Chapter 45
Application of Fuzzy Expert System in Medical Treatment

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ABSTRACT

The incidence of breast cancer is increasing day by day. Emotional significance of females for the fear of removal of breast demands attention and carries a particular terror. Fuzzy logic-based expert system is a powerful tool that is used in this chapter to get the benefits of soft computing in modern medical science. This chapter deals with reasoning for medical implementation in breast cancer diagnosis. The motto of this expert system using MATLAB software is to make the people of the world healthier, free from breast cancer and its metastasis through the power of information. Special revolutionary screening technology and a few (cancer markers) blood tests enable breast cancer diagnosis, configuration, and control, and prompt necessary decisions for treatment. Thus, this system provides healthier living, better healthcare outcomes, and helps to lower the overall cost of the healthcare system.

INTRODUCTION

Nowadays the use of computer technology in the fields of medicine area diagnosis, treatment of illness and patient pursuit has highly increased. In these fields having very high complexity and uncertainty and the use of intelligent systems such as Fuzzy Logic, artificial neural network and genetic algorithm have been developed in computer. It is needless to mention that Fuzzy Logic has proved to be a powerful tool for decision making systems, such as expert systems and pattern classification systems. Human disease diagnosis is a very complicated process and requires very high level of expertise. Fuzzy set therefore has been applied in various fields of medical applications like Asthma, Heart disease etc. in past decades and proved as wonderful.

In traditional rule-based approach, knowledge is encoded in the form of antecedent – consequent structure. When any new data is encountered, it is matched to the antecedents clauses of each rule and those rules where antecedent match a data exactly are fired, establishing the consequent clauses. This process continues till the desired conclusion is reached, if no new rule can be fired. Some practical examples of using fuzzy logic to develop fuzzy intelligent systems are fuzzy systems in their microprocessors like control of subway system in Sendai city of Japan, fuzzy washing machines, fuzzy cameras and camcorders that map image data to lens setting and fuzzy voice commands "up", "land", "hover" to control unmanned helicopters. The prime characteristic of fuzzy logic is its capability of expressing knowledge in a linguistic way allowing a system to be described by simple "human-friendly" rules. A fuzzy inference system is a rule based system that uses fuzzy logic rather than Boolean logic to reason about data consisting of four main components:

1. A fuzzifier which translates crisp (real valued) inputs into fuzzy values, and
2. An inference engine that applies a fuzzy reason.

We present a scientific approach for analyzing fuzzy systems for breast cancer diagnosis. By judiciously designing an appropriate representation scheme and fitness function, the genetic algorithm is then able to produce successful systems. These surpass the best known systems to date in terms of combined performance and simplicity. Introduction Fuzzy logic is a computational paradigm that provides a mathematical tool for dealing with the uncertainty and the imprecision typical of human reasoning. A prime characteristic of fuzzy logic is its capability of expressing knowledge in a linguistic way, allowing a system to be described by simple, "human-friendly" rules. The decision process for selecting the best suited follow-up treatment for a suspected breast cancer case is strongly dependent upon the correct diagnosis and assessment of the breast cancer risk. Besides the latest technological developments, the methods and criteria used to quantify the characteristics of detected lesion, so as to define the developmental stage of the breast cancer, and thus to finally select at a reliable risk estimate, are still poorly defined for many physicians.

Breast Cancer is the development of cancerous tumors that develop from breast cells.

The reason for selecting this topic as the number of breast cancer patients are increasing day by day and also increasing the risk factors makes the things more complicated to diagnose the disease. A fuzzy inference system is a rule-based system that uses fuzzy. In this chapter the factors that cause of breast cancer considered are:

- **Age:** Breast cancer is most common among women over 50 who have been through menopause.
- **Gender:** A woman is more prone to breast cancer than a male.
- **Family History:** If someone has close relatives who have had breast cancer or ovarian cancer, she may have a higher risk of developing breast cancer.
- **Overweight:** It may cause breast cancer.
- **Exposure to Estrogen:** If someone has taken estrogen therapy for prolonged period then she has a higher risk of developing breast cancer.
- **Previous Benign Breast Lump:** If benign breast lump is left without any treatment for prolonged period then it may get converted into malignant breast cancer.
- **Certain Inherited Gene Mutations:** Certain inherited gene mutations can dramatically increase the risk for developing breast cancer like BRCA1 and BRCA2.

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