A Fuzzy Based Model for Brest Cancer Diagnosis

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Abstract: The purpose of the present paper is to classify among different age group of the patients and their symptoms of breast cancer through the mammographic images under single dieses and to determine appropriate therapeutic action. This also helps to diagnosis of diseases which having the same symptoms.

This paper deals with knowledge based expert systems which have been developed for the diagnosis of diseases based on the symptoms obtained from the interaction and observation from the patient. The diagnoses are vague or uncertain for the treatment so there is a requirement of fuzzy. An example of Brest Cancer and other group of diseases is taken where the retaliated diagnosis is approach to fuzzy logic.

I. INTRODUCTION

The Medical information acquired in the two ways

- Through numerical or Linguistic evaluation by Medical Experts.
- By statically evolutional of the database or schema containing the medical data of the patient with confirm diagnosis. The information on the relationship gathered numerically or linguistically.

Generally the primary stage of investigation of diseases is uncertain, mainly Medical Experts follow the way of diagnosis through the interaction from the patients and also know the history of the patient, and after the process of the primary investigation he got a schema of various symptoms from the patients. The Expert kept all the information in mind and these information is vague at the right movement because various diseases having some common symptoms so for the diagnosis there is a requirement of **fuzzy logic** i.e. relationship from the standard data base through fuzzy membership function , and identify the actual diseases through fuzzy membership which is represented by the binary value (1) and if the symptoms is not retaliated with the standard schema that shows false membership (0) .After the diagnosis of the diseases they prescribe the related treatment for the diseases. After the medicine if the patient is perfectly alright so the treatment is true i.e. true relationship, and if the patient doesn't get any relief i.e. false relationship .Then once again the patient approach to the Expert. The accuracy of this expert system depends on the accuracy of the data presented to it. The physician subjects the patient to a physical examination from which he obtains more or less objective data. However, measurement errors, organizational
problems (misleading samples, sending them to the wrong laboratory, etc), or improper behavior on the part of patients prior to examinations lead to imprecise and sometimes even totally incorrect data and physicians make mistakes, overlook important indications, or fail to carry out a complete examination. Furthermore, they may misinterpret other indications because the boundary between healthy and pathological status is not always clearly defined. There are always borderline values that can not be said to be either normal or pathological and the physician can not interpret it. But with this expert system, we can define the healthy, borderline, clear cut and severe pathological conditions. There has been a growing interest in healthcare among many people. Some topics related to healthcare are: drinking water quality, driving fatigue, health risks in work environment and healthcare organizations.

II. FUZZY CONTROL TECHNIQUES

Various therapeutic situations are related to control problems. Although the early medical systems appeared at the same time as the article by Zadeh (1965), there has been little communication between the research fields, but recently this has changed due to the developments in computer systems, and rapid development of the literature searching methods motivated by the internet. Many systems are being developed which utilize fuzzy logic and fuzzy set theory.

III. RULE-BASED OPEN-LOOP SYSTEMS

Deterministic open-loop fuzzy control approaches have been proposed in many applications. Generally, in open-loop configuration, it is assumed that the pharmacokinetics relationships can be modeled exactly by a linear system with known parameters. Open-loop fuzzy control is based on a different approach. Rather than assuming the patient model is known, the physiological behavior is modeled using control rules and actions. Most of the controllers are advisory systems. In healthcare, the "heaviness" is defined by mean of fuzzy sets for advising workers how heavy their weight. Also fuzzy control was used to develop a computer-based system for control of oxygen delivery to ventilated infants. An open-loop system for treatment of diabetic out-patients was developed for calculating the insulin dose. Advisory expert systems can also be considered as an open-loop controller for advising on drug administration in general anesthesia

IV. FUZZY LOGIC

Definition and design of Fuzzy Relational Maps (FRMs) .In FCMs with the help of correlations between causal associations among concurrently active units. But in FRMs we divide the very causal associations into two disjoint units.A fuzzy set A in X is characterized by a membership function $\mu A(x)$ which maps each point in X onto the real interval [0, 1]. As $\mu_A(x) = 1$, the "grade of membership" or true membership function of x in A increases. A is EMPTY or Null iff for all x, $\mu A(x) = 0$.ie. False membership. A = B iff for all {x: $\mu A(x) = \mu B(x)$ [or $\mu_A(x) = \mu_b(x)$]}

Definition9: Data are binary Computer representation of stored logical entities. Index files and data dictionaries, store administrative information known ads meta data. A fuzzy relational R on a relational schema if A_i be the set of attributes and $R(A_1,A_2,\ldots\ldots,A_n)$ is the fuzzy sub set of the Cartesian product of Universe defined by $dom(A_1)\_dom(A_2)\_\ldots\ldots\ldots\ldots dom(A_n)$. According to the complexity of the $dom(A_i)$ the classical fuzzy relational can be classified to type 1, fuzzy relational. In first type each attribute domain dom(Ai) can only crisp set or a fuzzy sub set so we can capture the impression of attributed value in a type 1 fuzzy relational allow each domain to be a crisp set, a fuzzy sub set of fuzzy sets, and the second type is relation express the imprecision in the association among the attribute value.

V. ALGORITHM

Step1: Get the input
Get the list of symptoms from the patient as i/p.

Step2: i/p of the mammogram result to the preprocessing
(Picture is converted into s/t copy)

While (mammogram i/p is available)

Step3: classify the image gray scale/color.

Step4: Identify the particular defect segment of the picture.

Step5: corping the identified part.

Step6: To identify the brighter spot boundary of the part.

Step7: To identify the pixel value of the gland.
(Extract the gland value)

Step8:To generate the fuzzy vector matrix for pixel value BAM.

Step9: To convert the correlated variables into uncorrelated variables to the .mathematical representation by RAM.

Step10: To producing a quantifiable result in fuzzy logic (Defuzzification).

Step11: Get the o/p image (denoise image).

Step12: To compare the o/p image to i/p image.
If (o/p is equal to i/p)
Output is correct.
else
End while.

VI. FUZZY TECHNIQUES FOR BIOMEDICAL DATA ANALYSIS

The knowledge acquisition system is capable of acquiring information on medical entities and relationship between the relationships is stored in terms of numerical values in the range 0 and 1.

Example: Cancer in its preliminary stage is uncertain in its character. There is a loss of appetite and sign of dyspepsia, neuralgia, nausea, rheumatic and articular pains, fever irregular or intermittent and un-accountable lassitude and anxiety. After some time the new symptoms are developed by periodical eruptions. The symptoms blotches first reddish, then brown with a white border and then appear and disappear in various parts of the body. Some times on the joint but generally on the articulation of the fingers and toes of the small tumor rise failed with a yellowish substance fast turning to darker hue. These tumors leaves the permanent spots pole or

brown, or nodels.According to its effect on the skin and mucous membrane (cutaneous cancer) or the nerves (anesthetic) or both mixed or complete the dieses develop in the form of leprous formation and diverges in to the different varieties. Each of these varieties merges frequently on others and some times became very difficult to draw the line between the causes. The effect of tubercular cancer they may occur on the part of the body but usually effect the face (forehead, eyelids ,noise, lips ,chin, cheeks and ears. In anesthetic cancer the anesthesia of the little finger is one of the characteristic symptoms which may occur. The ulcer, at first usually located on to the finger, attack on the fingers, on other hand in some cases feet is also effected at the same time. The medical history of the patient, which is highly subjective and may include simulated to understated symptoms that finally leads to the correct diagnosis.

VII. FUZZIFICATION OF THE SYMPTOMS

A binary relationship is established for the symptoms of the subject and takes the values between 0 and 1 .These values indicate the degree of which the exhibits a symptoms. In fuzzy set theory these binary is expressed in terms of membership function. Dieses or diagnosis also takes values between 0 and 1.Fuzzy values is ranging from 0 and 1 represent the membership function of any dieses while the values 1 and 0 represent the confirmation of the dieses. Some fuzzified symptoms of some dieses is given in the table for the Cancer fuzzy number is assigned to the symptoms Glaucoma is a silent disease which results in blindness which has symptoms similar to other common eye and ear problem. If deducted during earlier stages can be cured and the damage to the human system can be reduced. It is basically due to the variation of pressure of aqueous

S.no.	Symptoms	Range	Fuzzification Value
	Temperature	T<98.6 F	00
		98.6 F<T<100 F	01
		100 F<-T<102 F	10
		102 F<T	11
2	Appearance	Normal	00
		Small	01
		Blowing	10
3	Bumps	Normal	00
		Small variation	11
4	Color	Reddish spot	00
		Whitish spot	01
5	Texture	Not seen	00
		Permanent	01
6	Lump	Normal	00
		Medium	01
		High	10
7	Excoriations	Normal	00
		Low	01

		Medium	10
		High	11
8	Feeling of discomfort	No	00
		Low	01
		Medium	10
		High	11
9	Reddish spot on the body	Not Seen	00
		Low	01
10	Brown Spot on the body	Not seen	00
		Low	01
11	Spot With White border	No	00
		Low	01
		Medium	10
		High	11
12	HRT(Hormone Replacement Therapy)	No pain	00
		Low	01
		Medium	10
		High	11
13	Discharge blood from nipple	Yes/ No	1/0
14	Gland on neck	Yes/ No	1/0
15	Change in voice	Yes/ No	1/0
16	Change in daily routine	Yes/ No	1/0

And some other symptoms also defined with the help of membership value for the same dieses .

7.1Fuzzy Clustering:

Clustering algorithms are mainly concerned with partitioning the data into a number of subsets. Within each subset, the elements are similar to each other. On the other hand, elements from different sets are as different as possible. There are different fuzzy clustering techniques based on unsupervised learning such as relation criterion functions, object criterion functions, c-means clustering, etc. Most of the clustering techniques are being applied to diagnosis. C-means clustering was applied for brain injury using magnetic resonance images),and tumor measurement in response to treatment Fuzzy classification differs from clustering by the labeling method, the former giving a label to each data set, while in the latter method a label is given to each data set. Supervised learning is usually used

for classification. Most of the fuzzy classification applications occur in the psychology field there are also forensic application and classification of path physiology laboratory data

VIII. Fuzzy Modeling and Identification

Fuzzy logic models can be developed from expert knowledge or from process (patient) input-output data. In the first case, fuzzy models can be extracted from the expert knowledge of the process. The expert knowledge can be expressed in terms of linguistics, which is sometimes faulty and requires the model to be tuned. Therefore, identifying the processes a more attractive way using the help of expert knowledge. This process requires defining the model input variables and the determination of the fuzzy model type. There are two ways to develop a fuzzy model, the first beings based on defining the initial parameters of the model (membership functions) and selecting the rules construction method Neuro fuzzy algorithms are often used for the tuning of parameters). The second method is used if there is no knowledge about the process, when the rules and membership functions can be extracted directly from the data by clustering the input / output space

8.1 Fuzzy Relational Mapping:

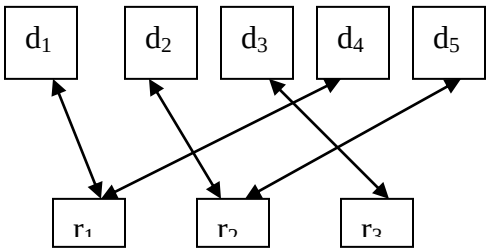
Relational mapping is defined between patient and Medical Expert by taking an example domain symptoms set Di={ d_1,d_2, d_3, d_4, d_5} and range disease

Set R={r_1, r_2, r_3} where r_1, r_2, $r_3$be the disease like hart attack ,general disease, canser.

IX. Fuzzy Matrices and their Applications

Matrix theory has become a very simple but an effective tool in the analysis of collected raw data. Fuzzy matrix or CETD matrix model is the one, which helps to analyze the raw data. The analysis is carried out in five stages. In the first stage the collected raw data, which is time dependent is made into an Initial Raw Data (IRD) matrix. **A** FRM is a directed graph or a map from D to R with concepts like policies or events etc, as nodes and causalities as edges. It represents causal relations between spaces D and R .Let D_i and R_j denote that the two nodes of an FRM. The directed edge from D_i to R_j denotes the causality of Di on Rj called relations. Every edge in the FRM is weighted with a number in the set {0, ±1}. Let eij be the weight of the edge D_iR_j, e_{ij} The weight of the edge Di Rj is positive if increase in Di implies increase in Rj or decrease in Di implies decrease in R_j ie causality of D_i on R_j is 1. If e_{ij} = 0, then Di does not have any effect on R_j. We do not discuss the cases when increase in Di implies decrease in R_j or decrease in D_i implies increase in R_j .When the nodes of the FRM are fuzzy sets then they are called fuzzy nodes. FRMs with edge weights {0, ±1} are called simple FRMs. An FRM with cycles is said to be an FRM with feedback.

When there is a feedback in the FRM, i.e. when the causal relations flow through a cycle in a revolutionary manner, the FRM is called a dynamical system.



And the fuzzy relational matrix is between D and R defined as

$$E = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

where (1 0 0) vector which shows that the symptoms is matched for diagnosis of dieses

9.2Error Back Propagation:

Through the above mentioned tables the out put that is the fuzzified values taken by the various combination of the symptoms

X. Dieses Diagnosis Related Theoretic Action

It is a complex partly uninvestigated process in which the knowledgebase expert system is obviously able to work with uncertain and imprecise set of possibilities so for that IF-THAN rule is followed .

XI. CONCLUSIONS

The fuzzy based expert system has been successfully developed and tested for the diagnosis initial level dieses. This approach is reliable and provides wide spread of information to help the physician in reaching a more logical conclusion for a more accurate diagnosis. The system has been successfully tested for disease diagnostics for number of combinations of healthy and diseased categories. With the help of this system, it is possible to know the degree of severity as well as the type of disease. The expert system has been successfully developed and tested for the diagnosis of other dieses. This approach is reliable and provides wide spread of information to help the physician in reaching a more logical conclusion for a more accurate diagnosis. The system has been successfully tested for disease diagnostics for number of combinations of healthy and diseased categories. With the help of this Algorithm we analyze by the denosing with the help of wavelet and curvlet transform the memographic, it is possible to know the degree of severity as well as the type of disease.

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