Chapter 68
Emerging Application of Fuzzy Expert System in Medical Domain

A. V. Senthil Kumar
Hindusthan College of Arts and Science, India

M. Kalpana
Tamil Nadu Agricultural University, India

ABSTRACT

Fuzzy expert system is an artificial intelligence tool that helps to resolve the decision-making problem with the existence of uncertainty and plays an important role in medicine for symptomatic diagnostic remedies. In this chapter, construction of Fuzzy expert system is the focused, which helps to diagnosis disease. Fuzzy expert system is constructed by using the fuzzification to convert crisp values into fuzzy values. Fuzzy expert system consists of fuzzy inference, implication, and aggregation. The system contains a set of rules with fuzzy operators T-norm and of T-Conorm. By applying the fuzzy inference mechanism, diagnosis of disease becomes simple for medical practitioners and patients. Defuzzification method is adopted to convert the fuzzy values into crisp values. With crisp values, the knowledge regarding the disease is given to medical doctors and patients. Application of Fuzzy expert system to diagnosis of disease is mainly focused on in this chapter.

INTRODUCTION

Decision making is one of the problems in recent decades. There are large volumes of data that are spread around the world. Experts make decision with the data. But the decision given by expert varies from one expert to another expert. This variation is due to ambiguity and vagueness in data. Many methods are derived to solve this problem. Origin of Artificial Intelligence was in early 1956. Many peoples used Artificial Intelligence in various domains but not in human level machine intelligence. In recent years AI is used in many areas in human level machine intelligence and it is applied for decision making, diagnosis, pattern recognition, analysis of evidence (Zadeh, 2008). Expert system is an very important

DOI: 10.4018/978-1-5225-1908-9.ch068

branch of artificial intelligence developed in mid-1960. With an application of the scientific study of artificial intelligence, expert systems are able to use human knowledge through an inference engine to solve problems that require a human expertise. Expert system has the ability to capture knowledge, easy to access from anywhere, able to operate within the dangerous situtation and developed for variety of purposes from all disciplines.

Many institutions developed online expert system for diagnosis purpose. The National Research Council, Canada has developed an online diagnosis system, they used acute leukaemia disease data to illustrate the efficiency of diagnostic tool. In recent times they used a new fuzzy classification method called PROAFTN. PROAFTN is used for medical diagnosis. Results from PROAFTN method are very accurate and promising to diagnosis acute leukaemia. The tool designed is secured, remote access, a decision support system and it is a standard framework for exchange of health information, an inexpensive internet communication pathway using web-based technologies. Information regarding the tool is viewed from the website of National Research Council Canada. YourDiagnosis was designed by expert group of very experienced doctors in Australia. They are from a large medical and hospital group called Macquarie Health Corporation Ltd. Macquarie Health Corporation Ltd. also owns Macquarie Hospital Services and Macquarie Medical Systems. Macquarie Hospital Services has been operated as a private hospital since 1976. Fuzzy logic is applied to the CHD risk assessment domain, architecture is derived based on fuzzy objects and proven to be highly adequate for capturing and efficiently processing case-knowledge. This scheme is designed upon well established object oriented principles; it can flawlessly incorporate in a wider, more general knowledge management system (Dubitzky, Schuster, Hughes, & Bell,1997). In the research (Schuster, Adamson, & Bell, 2002) an alternative study is presented for scenarios where a larger number of rule antecedents are applied to the same rule consequent. Results of the method in the domain of CHD risk assessment indicate the value of the method. In many areas, medicine fuzzy logic approaches are designed and used. Fuzzy Expert System is used for calculating the prostate cancer diseases risk (Saritas, Allahverdi, & Sert, 2003). A fuzzy expert system was developed to diagnosis and treatment of male impotence. The experimental result shows that system works much better than non-expert urologist. The accuracy is about 79% compared with the past history (Koutsojannis & Hatzilygeroudis, 2004). There are other applications such as chronic intestine illness symptoms such as sedimentation and prostate specific antigen are used to develop a fuzzy expert system to determine the drug dose(Allahverdi, Saritas, Ozkan, & Argindogan, 2006).

BACKGROUND

Fuzzy Logic

An expert uses their common sense to solve a problem. In many situation they use vagueness and ambiguous. To represent the expert knowledge with vague and ambiguous in terms of computer we use fuzzy set theory (or fuzzy logic). Fuzzy logic is the theory of fuzzy set which is used to calibrate vagueness. Fuzzy Logic is a powerful reasoning method that can handle uncertainties and vagueness. Conventional logic and Boolean logic uses sharp distinctions. Fuzzy logic reflects how people think. It helps to model our sense of words, decision making and common sense. Fuzzy Logic is very impressive tool to build intelligent decision making mechanism for approximate reasoning. Fuzzy or multi-valued logic was coined by Jan Lukasiewicz in 1930. The study was based on mathematical representation of