

Application of BP Neural Network Identification in TCM Pulse Signal Identification System

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Abstract: In recent years, Chinese medicine has been widely developed. Among them, pulse diagnosis of traditional Chinese medicine is an important part of TCM theory and practice research. Based on the importance of pulse diagnosis in traditional Chinese medicine, this paper takes the application of BP neural network identification in the informationization of TCM pulse as the entry point, and briefly introduces the relationship and characteristics of the two, and analyzes its specific application.

1. BP neural network and Chinese medicine research

BP neural network was launched in the 1980s. It is constructed by simulating the principle of biological nervous system. It is a new intelligent information processing system that can realize nonlinear mapping. BP neural network was proposed by scientists named Rumelhart and McClland in 1986. It is a multi-layer feedforward network trained by error inverse propagation algorithm and is one of the most widely used neural network models. Neural network is a multi-disciplinary interdisciplinary subject of information science, mathematics, biology, medicine, etc. It has the characteristics of self-learning, self-organization, parallel distributed processing, and good fault tolerance. The BP network can learn and store a large number of input-output mode mapping relationships, find optimized solutions at high speed, and have associative storage functions without revealing mathematical equations describing such mapping relationships in advance. Neural networks are widely used in control optimization, information processing, pattern recognition, fault diagnosis and prediction.

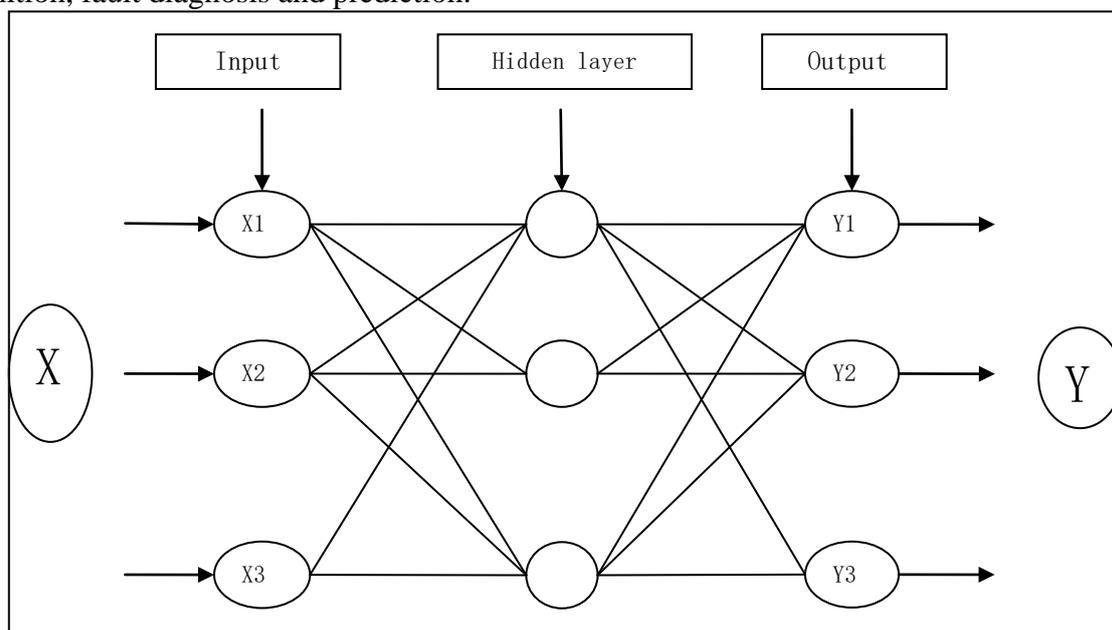


Figure 1. BP neural network model diagram

The Chinese medicine field is huge in data, fast in generation, complex in structure, and characterized by diversity, incompleteness, redundancy, privacy, ambiguity and nonlinearity. In recent years, in the field of traditional Chinese medicine, many scholars have used BP neural network technology to make many useful researches and explorations in terms of theory and practice. Obviously, linear modeling is not suitable for the clinical nonlinear modeling method of TCM, but it can be established to fully approach the actual structure of the system by discovering the characteristics implicit in the input and output data under the condition that the internal structure and mechanism of the system are unknown. An equivalent model of the mechanism. In this way, a large number of multiple synergistic or collinear relationships between TCM clinical information can be well simulated, which is more suitable for its complex and nonlinear features, and to explore suitable nonlinear mathematical modeling methods. This has an important role in promoting the clinical diagnosis and treatment of TCM, and can achieve twice the result with half the effort.

2. Research situation

Combining the BP neural network, BP neural network and the keywords of traditional Chinese medicine and TCM pulse diagnosis, we can find that the research on this aspect is very full. The number of documents from 2017 to the present is very large, with 5000, 3000, 100 respectively. More articles. It can be seen that BP neural network has been widely used in various fields of TCM research, and it has great significance for the study of TCM pulse diagnosis.

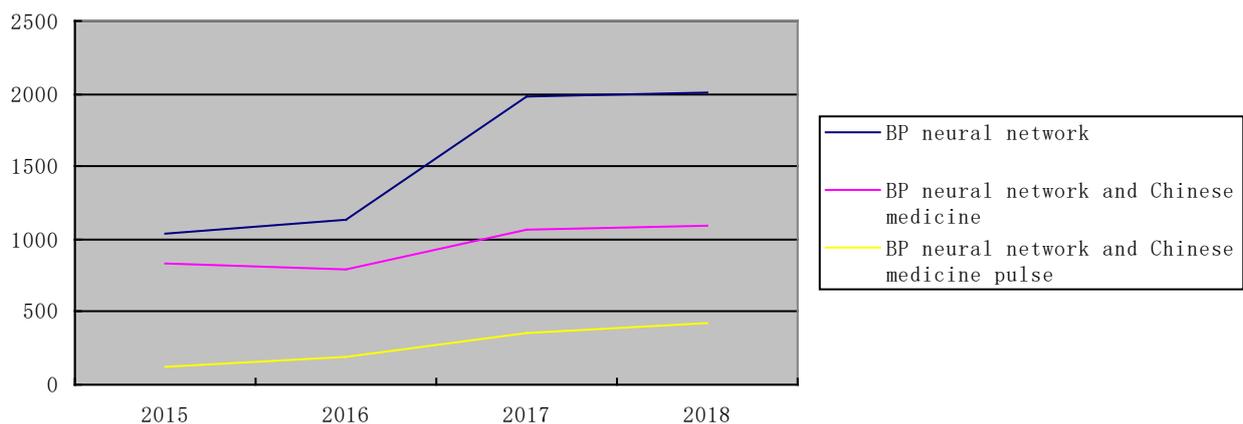


Figure 2. Research status since 2015

From the research content, in practice, some research institutions have also carried out useful exploration. The Beijing Institute of Computer Technology Applied uses a neural network model to diagnose clinical cases; Central South University has established a multi-layer feedforward artificial neural network classification system based on a custom network structure. Shanghai University of Traditional Chinese Medicine designed a neural network model of TCM syndrome differentiation based on MFB-P algorithm. Hunan University of Traditional Chinese Medicine has used a variety of algorithms including ANN to construct a dialectical software based on TCM theory for clinical, scientific research and teaching. ANN has been successfully used in disease prediction, tongue image processing, pulse recognition analysis, medical image processing and so on.

3. The characteristics and significance of BP neural network in the diagnosis of traditional Chinese medicine

3.1 The pulse signal is a non-stationary signal with a deterministic and random variation.

The pulse signal is a periodic periodic quasi-periodic signal. The pulse wave frequency is 30-200 times/minute. The spectral components are mainly distributed between 0 and 10 Hz. It is an infrasound wave and the highest frequency does not exceed 40 Hz. Affected by human

physiological activities and pathological changes, its time domain and frequency domain have corresponding changes. In addition, because the pulse signal is a non-invasive surface acquisition method, it will be interfered by human breathing, muscle tension, transducers and other reasons. The traditional pulse signal feature extraction and analysis methods can not fully meet this requirement, and often lose a lot of effective information, so it is difficult to use it in clinical practice.

3.2 Signal analysis can get different resolutions in different parts.

The core of BP neural network is wavelet analysis. Wavelet analysis can effectively observe the changes of pulse information. In general, for the high-frequency components of the signal, use a gradual sharp time resolution to closely observe the components of the analyzed signal. For low-frequency components, use a sharper frequency resolution to move closer to the overall trend of the observed signal. . This feature of wavelet is particularly effective for analyzing signals with non-stationary components and is a new signal analysis tool for special applications. The singularity detection, time-frequency localization and discrete focusing properties of wavelet can obtain the best time domain resolution and frequency domain resolution in different parts of the signal, and it is easy to implement adaptive filtering and abandon interference, which is the characteristic of pulse signal. Extraction and analysis provide a new approach.

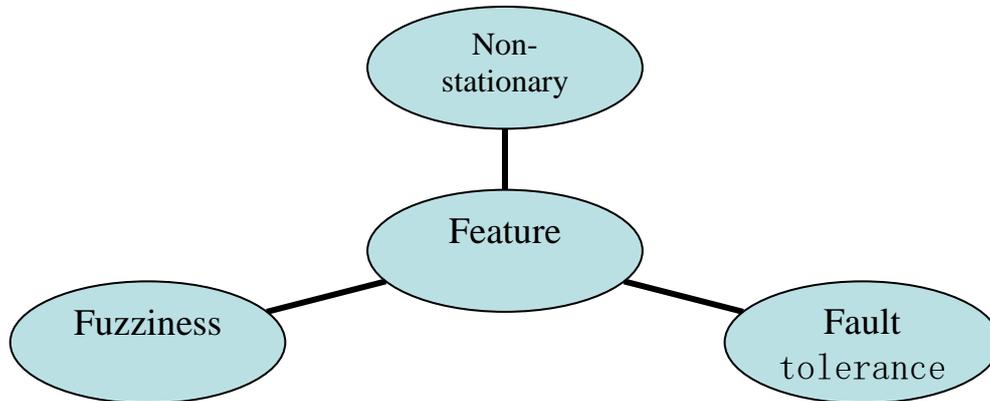


Figure 3. Characteristics of BP neural network in diagnosis of traditional Chinese medicine

3.3 Pulse signals have uncertainty and ambiguity.

The pulse signal is a one-dimensional electrical signal that changes with time and its characteristic performance is uncertain. At the same time, the classification of pulse signals is based on the knowledge of medical experts, and this knowledge comes from the empirical conclusions of pathological experiments and clinical practice, that is, in the context of complex backgrounds. In addition, the factors affecting the judgment include various factors such as the shape, size and pattern recognition of different waveforms in the pulse signal. These reasons make it difficult to obtain satisfactory results by using the traditional pattern recognition method. The current pulse recognition system only realizes the identification of a single pulse.

3.4 Neural networks are highly fault tolerant and self-learning.

The distributed storage of information, large-scale adaptive parallel processing, and high fault tolerance of neural networks are the basis for pattern recognition. In particular, its self-learning, self-organization and self-adaptation are very strong. This can be used to directly learn the numerous samples of the pulse, and continue to learn and train in actual use to enrich its classification recognition ability. Compared with the traditional statistical pattern recognition method, the discriminant function using neural network can be not only linear, but also nonlinear, and can deal with some problems that the background knowledge and the reasoning process are

uncertain. Therefore, using the neural network model to identify the pulse signal is beneficial to solve the problems of complexity and uncertainty encountered in signal recognition. The neural network is used to classify and recognize the pulse signal, so it is not necessary to construct a complex pulse signal analysis algorithm to meet different pulse classification requirements.

4. Application of BP neural network in diagnosis of traditional Chinese medicine

BP neural network has important applications in Chinese medicine informationization, especially in the pulse signal recognition system of traditional Chinese medicine. Specifically in the following aspects:

4.1 Promote the informationization of pulse identification in traditional Chinese medicine.

With the cross-infiltration of multiple disciplines such as biomechanics, information engineering, and mathematics in traditional Chinese medicine, the theory and methods of recording, extraction, and identification of TCM pulse information have made great progress. BP neural network can be applied to the identification of different types of pulse, including pulse recognition of normal people and other physiological and pathological states, recognition of normal and pregnant pulse, recognition of pulse of normal people and cardiovascular and cerebrovascular diseases. The BP neural network can select a certain number of characteristic parameters from the characteristic parameters obtained from the pulse wave map as the input value of the artificial neural network system. Then, corresponding to the input node of the neural network, the specific pulse is called the output node, half of the sample is used as the training sample, and the other half is used as the test sample, and then the result is analyzed, and the recognition accuracy is found to be above 70%. Practice shows that the neural network can perform time domain-frequency domain analysis on the pulse information, and can consider the ambiguity of the pulse image, and has certain intelligent processing ability, which greatly improves the discriminating accuracy of the pulse of traditional Chinese medicine.

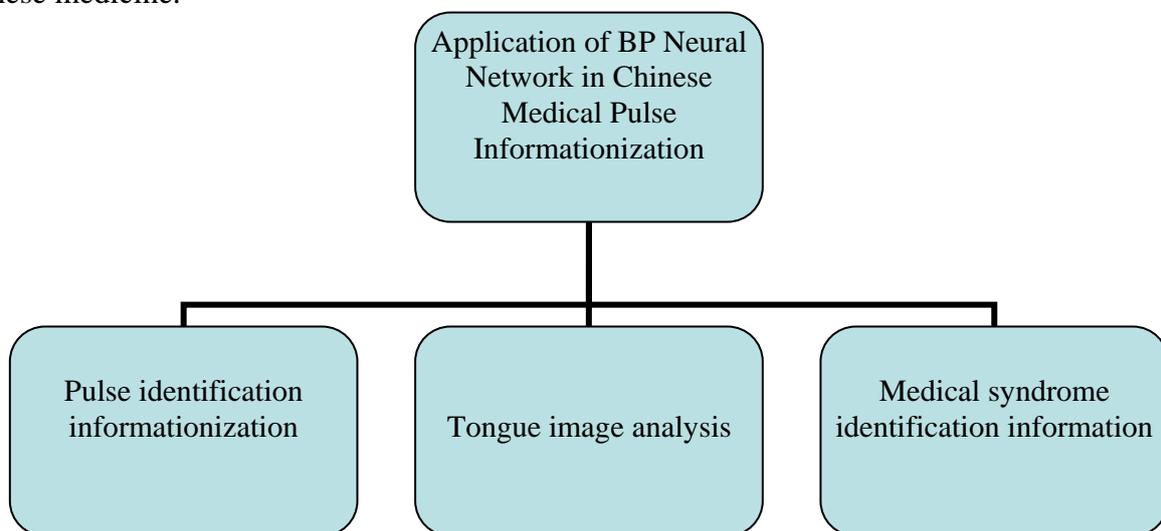


Figure 4 BP neural network TCM pulse information application

4.2 Promote the identification of TCM tongue image identification.

Some scholars have established a neural network model for intelligent diagnosis of tongue diagnosis in traditional Chinese medicine. In the specific practice, the input sample data is normalized firstly, and the RBF algorithm based on immune clustering is used to learn and train to achieve the desired experimental results. Taking the diagnosis of liver disease syndrome as an example, the results show that the system has the characteristics of strong diagnostic ability and strong generalization ability. Some scholars have constructed a three-layer feedforward neural network with the tongue image and the main factor as input values. The accuracy rate of the sample training set is 100%, and the accuracy of the effective set calculation can reach 80%. Zhou Jinhai

and others converted the textual expression of tongue image into binary number, selected BP neural network mining algorithm, built a TCM tongue diagnosis knowledge base, and verified the training data. The constructed TCM tongue diagnosis can satisfy the non-sample test value. prediction.

4.3 Promote the informationization level of TCM syndrome identification.

Traditional Chinese medicine is a complex system. Clinical information and disease often have nonlinear, complex, ambiguous and non-quantitative characteristics. How to analyze and integrate massive information and explore its internal laws is a difficult point in syndrome research. The main purpose of syndrome research is to find out the law of syndrome differentiation by analyzing the characteristics of syndromes, revealing the correspondence between syndrome differentiation and four diagnostic information. BP neural network has powerful nonlinear mapping function, unique information storage, large-scale parallel processing, good fault tolerance and powerful self-learning, self-organization and self-adaptive capabilities. BP neural network can fully simulate the nonlinear mapping relationship between syndrome and clinical information without opening the black box and without knowing the internal structure, truly reflect the whole picture of syndrome, establish syndrome model, reflect the inherent law of syndrome and feature. The neural network-based TCM syndrome diagnosis model can find hidden and meaningful knowledge from the massive data and make forward-looking judgments. This advantage makes BP neural network technology possible to solve the TCM syndrome diagnosis standardization research. More difficult methods to determine provide more scientific methods and approaches.

5. Conclusion

BP neural network has a very wide range of applications in the field of traditional Chinese medicine, especially the impact on the informationization of pulse diagnosis of traditional Chinese medicine. With the penetration of Western medicine, mathematics, biomechanics, information engineering and other multidisciplinary fields in the field of traditional Chinese medicine, the theory and methods of pulse signal processing in traditional Chinese medicine have made great progress, but it is difficult to make major breakthroughs. The main reason is Defects and deficiencies in non-stationary random signal analysis, recognition theory and techniques. The diagnosis of pulse in traditional Chinese medicine is a nonlinear complex giant system. Its complexity characteristics determine that it is necessary to conduct more research from different scientific perspectives with different methods and tools. With the rise of the health management industry in society and the Internet, the application prospects of Chinese medicine are also growing. To promote the further development of TCM diagnosis under the impetus of scientific research methods, scientific analysis methods such as BP neural network must be applied flexibly. In traditional Chinese medicine, the clinical information is more accurately discriminated and classified.

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