

# The conception of the algorithm model of traditional Chinese medicine (TCM) prescription based on deep learning

Yuan Zhou, Yaofeng Miao

School of engineering, Xi'an International University

myfzhy@163.com

**Keywords:** "Cause, location, nature and trend of disease"; Deep learning; Algorithm model; choose the therapy and determine the prescription

**Abstract:** This project takes the neural network as the basic architecture of the improved algorithm, and uses a deep nonlinear network structure to learn the deep learning technology of complex function approximation and integrates the "cause, location, nature and trend of disease" of traditional Chinese medicine. Also, this algorithm model explores the thinking mode of selecting legal parties for famous experts of traditional Chinese medicine, and checks whether the treatment process of doctors is standard and reasonable, also finds out cases of wrong treatments, so as to improve clinical efficacy and standardize the treatment process of traditional Chinese medicine.

## 1. Introduction

In recent years, with the development of Chinese medicine informatization, Chinese medicine workers and information workers have conducted a lot of researches and explorations. The syndrome reflects the occurrence and evolution of the disease and the specific internal as well as external environment. It is a complex non-linear "internal reality and virtual" "dynamic space-time" also "multi-dimensional interface" system, including "what the patient says" and "information obtained by active inquiry or dynamic observation". We should use the automatic learning ability of the network to fully identify the information, and distribute the information in the network connection, then simulate the syndrome model to explore its internal rules, also use the artificial neural network technology to establish a non-linear mapping relationship to simulate the syndrome diagnosis model, as well as apply it to the diagnosis of new cases, in order to examine whether the doctor in the treatment process specification is reasonable, and check out the disease and cure patients, so as to improve the clinical curative effect, together with making the traditional Chinese medicine treatment process standardization and standardization.

## 2. Existing problems in the study of TCM informatization

### 2.1 Obstacles in the digitization of traditional Chinese medicine

Due to the cognitive impairment of fonts, only solid TCM literature can ensure accurate input of uncommon Chinese characters. In addition, the traditional search function of Chinese medicine database is single. Users have to navigate through and select one at a time to get the information they needed. Information retrieval refers to the degree of difference. The common phenomenon of prescriptions and drugs in ancient medical books is homonymy and synonymous, which makes accurate content retrieval much more difficult.

### 2.2 Standards in the informatization process of TCM data

In recent years, various TCM institutions and research institutes have organized a large number of TCM clinical databases. However, in the informatization process of TCM clinical data, there are no unified standards, such as TCM terminology, prescription principles and change rules, TCM diagnosis and treatment schemes. There is no uniform standard, which makes many clinical data be incompatible with each other, resulting in poor data integration. As a result of unregulated, it has

formed a large number of scattered islands of information. The unreasonable development and low-level duplication of clinical data resources of traditional Chinese medicine greatly impeded the in-depth sharing of clinical data and deeply explored its intrinsic value.

### **2.3 Unsystematically of unified discipline in TCM information research field**

The development of digitalization and the modernization of TCM information are inseparable from the support of TCM knowledge and informatics. However, the knowledge system of single subject cannot realize the process of TCM informatization. It is necessary to integrate and penetrate the two closely. This requires an interdisciplinary approach to support the construction of TCM information technology. And there is a lack of researches on the conceptual connotation of the discipline system and the rational construction of the theoretical system structure, so it is difficult to meet the necessity of guiding practice.

This project is based on the data of electronic medical records in the outpatient clinic of the "digital medical treatment platform of traditional Chinese medicine" of the Guangxi provincial administration of traditional Chinese medicine. At present, the data of electronic medical records in this platform come from the hospitals of traditional Chinese medicine in various cities in the province and the counties under its jurisdiction, and the data has been uploaded for more than 1 million. Then, the mass data mining technology of big data is adopted to select appropriate data mining methods to conduct data mining with massive real data of electronic medical records for the dominant diseases of traditional Chinese medicine, such as skin disease, cardiovascular disease, stroke and hemiplegia sequelae, etc, and to dig out the traditional Chinese medicine syndrome, treatment and prescription information, then establish data warehouse. The above approach solves the problem of quality and capacity of sample collection.

The neural network is used as the basic framework of the new algorithm, and the deep learning technology is used for deep learning. The deep learning technique is used for complex function approximation and TCM combination location potential, and the data warehouse is established by using the information mined, as well as the training model is used to determine the more efficient network weight in the new algorithm, also the matching accuracy of "certificate" to "square" is improved.

## **3. Construction of new algorithm model**

### **3.1 Arrange and summarize the data**

The data of electronic medical records in the outpatient department of "digital TCM diagnosis and treatment platform" of Guangxi provincial administration of traditional Chinese medicine were collected and summarized.

We should establish a data warehouse of "syndromes" and "prescriptions" for preponderant diseases of traditional Chinese medicine through literature mining and collection of clinical data, and sort out the "syndromes" and corresponding prescriptions for preponderant diseases of traditional Chinese medicine, also further carry out data pretreatment and data mining, and then to establish a data warehouse of deep learning. Deep learning is mainly divided into three parts, included training system, adjustment and testing in unsupervised ways.

We need to carry out deep learning algorithm training, and use BP neural network to further verify the algorithm, also adjust and optimize the network weight. When each unsupervised training layer is used, the training results are used as higher level input, and the learning characteristics are extracted from the layer. When each unsupervised training layer is used, the training results are used as upper input and the learning characteristics are extracted from the layer. Analyze and learn the correlation between each layer, and preliminarily determine the weight of each layer network. Using a BP neural network, the reverse propagation learning algorithm is used to go through each intermediate layer to correct the connection weight from the output layer and then back to the input layer. Until the global error of the network tends to give this process repeatedly and alternately, and we will use the minimum value to complete the learning process.

### **3.2 Carry out training for deep learning and optimize the weight estimation network**

1) The design of artificial neural network model for the dominant disease of traditional Chinese medicine

According to the theory of "cause, location, nature and trend of disease" in Chinese medicine, it and the "treatment method" are used as the hidden layers. The number of nodes in the hidden layer is determined, and the neural network usually needs a large number of neurons connected with each other. Studies show that the more nodes in the hidden layer of the neural network, the better the network's ability to approximate function. However, the number of nodes in the hidden layer should not be too large. This project intends to use the hidden layer structure optimization algorithm based on grey relational sensitivity to minimize the error between the actual output value and the expected output value of the whole network.

2) Further adjust and optimize the network weight of deep learning

The conjugate gradient BP neural network has strong nonlinear mapping ability and realizes mapping from input to output. The neural network can approximate any nonlinear continuous function with any precision to make it particularly suitable for solving complex problems with internal mechanism. This network has a high degree of self-learning and adaptive capacity, what is, during training, it can automatically extract the rules between input and output data by learning, and the content learned in the network weight is stored in an adaptive way.

## **4. Feasibility of algorithm model construction**

### **4.1 Excellent professional team**

It has professional teams covering key disciplines of traditional Chinese medicine, information science, big data research, software engineering, etc

The research team is composed of 8 people, including 1 senior professional titles. All the members of the research group are masters or PhD degrees. The members of the research group have hosted or undertaken the national natural science foundation of China, the 973 program of the ministry of science and technology, also the science and technology support program and many provincial science and technology projects. Such complementary advantages and joint tackling form will contribute to the researches and implementation of the projects.

### **4.2 Initial weight**

The project has achieved three key conditions for the successful implementation of deep learning algorithm included sufficient data, sufficient computing capacity and specialized weights. This subject is supported by the previous projects, and there are 1 million real Chinese medicine electronic record data to train the algorithm model, and constantly adjust the coded value of "cause, location, nature and trend of disease". More professional TCM teams provide capability of weights processing during the initial stage of hierarchical feature extraction. The cloud computing platform of IDC where the project leader is working is the most complete research and application organization of traditional Chinese medicine big data in southwest region at present. Due to the rapid development of hardware, the computer has been able to provide nearly unlimited computing capacity, providing reliable guarantee for weight calculation and feature extraction of deep learning.

## **5. Conclusion**

This paper proposes to use the technology of deep learning and the method of "choose the therapy and determine the prescription" in Chinese medicine to study the main features layer by layer, also explore the theoretical thinking of "selecting legal prescriptions" in Chinese medicine, as well as provide new research methods for the informatization research of syndrome differentiation and treatment. It is the combination of TCM syndrome differentiation and treatment system and neural network deep learning model.

## **Acknowledgments**

Supported by the Key research and development program (general program) of Shaanxi Provincial science and technology Department (Program No.2018SF-333)

Supported by the Fund for innovative research team Program of Xi'an International University (grant No.XAIU-KT201801)

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