoir type group, each processing unit represents the name of each type of reservoir. The connection between them is mutual inhibition, if it is a kind of oil layer, then the possibility of other types of oil layer is inhibited. In a group of reservoir characteristics, several values are mutual inhibition. For example, in the group characteristics of the thickness of oil, with three processing units, they are hitck, medium and hitn, the three is mutual inhibition. The database information is shown in table 1.

Table 1 database information table

Name	A	B	Result
X1	a1	b1	R1
X2	a2	b2	R2
X3	a3	b3	R3

The artificial intelligence neural network is used to mine the association rules of database information, we get the following results:

As shown in Figure 3, when a unit of a characteristic group has an external input, resulting in its value increase, the sudden rise in value quickly spread to all hidden units which are connected with it, these excited or inhibited units transfer the state values of the changes to their respective units until the network reaches a new equilibrium. It can be seen from the results that the method has a very effective role in information mining and association processing.

4. Conclusion

Based on the artificial neural network, this paper studies the application of artificial intelligence in information processing. The author first analyzes the basic

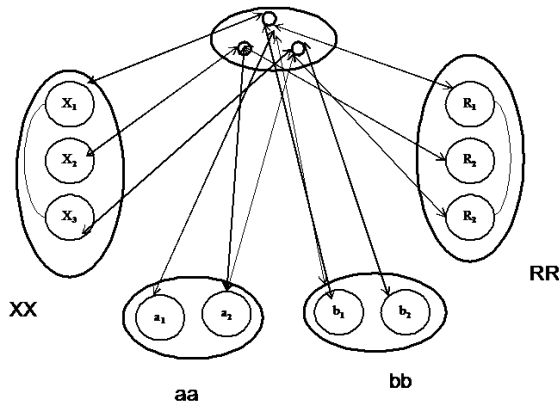


Fig. 3. results of Database Information Association

characteristics of information processing and information transmission mechanism of artificial intelligence neural network. On this basis, the author establishes the mathematical model of artificial neural network, and artificial neural network is applied in the intelligent information database as an example to verify. It fully shows that the use of artificial intelligence for information processing, with a more intelligent, efficient and accurate target for future information processing and processing has a greater advantage.

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