Chapter 41

Implementation of Fuzzy Technology in Complicated Medical Diagnostics and Further Decision

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ABSTRACT

This chapter presents the importance of fuzzy expert systems in the medical field. Efficient and suitable medical work becomes difficult many times without the knowledge of the rules of logic. The chapter highlights the ways of implementing both classical logic and non-classical approach (e.g. temporal and fuzzy logic) in some adverse areas of medical diagnostics. The implementation of fuzzy expert systems is supported by some examples illustrating how indispensable the cognition of logic and showing how applying logic can effectively improve work in medicine. Fuzzy Expert Systems for diagnosis of urinary incontinence, Parkinson's disease, including neurological signs in domestic animals, as well as its implementation for diagnosis of prostate cancer are elaborately discussed.

INTRODUCTION

An essential element of the medical profession is to take numerous decisions rapidly. In this process a medical practitioner usually rely on gained knowledge and experience. However, it seems essential for them to have the ability to think logically, to use reasoning, to infer precisely and express their thoughts clearly for justifying the assertions made. Even when their actions are on the basis of certain algorithms or standards, they have to logically model the situation. Insufficient knowledge concerning the rules of logic can lead to dangerous errors and may result in continuous failures in performance flowing from faulty reasoning processes. Computer programs by making use of Artificial Intelligence (AI) techniques

for solving difficult problems involving knowledge, heuristics and decision-making are called expert systems, intelligent systems or smart systems. An expert system is designed on the basis of a set of rules with a view to find what action to set off when a certain situation is encountered. The expert system is a technology that able the human being to collect and control the human expert's knowledge and expertise in a particular problem domain for solving similar problems through computer system. Experts of any fields are always few in numbers and expensive to consult. Also they have short time due to much work to do. Consequently there is an urgent need of storing the expert's knowledge in the computer in such a way that have a great extent of knowledge of problem domain solving problems of the users and sparing experts for others works.

Fuzzy logic is a form of many-valued logic deals with reasoning that is approximate rather than fixed and exact. Compared to traditional binary sets, where variables may take on true or false values, fuzzy logic variables may have a truth value that ranges in degree between 0 and 1. Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false.

For the last couple of decades, academics and researchers began to recognize the importance of expert system and its associated concepts became one of the most popular topics related to decision making and knowledge management. From the very beginning, expert systems have been developed in many areas, like agriculture, chemistry, computer science, engineering, physics, geology, medicine, space technology etc. It has been widely applied to various studies and issues, including performance assessment commercial loan underwriting, logistics strategy design, farm productivity, mergers and acquisitions, budget planning, earthquake design, system dynamics, conveyor equipment selection, customer service management and knowledge inertia.

Expert system is adopted largely using fuzzy logic principals. It has developed the knowledge acquisition tool related to the problem in the development of intelligent expert system. Suitable and proper medical work becomes complicated without the knowledge of the rules of logic. This chapter depicts adaptation of expert systems technology using fuzzy logic to handle qualitative and uncertain facts in the decision making process in the field of medical sciences. Human behaviors are mostly based upon qualitative facts, which cannot be numerically measured and hardly to decide correctly. An attempt has been taken to cope with such problems. The existing and developed Expert System has been applied to acquire knowledge about the problem domain that showed interesting results and thus providing a sketch to find solutions of such types of problems. Through Fuzzy Logic one can numerically weighted the linguistic terms, like; very good, good, bad, or high, medium, low or satisfied, partly satisfied or unsatisfied by assigning priorities to these qualitative facts. During final decision making weights are given to the key parameters according to their priorities through mapping numeric results from uncertain knowledge and mathematical formulae are applied to calculate the numeric results at final.

OVERVIEW

Classical logic only permits propositions having a value of truth or falsity. The notion of 1+1=2 is absolute, immutable and mathematical truth. However, there exist certain propositions with variable answers, such as asking various people to identify a colour. The notion of truth does not fall by the wayside but rather a means of representing and reasoning over partial knowledge is afforded by aggregating all possible outcomes into a dimensional spectrum.

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