

Successful Expert Systems in Ayurveda: A Comparative Study

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Abstract

Ayurveda is a unique legacy of Indian system of medicine. In ancient times Ayurveda was the only tool to fight against different ailments. Even today there are a number of diseases in which treatment by Ayurveda is a better option. Currently, Medicine is one of the segment where Artificial Intelligence is widely used for diagnosis as well as treatment of various diseases. A few expert systems have also been developed for this purpose. In this paper we have conducted a survey of expert systems created for disease diagnosis and tried to evaluate the strength and weakness of these expert systems.

Keywords: Ayurveda, Knowledge Base Management, Expert System

Introduction

Ayurveda word is from Sanskrit which means Ayur as life and “Veda” means the knowledge. So “Ayurveda’ is ‘Science of life’. It integrates different phases of life whether physical, psychological, and spiritual or social. Ayurvedic medicine has a very strong bearing on the concept of Prakurthi, which means natural form of the build and constitution of the human body [1]. According to Ayurvedic classification individuals can be grouped into 7 types of their dominancy of components such as Vata, Pita, Kapha, Vata Pita, Vata Kapha, Pita Kapha, or Vata Pita Kapha. In general population, human constitution is combination of Vata, Pita, and Kapha. A balanced state of the Prakurthi makes a healthy and balanced person (physically and mentally). The diagnosis of prakruti offers unique insights into understanding and assessing one’s health. It assesses the, dominance of Prakurthi and gives advice for preventive and primitive health care. For example unbalance vata shows anxiety disorders, pittha - anger disorders and kapha depression disorders.

Need of IT

In Ayurveda practitioners are hardly able to utilize the all data efficiently to manage the patients. Hence there is an urgent need to link computer technology and Ayurveda so that it could be utilized for present practical applications of diagnosis and treatment [2]. There are several important factors that affect the current and future role of computers and information technology in Ayurveda treatment. These factors include advances in information science, biotechnology and computer hardware and software, changes in the background of Ayurveda professionals, changes in the medico legal climate and changing strategies for healthcare. Many promising systems that incorporate advanced information technology have been developed for clinical use, with regular improvements in availability, speed, and ease to use [3]. The revalidation and modernization of Ayurveda can be possible through the application of Information and Communication Technology (ICT) and research in both fundamental and applied aspects of Ayurveda. However the question of developing theories and methodology poses a great challenge to Ayurveda practitioners and information technologists at international level [4]. For the smooth interactions between them, application of ICT in Ayurveda looks quite important. The ICT has vast capability to enable reliable storage, retrieval, transfer of the communication.

The current system of treatment concentrates on three- dimensional approach - patients, doctors, and drug vendors and suppliers [5]. There are few new major components which can be adopted in the healthcare systems of Ayurveda are Consultant Information System, Drug Information System, Patients Information System, Knowledge base in digital format and Information and Communication Technology. The above systems help to connect distant resources to work as a part of the system [6].

1. Survey of available expert systems

D.S. Kalana Mendis and *et al.* developed a framework for tacit knowledge modeling, in domain of “Ayurvedic” medicine as a case study for domain with tacit knowledge. They have developed an approach to model such tacit knowledge using PC and Fuzzy Logic that has been linked with Expert system technology. It consists of Interface, Inference engine, knowledge base, fuzzy logic module, principal component analyser and database. The tacit knowledge is analysed and modeled by classification of individuals. Once the principle components are analysed the system activates the fuzzy logic module. D.S. Kalana Mendis and *et al.* suggested another new approach enhancing the ability of classifying human constituents using an expert system based on principal component analysis and Fuzzy logic. The framework for modeling of commonsense knowledge has been developed on the basis of phases – PC analysis, knowledge classification and intelligent reasoning using the expert system technology. The system consists of a user interface, inference engine, knowledge base, fuzzy logic module, principal component analyzer and a database. Commonsense knowledge has been extracted from the expert and formulated in a questionnaire. It is evaluated using Likert scale technology [8]. Another expert system was proposed by A.N. Masizana-Katongo and *et al.* that will provide general information on HIV and AIDS to the public. This proposed system was framed to act as an online ‘expert’. The system will accept as input an FAQ from the user and provide the most relevant answer to the question. The main focus was on two areas. The first was to determine the various forms in which a typical FAQ question could be mapped to the relevant answer. Another challenge was to determine the degree of relevance of the answer to a particular question. The system was developed using Exsys CORVID development tool [7]. This product provided an advanced environment to develop Knowledge Automation Expert Systems in various domains and has good features to allow web applications.

Discussion

Ayurvedic expert system model can be of a great importance both in diagnosis and disease management. As discussed in the above three expert system models their contribution can be proven unmatched.

Research done by D.S. Kalana Mendis and *et al.* was to study the power of intelligent techniques that have been given promising results when classical methods fail for enhancing the method of human constituent classification in Ayurvedic Medicine.

In expert systems developed by Kalana Mendis Mendis and *et al.* a pilot survey has been done for the purpose of extracting principal components. The SPSS is used for conducting the functions of principal components extracting. The authors set up their evaluation criterion as a comparison between the system and a real world expert in the similar domain. Both Ayurvedic expert and the system have been used to investigate human constitutions separately. The evaluation proved that the percentage of same overall conclusion made by the system and the Ayurvedic expert is 77%. Difference of 23% has been shown due to model

refinement process carried out by the Principal Component Analyzer. This leads to the reduction of the dependency among questions in the questionnaire. Also in the expert system developed by Masizana-Katongo and *et al.* the inference engine uses the problem-solving logic to emulate the decision making of domain experts. It allows the domain experts to easily describe their decision-making steps in a logical manner using tree-structured logic diagrams described as rules. People interact with the system as if they were talking to the expert and in this case an expert in HIV and AIDS knowledge. The rules of the system are defined, organized and structured using one or more logic blocks in tree-structured diagrams. The logic may be a complex branching tree that systematically covers all possible input cases, or a simple diagram that correlates with a few rules. Logic Blocks are created and maintained in a visual, intuitive development environment using the IF/THEN representation.

Conclusion

These various expert systems equip human with an exceptional tool that would make the better interpretation and treat the diseases through Indian system of medicine i.e. Ayurveda. The survey also helps us in understanding that artificial intelligence can be used as a very strong tool for expert systems development. The human body, according to Ayurveda is classified as three categories i.e. VATA, PITTA, KALPA. The body is basically combination of these three Tatvas. The treatment to the patient can be formulated according to classification of the person. The Ayurveda strongly believes that the food also has to be eaten according to Tatvas of the person. The Expert systems can also incorporate the diet management of the patient to make it complete system of diagnosis and cure.

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