Analysis of Intelligent Tongue Diagnosis Technology Solution based on Artificial Intelligence

Zhiling Zhang[1, *], Manyin Shi[1], Qunsheng Ruan[1,2]

[1] School of Information and Electromechanical Engineering, Ningde Normal University, Ningde, Fujian, 352100, China

[2] School of Informatics, Xiamen University, Xiamen, Fujian, 360003, China

Abstract

The frontier artificial intelligence technology is introduced into tongue diagnosis of traditional Chinese medicine to effectively solve many problems, such as the description of the principle of internal syndrome differentiation and treatment of traditional Chinese medicine, the separation between macro-characterization and micro-realization, and the internal knowledge discovery of multi-modal data sets of tongue diagnosis, so as to realize the scientific and qualitative deduction of the dialectical relationship in tongue diagnosis of traditional Chinese medicine. Under the guidance of the theory of traditional Chinese medicine and the knowledge system of diagnosis and treatment rules,The introduction of artificial intelligence, cloud computing, big data analysis and other cutting-edge technologies, for the objective data of tongue diagnosis and modern clinical data, focusing on the automatic labeling of tongue, multi-modal data fusion, unified data modeling, disease diagnosis model construction, timely application of two-way feedback mechanism, provides an efficient artificial intelligence solution for the intelligent and accurate diagnosis of tongue diagnosis.

Keywords

Artificial Intelligence, Tongue Examination, Data Integration, Diagnosis of Disease.

1. Introduction

In recent years, the application research of information technology in medical treatment is in the ascendant. After years of research and accumulation, the health cloud architecture and information system integration specifications based on cloud computing model have been initially formed, some medical big data platforms have begun to take shape, and artificial intelligence medical products based on cloud computing and big data have emerged one after another.Intelligent voice question and answer system, registration robot, diagnosis and treatment plan and curative effect intelligent analysis expert system have been preliminarily applied to clinical practice [1-2].

Generally speaking, the application research of artificial intelligence and other cutting-edge technologies in the medical field is developing rapidly, and many of the new research results are worth learning from [3]. For example, for the fusion and modeling of medical clinical multi-modal data, academia has proposed a variety of methods, such as non-neural network structure cross-modal, neural network cross-modal and so on.Try to establish a unified model for different modal information describing the same thing to learn the feature representation of the common information implied in these data, and then try to learn the association between different modal information and establish a reasonable common representation space to serve cross-modal retrieval, analysis and other tasks [4-5]; In that aspect of tongue picture classification and automatic label,The algorithms represented by deep learning, support vector machine, transfer learning and deep convolution feature

are the most prominent, and their processing results have obvious advantages over shallow learning algorithms. Natural Language Processing and Knowledge Discovery for Clinical Information of Tongue Diagnosis;Some improved algorithms or methods, such as supervised learning algorithm, method based on document topic structure, multi-mode keyword extraction and concurrent mining of association rules, have been proposed one after another, which greatly improves the accuracy and speed of core word extraction, promotes the process of knowledge discovery in massive clinical information, and lays a good foundation for subsequent medical big data analysis [6-7].In the aspect of expert system research, collaborative multi-expert system gathers expert systems in similar fields or multiple aspects of a field, presents advanced artificial intelligence characteristics, has powerful problem reasoning, knowledge acquisition, result prediction and other capabilities, and is conducive to accurate diagnosis of diseases [8].

Although great progress has been made, there are still many problems to be solved in the application of advanced technologies such as artificial intelligence in the field of clinical diagnosis of traditional Chinese medicine, such as:How to effectively display the profound technical connotation contained in the diagnosis and treatment process of TCM dialectical thinking, how to select and apply the artificial intelligence method of information process simulation of human thinking to innovate and develop the diagnosis and treatment mode of TCM, and how to apply the frontier technology based on the ontological knowledge of TCM and the guidance of clinical norms and standards [9].

In the era of big data, cloud computing, big data technology and artificial intelligence technology have become the key technical support to realize the objective diagnosis of traditional Chinese medicine, and these cutting-edge technologies are introduced into tongue diagnosis of traditional Chinese medicine.It can effectively solve many problems such as the description of the principle of internal syndrome differentiation and treatment of traditional Chinese medicine, the separation between macro-characterization and micro-realization, and the internal knowledge discovery of multi-modal data sets of tongue diagnosis, so as to realize the scientific and qualitative deduction of the dialectical relationship in tongue diagnosis of traditional Chinese medicine [10]. Therefore, carrying out such research will greatly promote the development of intelligent diagnosis and treatment assistant technology of traditional Chinese medicine.It benefits the vast number of patients and has broad prospects for development.

2. Main Technical Contents of the Study

With the support of modern Chinese medicine diagnostic technology, the integration of Chinese and Western medical big data, with the help of system science and artificial intelligence technology, the relevant research work is carried out to meet the needs of health assessment and diagnosis and treatment of typical diseases, and the research goal is expected to be achieved: for diabetes and gastric diseases, the introduction of artificial intelligence, cloud computing and big data analysis. Facing the objective data of tongue diagnosis and modern clinical data, this paper focuses on the automatic annotation of tongue pictures, multi-modal data fusion, unified data modeling and disease diagnosis model construction. Through the research of this project, we can achieve a breakthrough in the application of modern diagnostic technology and innovate and develop the disease diagnosis model based on the data fusion of traditional Chinese and Western medicine.

2.1 Research Content

1) The ontology knowledge base of TCM related to tongue diagnosis is constructed, and the mining model of disease, syndrome and prescription is constructed. This paper systematically combs the medical records of tongue diagnosis, ancient literature and modern research literature of traditional Chinese medicine, takes tongue diagnosis as the breakthrough point, determines the connotation elements of the ontological category and syndrome characteristics evaluation in the field of traditional Chinese medicine, and analyzes the conceptual relationship between traditional Chinese medicine and pharmacy. Construct a standardized thesaurus of TCM ancient books and clinical terms, clarify the semantic relationship between concepts, develop a knowledge expression framework in line with

the characteristics of TCM, and make the connotation and essence of TCM concepts explicit and standardized; Under the demonstration of experts, the ontology knowledge base of traditional Chinese medicine based on tongue diagnosis was constructed and perfected.

2) Construct clinical big data acquisition, storage and analysis scheme, and multi-modal data association analysis scheme. In view of the characteristics and distribution of multi-modal tongue diagnosis clinical big data, according to the unified norms and standards of data acquisition, an intelligent data acquisition interface is constructed to realize the centralized, unified and standardized acquisition of multi-modal big data distributed at multiple points. Cloud mode is used to effectively store the collected clinical data of tongue picture and tongue diagnosis, and cloud platform is used to implement data storage and access control to ensure data security. Desensitizing the clinical data of multi-modal tongue diagnosis stored in the cloud to ensure the privacy and security of sensitive data; On the basis of the classified tongue image set, The deep learning algorithm is further used to implement the automatic and intelligent accurate labeling of tongue images. In-depth analysis of the characteristics of clinical multimodal data of tongue diagnosis, and then complete data slicing, fusion and so on.

3) Cloud computing, big data analysis, machine learning and other cutting-edge technologies in the application of tongue intelligent diagnosis. By using the deep learning framework, cloud computing mode, transfer learning, reinforcement learning, support vector machine and other cutting-edge machine learning algorithms, the relationship between multi-case comparison, tongue picture and clinical diagnostic indicators is studied. Construct a perfect knowledge base of disease and syndrome diagnosis. In view of the characteristics of multi-modal tongue diagnosis clinical data, based on Google's open source TensorFlow deep learning framework, the deep learning framework is logically designed into seven layers, including: Unified and efficient data input, tongue data training preparation, command line parameter modulation, neural network model definition, optimization algorithm selection, online continuous learning and model training result visualization.

4) Taking tongue diagnosis as the core, the deductive model of syndrome differentiation was constructed. Aiming at the main line of TCM tongue diagnosis-disease-syndrome-curative effect syndrome differentiation and treatment, integrating other four diagnostic data (complexion, tongue, pulse objective information data, inquiry information) and clinical indicators and other multi-modal data, this paper studies the logic deduction of syndrome differentiation and treatment of tongue diagnosis combined with disease and syndrome, aiming at different situations such as basic syndrome, atypical disease and syndrome. Aiming at "disease and syndrome diagnosis", "diagnostic decision-making" and "diagnostic evaluation", the logical deduction model of multi-modal data fusion of traditional Chinese medicine and Western medicine is studied.

5) This paper studies the technical strategy of the bidirectional learning mechanism of incremental learning and data feedback. The incremental learning mechanism is introduced to meet the learning needs of the diagnostic model for the growing clinical case data of tongue diagnosis, and to avoid the shortcomings of low accuracy and poor stability of the traditional incremental learning algorithm. To this end, the existing incremental learning algorithm is to be improved to enable semi-supervised learning. The improved semi-supervised incremental algorithm model is trained by using partially labeled tongue diagnosis data at the right time, and the model is tested by using unlabeled tongue diagnosis data to form a phased incremental learning model, so as to iteratively optimize the disease diagnosis model; It uses a two-way data feedback mechanism combining effect evaluation and crowdsourcing feedback. The prediction results of the diagnostic model after incremental learning are evaluated, and the prediction and evaluation results are submitted to the expert problem system for evaluation in the form of crowdsourcing problem, and the evaluation results are fed back to the diagnostic model to provide a basis for the self-optimization decision of the diagnostic model.

2.2 Technical Difficulties to be Solved

1) Tongue diagnosis clinical multi-modal data fusion analysis technology, based on the realization of massive heterogeneous data fusion processing and cloud storage, constructs a unified model adapted to TCM diagnosis.

2) For the diagnosis and classification of tongue images, machine learning methods, semi-supervised learning ladder network and in-depth learning are applied to realize the intelligent and accurate diagnosis of tongue diagnosis. Cognitive default reasoning and paraconlogic construct the logic deduction model of disease and syndrome; Intelligent processing method of association rules based on tongue diagnosis and clinical comprehensive data.

3) Establish incremental learning and two-way feedback mechanism to adapt to the dynamic characteristics of clinical data of tongue diagnosis and improve the efficiency and accuracy of adaptive learning of diagnostic model.

3. Research Technology Route

1) Unified modeling of multi-modal data: The existing clinical data of tongue diagnosis contains a large amount of unstructured information. In order to make the machine understand these data, the most commonly used method is to use the knowledge base of traditional Chinese medicine to process the natural language and realize the discovery and extraction of new entities and relationships. Conventional medical dictionaries do not contain specific associations between entities, The existing machine learning methods can not completely establish the link relationship between entities. Therefore, this study intends to use the combination of machine learning and crowdsourcing technology to construct the concept map of medical health. Under the guidance of traditional Chinese medicine knowledge, the probability model of multimodal sentence generation in tongue diagnosis is calculated by using language model based on neural network. Then the word segmentation results are obtained by using the labeling algorithm, and the weight of the words related to tongue diagnosis is calculated by using the supervised machine learning method, and the core words (entity relations) in the sentences of tongue diagnosis information are extracted under the condition of a set threshold. In order to judge the validity of the extracted entity relationship, it is necessary to further submit it to the crowdsourcing expert system. It completes the entity link between the entity relationship and the entity object extracted from the Chinese medicine diagnosis and treatment dictionary machine, and finally constructs the health concept feature library of tongue diagnosis. As shown in Figure 1.
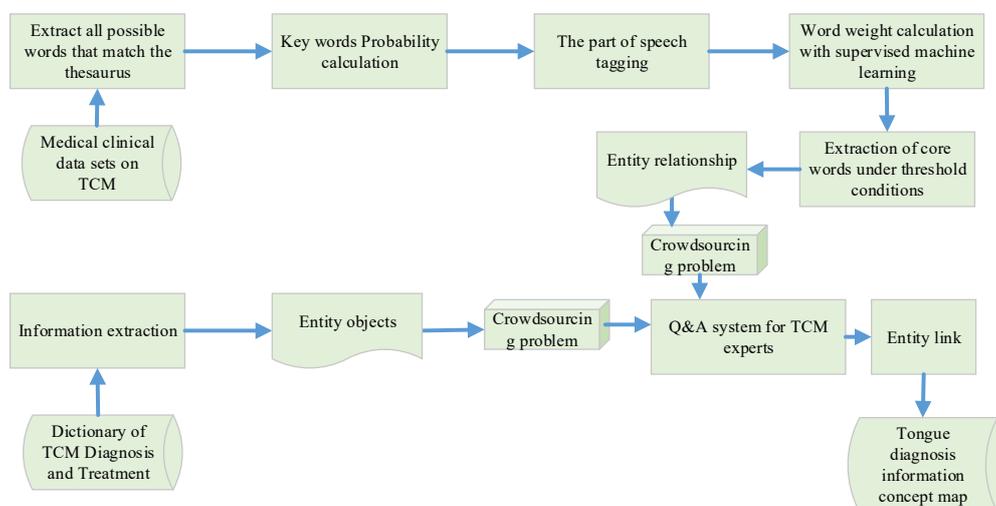

Figure 1. Technical route for unified construction of multi-modal data

2) Research on automatic labeling and analysis of tongue images: An image classification and labeling method based on transfer learning is proposed to solve the problem that the deep learning method cannot be trained due to the insufficient number of samples in the image data set in the field of tongue diagnosis; Then, a method based on two-level hierarchical feature learning is proposed to further obtain the special features between image categories with high similarity. Thereby improving the accuracy of tongue diagnosis image classification and labeling. The research technology route is shown in Figure 2.
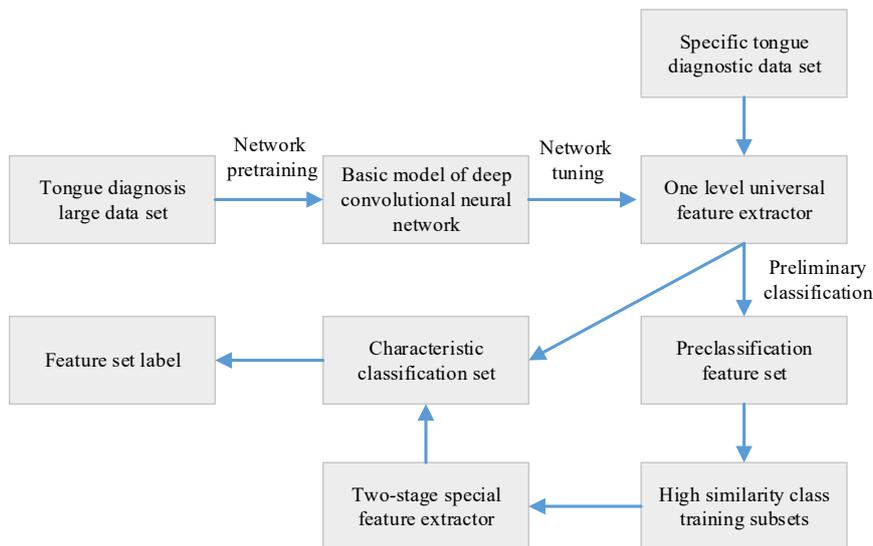
Figure 2. Deep learning tongue image classification process based on transfer learning

3) Research on intelligent tongue diagnosis method: In order to meet the needs of multi-modal data fusion and knowledge mining in tongue diagnosis, based on the established disease diagnosis model, heterogeneous multi-source data such as tongue images, clinical test data and doctor's diagnosis and treatment data are classified, labeled and fused, and sensitive feature sets are extracted. The diagnosis results are used as the input data of the diagnosis model, then the model makes an accurate judgment on the disease, and then the diagnosis results are submitted to the Chinese medicine experts of the crowdsourcing problem for evaluation, if the diagnosis results pass the evaluation, the results are output, otherwise, the diagnosis model is studied and optimized, and the diagnosis accuracy of the model is continuously improved. The research technical route of intelligent tongue diagnosis method based on multi-modal data is intuitively expressed as shown in Figure 3.
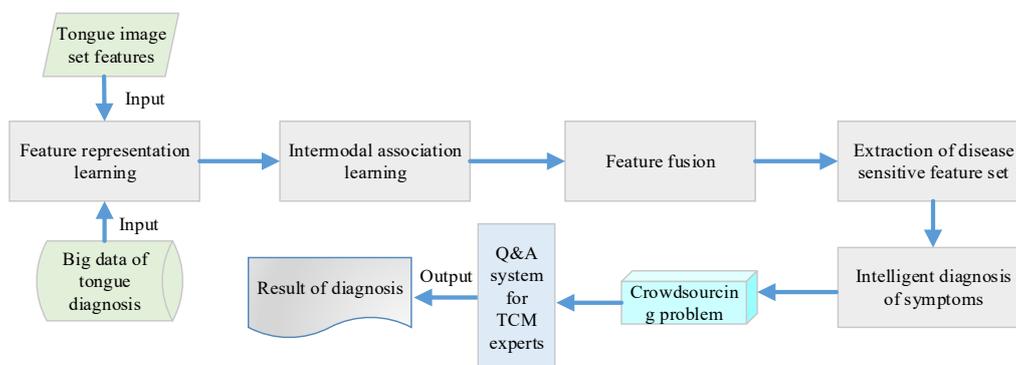

Figure 3. Technical route of intelligent tongue diagnosis method

4) Research on the bidirectional learning mechanism of incremental learning and data feedback: Firstly, the existing incremental learning algorithm is modified to enable it to carry out semi-

supervised learning, which solves the problems of low accuracy and poor stability of incremental learning algorithm. Then, the multimodal training data and test data are extracted from the tongue diagnosis database, and the extracted training data are labeled. The established labeled training data set is used to train the modified semi-supervised incremental learning algorithm, and the stage training model is obtained. Then the test data is used to test the effect of the stage training model, and the test results are submitted to the crowdsourcing expert system, which gives the evaluation results. Finally, Whether the incremental disease diagnosis model is established according to the evaluation result of the crowdsourcing problem expert system. The technical route for the construction of the reinforcement learning and two-way feedback mechanism for tongue diagnosis is shown in Figure 4.
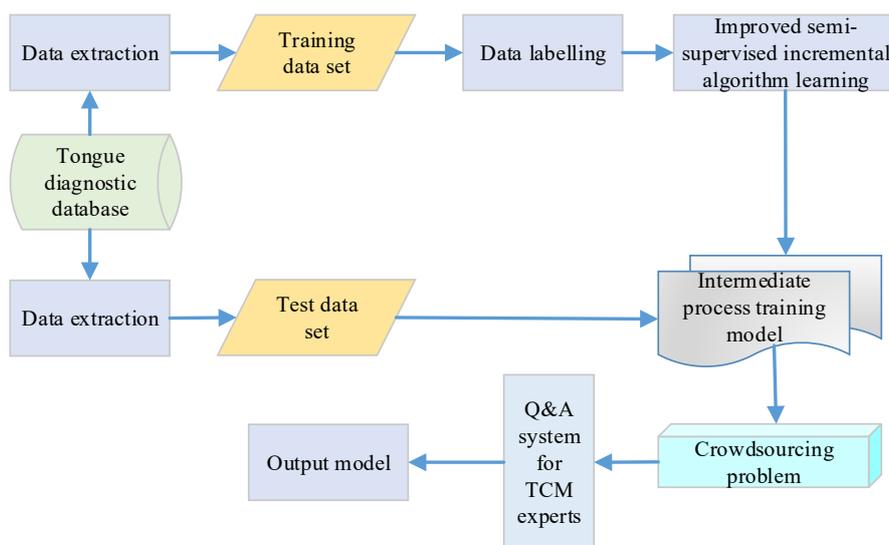

Figure 4. Technical roadmap for research on enhanced learning and two-way feedback mechanism for tongue diagnosis

4. Conclusion

It breaks through the bottleneck of traditional data storage and management, realizes the heterogeneous fusion processing and cloud storage of TCM tongue diagnosis clinical data, and uses big data analysis technology to build a unified model adapted to TCM diagnosis, so as to identify the internal relationship between tongue diagnosis clinical data and the relationship between various diseases and syndromes. Explore the artificial intelligence method of information process simulation with human thinking.Knowledge engineering and in-depth learning are applied to innovate and develop new diagnostic modes of traditional Chinese medicine, overcome the problems of traditional artificial empiricism and insufficient accuracy of auxiliary diagnosis, and realize intelligent and accurate diagnosis of tongue diagnosis. Based on the fact that time-series cases usually change dynamically, incremental learning and two-way feedback mechanism are introduced to adapt to the dynamic characteristics of clinical data of tongue diagnosis.This is very helpful to improve the efficiency and accuracy of the adaptive learning of the diagnostic model. Based on the above, this paper systematically describes the intelligent technology solution of tongue diagnosis based on artificial intelligence, which can provide valuable reference for such researchers or related system developers.

Acknowledgments

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