

Efficiency Analysis of Pattern Recognition Based on Feedforward Neural Network

Ming Yang

School Computer Science Technology, Shandong University of Finance and Economics, Jinan, 250002, China

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Abstract: At present, the research in the field of AI focuses on the integration of intelligent recognition methods, and a new feedforward neural network model for pattern recognition is proposed. The model has the property that the training is consistent with the classification standard in practical application, which makes the pattern recognition classification more reasonable and natural. The change of the corresponding error function can speed up the training speed of the network. Since fuzzy neural network technology has many excellent abilities such as knowledge storage and uncertain information processing, the application of neural network in pattern recognition can make up for the defects and deficiencies in the original technical field. Therefore, the application of neural network in pattern recognition has become a research focus. Feedforward neural network model is the most widely used neural network model so far, especially in the field of pattern recognition. Combined with the design process of simple character recognition system, this paper discusses the basic mathematical principle of feedforward neural network algorithm, and gives the basic flow of using this algorithm to solve the problem of pattern recognition. This paper focuses on the principle of network training, and deeply analyzes the relevant factors affecting the efficiency of network training.

1. Introduction

Feedforward neural network integrates biophysics and mathematics. It is a new problem-solving method. It is widely used in many fields such as machine learning, expert system, intelligent control, pattern recognition and computer vision [1]. It is a basic artificial neural network algorithm, which is widely used in solving pattern recognition problems; However, its network training process has always been a focus worthy of research and exploration [2]. In the application of pattern recognition, it is very important to design a neural network classifier with incremental learning function according to the neural network learning theory, because in practical application, obtaining all the data required for training neural network at one time is not only time-consuming, laborious, but also sometimes unrealistic [3-4]. At present, the field of AI is carrying out the fusion of multiple intelligent recognition methods to improve the recognition effect. The fuzzy neural network based on fuzzy logic and neural network plays a very important role in the realization of real intelligent simulation [5].

As artificial neural network is a new information processing model composed of imitating biological neural system, it has some remarkable characteristics, does not need accurate mathematical model, and is good at learning useful knowledge from input and output data. Because neural network is composed of a large number of simple computing units, it is easy to be realized by software and hardware, etc. [6]. Because of the unique structure and characteristics of neural network, people expect it to solve some problems that are difficult to be solved by traditional methods [7]. When the sample size is large, the training of all samples is often infeasible due to the limitation of system memory, and incremental learning does not need to use all training samples, so it can complete the learning of samples when occupying small memory resources [8]. Based on the design and development process of a character recognition system, this paper focuses on the method of using feedforward neural network algorithm to solve the problem of pattern recognition [9]. It also analyzes the relevant factors affecting the network training efficiency. Finally, through the

example simulation, it more intuitively shows the impact of various relevant factors on the network training efficiency [10].

2. Feedforward neural network algorithm

2.1. Overview of neural network

Although modern computer has strong computing and information processing ability, its ability to solve complex problems such as pattern recognition, perception, evaluation and decision-making is far inferior to people, and it lacks the ability to learn from and adapt to the environment. Human brain has a large number of neurons, and its performance in situation analysis, judgment, learning and decision-making is much higher than that of computer. In essence, mode is a concept with rich connotation. It mainly refers to the external information that human beings can receive directly or indirectly by using their senses. In order to imitate the working mode of human brain and construct an information processing system closer to human intelligence, so as to improve the ability of computer to solve intelligent problems, feedforward neural network is designed and implemented. The so-called generalization ability of neural network refers to the ability of network to make correct response to test samples after learning. Therefore, it can deal with those untrained, noisy or incomplete data, so as to obtain appropriate solutions corresponding to these data, and show good fault tolerance. Generalization ability is very useful, because the data obtained in the real world are often polluted or incomplete by noise, so the neural network without generalization ability has no practical value. Feedforward neural network is a parallel distributed processor with a large number of connections. It has the ability to acquire knowledge and solve problems through learning, and the knowledge is distributed and stored in the connection weight, rather than in a specific storage unit according to the address like a conventional computer.

2.2. Feedforward neuron model

The design of feedforward neuron model is a major achievement of computer bionics. At present, it is very mature. Figure 1 shows the basic structure of neuron model:

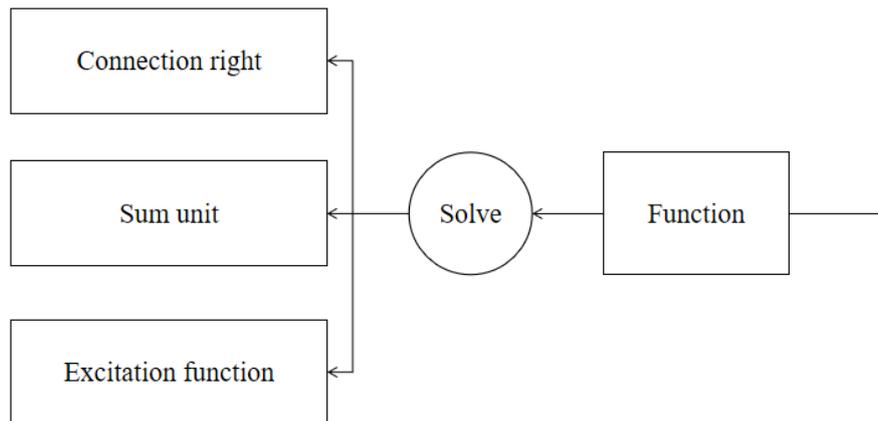


Figure 1 Basic structure of neuron model

It mainly has three basic elements: a set of connection weights, and the connection strength is represented by the weight on each connection. A positive weight indicates excitation, and a negative weight indicates inhibition; A summation unit for calculating the weighted sum of each input information, and in addition, in order to adjust each input information; A nonlinear excitation function plays a nonlinear mapping role and limits the output amplitude of neurons within a certain range. Feedforward network is a typical topology. When feedforward neural network is applied to pattern recognition, it is generally divided into two stages: training and learning stage and actual operation stage of classification, as shown in Figure 2:

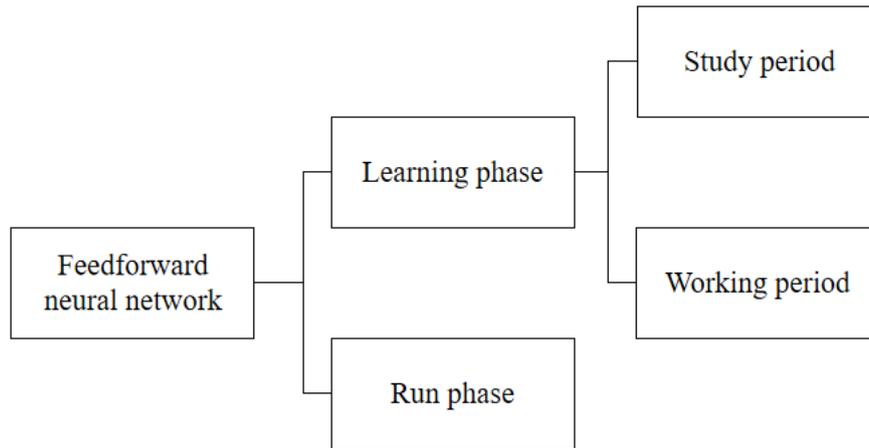


Figure 2 Feedforward neural network mode stage

The work of training and learning stage is to establish the sample set, input the samples into the network, and train the network through learning algorithm. In the feedforward network, each neuron receives the input of the previous layer and outputs to the next layer without feedback. Nodes are divided into two types: input element and calculation element. Each computing unit can have any number of inputs, but only one output. Feedforward networks can be divided into different layers. It also has a working process. The working process of feedforward neural network is mainly divided into two stages. One stage is the learning period. At this time, the state of each computing unit remains unchanged, and the weight on each connection is modified through learning. The second stage is the working period. At this time, the connection weight is fixed and the change of cell state is calculated to achieve a certain stable state.

3. Application method of feedforward neural network

3.1. Network mode analysis

The effect of feedforward network is mainly function mapping, which can be effectively used in pattern recognition and function approximation. Therefore, it has unique advantages in solving pattern matching problems such as character recognition and speech recognition. In order to explore the application of feedforward neural network in character recognition technology, a simple character recognition system is constructed. The system can learn and memorize the given character samples through artificial neural network, and finally realize the recognition of characters with unknown shape given by users. When solving practical problems, the so-called network structure design is mainly to determine the number of neurons in the input layer and output layer, the number of hidden layers and the number of neurons in each hidden layer. In the design process, the pattern recognition system is mainly composed of two core modules: learning module and testing module, and the whole system has many functions in the operation process, such as training pattern sample feature data input, formulating classification decision rules, error rate detection, pattern sample feature selection and positive feature extraction method adjustment. The system will train the sample pattern according to the envisaged classification decision mathematical model to obtain the classification decision rules. The data preprocessing function is designed in the learning module and test module of the pattern recognition system. Some data features that are effective for classification and discrimination can be defined and retained. This process is called the feature selection of the pattern recognition system in the operation stage.

3.2. Conclusions

The related research on the application of feedforward neural network in pattern recognition has been started in China at an early stage, but the research results proposed by scholars have not been widely used. Some experts have optimized and improved the application of pattern recognition in

seismic feature extraction, and carried out a series of experimental studies in combination with different geological conditions in different regions. Many remarkable results have been achieved, and on this basis, the human-computer interaction function has been added to the whole system. The improved pattern recognition system has been widely used in related fields in China. At first, the pattern recognition system used in some fields was mainly based on statistical recognition strategy. For neural networks, it can effectively solve the problem of learning and training feedforward and reverse neural networks, so it opens up a new way for the whole research field of neural networks. The effective solution of the learning problem of feedforward reverse neural network fully highlights the advantages of neural network, and feedforward reverse neural network pattern recognition has become a core development direction in pattern recognition, and has been widely used in the detection fields of biological, medical, geological and chemical products. The application of neural network in pattern recognition will bring great changes to the society. At the same time, it also means that pattern recognition technology based on neural network will become a core technology in the network digital era.

4. Conclusions

At present, feedforward inverse neural network pattern recognition has been applied in various fields of society. The incremental learning of neural network should realize the learning of new samples without using the original samples, while maintaining the original knowledge of neural network. Although the current research on incremental learning has made some progress, the ability of neural network incremental learning still needs to be improved. Next, we need to further study the learning theory of neural network and find the neural network weight adjustment, structure adjustment and neural network integration methods that better meet the requirements of incremental learning. The feasible way is to integrate multiple neural networks into a system and realize incremental learning by continuously embedding subnetworks with different knowledge in the learning system. Although there are still some deficiencies and defects in the technical system, it is bound to usher in a new development period with the support of modern science and technology, which plays a very important role in promoting all production fields of our society.

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