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Design and Implementation of the Traditional Chinese Medicine Constitution System Based on the Diagnosis of Tongue and Consultation

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ABSTRACT The modernization and digitalization of new constitution of traditional Chinese medicine (TCM) has promoted the development of TCM information. The key to constitution identification and tongue diagnosis and consultation diagnosis. In this paper, a tongue diagnosis method based on the combination of the language of virtual patients (VPC) and the support vector machine (SVM) is proposed. To acquire the tongue body and tongue coating, a feature extraction method based on the Lab color space is proposed. Based on the clustering analysis of the difference between the color components of the tongue body and tongue coating in the Lab color space, the separation is realized. Then, the relationship between the tongue image and constitution can be analyzed. The method for consultation diagnosis is divided into a questionnaire and a question answering system. The questionnaire includes 29 questions about the corresponding tongue and disease states, so the final result of each type of constitution is calculated. The last constitution type is determined on the basis of the scores of both diagnosis. In addition, the key question answering system is used for constitution calculation. First, a relevance analysis calculation method combining the fuzzy language model and word2vec is proposed. Then, a modification between relevance calculation method combining the Word Mover's Distance (WMD) and adding distance is proposed. Finally, the experimental results show the effectiveness of the proposed method and a constitution identification application is developed based on the content of this paper.

INDEX TERMS Traditional Chinese medicine; constitution identification; tongue image; sentence similarity; question answering.

1. INTRODUCTION
In traditional Chinese medicine (TCM), constitution refers to the all-round and stable inherent characteristics of the shape, structure, physiological function, and mental state formed by innate and acquired habits in the course of human life. Constitution is able to reflect an individual's current physical condition and future health trends in the form of a constitution type. The constitution type is the basis for the diagnosis, treatment, and prevention of disease [1]. Constitution identification is divided into the "four diagnosis of TCM," which traditionally involve looking, hearing, and questioning, to a great extent or the practice of TCM [2]. Constitution identification can be applied not only to general TCM data but also to the general population base. Many people have understood their health status to prevent disease [3]. This paper will focus on the identification between tongue diagnosis, consultation and constitution.

Tongue diagnosis is a method of diagnosing a patient's internal condition by observing the state of the tongue. Changes in the body are usually expressed by tongue changes, such as the texture of the tongue and the color of the coating. Therefore, tongue images can be used as one of the essential bases for exploring the physiological function of and pathological changes in the human body. Traditional tongue diagnosis requires doctors to look, experience and quantify diagnostic indexes. Therefore, it depends on doctors' experience. In recent years, the development of computer technology has promoted the objectiveness and automation of tongue diagnosis in TCM [2]. Machine learning methods have been applied for tongue diagnosis. For example, in [4], an artificial neural network application based on the Java language was designed. Zhou

Traditional Chinese Medicine in the Treatment of ADHD: A Review



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KEYWORDS

- Traditional Chinese medicine • Chinese herb medicine • Acupuncture • Tui na
- Tai chi chuan • Diet • Attention-deficit/hyperactivity disorder

KEY POINTS

- This is the first systematic review of traditional Chinese medicine (TCM) used in the treatment of attention-deficit/hyperactivity disorder (ADHD) in the English language.
- TCM is a natural therapy that has a rich cultural influence and is characterized by holism and individualized treatments based on traditional medicine theories and syndrome differentiation.
- TCM therapies, characterized by the combination and individualized use of herbal medicine, acupuncture, tui na, tai chi chuan, and diet, have been proven to be effective in improving ADHD symptoms in conjunction with Western pharmacologic therapy or alone.
- TCM is safe and has less side effects than pharmacologic therapy.
- TCM is commonly accepted and practiced in Asian countries. However, it is not well known or commonly used in Western countries.

INTRODUCTION/BACKGROUND

Target of Treatment: Attention-Deficit/Hyperactivity Disorder Symptoms, Associated Features

Attention-deficit/hyperactivity disorder (ADHD) is a prevalent childhood-onset neuropsychiatric disorder that occurs in approximately 5.29% of school-aged children worldwide, with an estimated 66% of these children retaining ADHD symptoms into adulthood.¹⁻³ ADHD is characterized by age-inappropriate inattention and/or

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Medical Diagnosis by Using Machine Learning Techniques

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Abstract
There are many challenges in data analytic research for TCM (Traditional Chinese Medicine), like various clinical record sources, different symptom descriptions, lots of collected clinical symptoms, more than one syndrome attached to one clinical record and etc. Novel methods on feature selection, multi-class, and multi-label techniques in machine learning field are proposed to meet the challenges. Here in this chapter, we will introduce our works on discriminative symptom selection and multi-syndrome learning, which have improved the performance of state-of-art works.

Introduction

With the increasing digitized data collection, TCM clinical data analysis has attracted more interests from TCM researchers and machine learning scientists. Various established machine learning techniques help to achieve remarkable improvements in TCM data analysis. Considering its own characteristics, TCM data analytic research still brings great challenges to machine learning techniques.

- Numerous symptoms can be recorded in clinical process. But high dimensional features will hurt the modeling performance of machine learning methods. How to select appropriate symptom subset for a certain disease in the data analytic process is a critical problem for data modeling and understanding.
- Usually, a patient is diagnosed as having more than one syndrome in TCM. Clinical data modeling can be abstracted as multi-class or even multi-label problem. Existing machine learning techniques are excellent on binary classification. Multi-class and multi-label modeling is still a challenge to machine learning researchers.

To face the above challenges in clinical data analysis, this chapter describes the novel techniques on discriminative symptom selection and multi-syndrome learning. Applications include feature selection for lip diagnosis, symptom selection for inquiry diagnosis of coronary heart disease, multiple syndrome classification for medical diagnosis and syndrome classification of hypertension with feature fusion.

Most TCM machine learning works does not consider the medical meaning and links among features. However, TCM data contain a large quantity of symptoms or syndromes which have specific medical meaning. Therefore, seeking the links between features including symptoms and syndromes in TCM data analysis is also important.

Among a large number of symptoms in TCM diagnosis data sets for a certain disease, some symptoms may be redundant. Therefore, selecting major or relevant symptoms is crucial to the performance of machine learning. Wang et al. (2009) used SVM (Support Vector Machine) to generate symptom weights in CHD (Coronary Heart Disease) prediction. Liu et al. (2010) used symptom frequency analysis to enhance modeling results in learning. Zhou et al. (2010) developed a clinical RM (Reference Information Model) and a physical data model to manage various

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