Research on Key Technology in Remote Education System of Spirit Diagnosing by Eye in TCM

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ABSTRACT

Spirit diagnosing is an important theory in TCM (Traditional Chinese Medicine), by which a TCM doctor can diagnose a patient’s body state. But this theory is complicated and difficult to master simply learned from books. To further the theory and skill of spirit diagnosing, in this paper, the authors propose a remote education system that can accept videos from a user and give the user an auto-diagnosed spirit. The key technology in this system is eye feature computation in spirit diagnosing, for which rules describing “the spirit” (spirit in TCM refers to the human’s mental state which reflects the one’s general physical condition) state are mined by the quantitative features regarding the human eyes. With videos capturing eye condition during a short period, a set of eye features are extracted. On this basis, attribute intervals of the eye feature space is generated by CAIM (class-attribute interdependence maximization). Several of the candidate rules are then mined by the association rule based on the cloud model. Finally, three complementary rule-pruning methods are modified and combined to trim the candidate rules. The cross validation test for mined rules has an average accuracy of 93%, which shows the high performance of the proposed method.

Keywords: CAIM, Cloud Model, Eye Feature Computation, Rules Pruning, Spirit Diagnosing, TCM

1. INTRODUCTION

For TCM, four kinds of typical diagnostic ways are usually utilized to acquire the information regarding an object’s health state. Wangzheng (derived from the TCM word 望诊[wang zheng]) is one of them. It has a long history and a relatively integrated theory. Because of relying on doctors’ observation, it is subjective and dependent on the individual’s judging criteria, so that it often induces the inconvenience in TCM application. Accordingly, it is expected to analyze the information acquired by the

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Wangzheng qualitatively and quantitatively in a way of digital processing.

On the other hand, the information of human’s “the Spirit”, which reflects the external appearance showing whether the object is healthy or not, is important for Wangzheng. Having the Spirit denotes that the zang-fu organs is healthy, while loss of the Spirit denotes that the zang-fu organs is in damage. There are five kinds of the Spirits: having the Spirit, lack of the Spirit, loss of the Spirit, the false Spirit and mental derangement. The skill of Spirit diagnosing in Wangzheng is hard to master simply from book. To spread abroad the theory and skill of Spirit diagnosing by eye, we propose a remote education system which can accept videos from user and response the user with result of auto-diagnosed Spirit. This paper focuses on the key technology of Spirit diagnosing by eye in our remote education system. We collect many humans’ videos of eyes and generate the association rules of the eyes’ features extracted from the object’s videos with the Spirit state annotated by the TCM doctors, so as to diagnose the human physical states automatically. To teach user the skill of Spirit diagnosing, the user should upload object’s videos to our system by internet, and then our system will response the object’s Spirit state to the user.

For this purpose, firstly, this paper presents a new method of capturing the object’s eyes’ movement. And then the feasibility of using CAIM and the Cloud model in generating the association rules of the extracted eyes’ features with the Spirit state is investigated. Furthermore, the boring rules are trimmed by combining some rule-pruning methods. Experiment results show that the mined rules are generally consistent with doctors’ diagnosis.

This paper is divided into six sections. Section 2 describes the relevant works about the art-of-state research in TCM diagnostic processing and the association rules mining; section 3 introduces the method of eye features computation, after depicting the mechanism of the Spirit diagnosing of TCM briefly; section 4 describes the method of association rules mining based on the CAIM and the Cloud model, and then induces a rule pruning method base on three complementary pruning methods in order to trim the large number of boring rules; section 5 shows and analyzes the experiment results; section 6 gives the conclusion and our future study.

2. RELATED WORKS

In the recent 20 years, TCM diagnostic information extraction and processing are mainly centered on the pulse and tongue (Weiwu, Zheli, & Qun, 2005; Haixia, Yiqin, & Fufen, 2005). For the last five years, tongue information processing technology has a great development and its practically clinical application has been started. However, for such complex information as eyes’ movement which is also important in TCM diagnosis, the research on the extraction and Spirit diagnosing by eye features is still at a blank stage. There is no research report in this field till now.

The concept and model of association rules were first raised by Agrawal et al. (1993). Since then, there have been a series of association rule mining algorithms. Agrawal and Srikant (1994) proposed Apriori algorithm, which is used for mining association rules. Although the algorithm can generate all the association rules, it is an inefficient mining algorithm. As a result, some of the improved Apriori algorithms have been emerged. There are: Hash algorithm (Park, Chen, & Yu, 1995), Block technique Algorithm (Savasere, Omiecinski, & Navathe, 1995), Sampling algorithm (Toivonen, 1996), Dynamic Item set technique Algorithm (Brin, 1997), Incremental mining algorithm (Cheung, 1996), Parallel and Distributed mining algorithms, Associated with Database System Integration mining algorithms.

FP-growth algorithm proposed by Han, Pei and Yin (2000), is a frequent pattern mining algorithm based on frequent pattern tree (FP-tree). It gets an order of magnitude faster performance than the Apriori algorithm. There have been some improved FP-growth algorithms: depth-first frequent itemset generating
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