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Early Detection of Variety of Carcinoma by Exploitation of Fuzzy Classifier

Manpreet Kaur[1], Anurag Sharma[2], Gurminderpreet Singh[3]
[1](Student, Dept. of Electronics & Communication, CTITR, Jalandhar, India)
[2](Assistant Professor, Dept. of Electronics & Communication, CTITR, Jalandhar, India)
[3](Dept. of Electronics & Communication CTITR, Jalandhar, India)

Abstract: In a way to deal with real health care issues, we tend to propose a fuzzy based decision creating the system for diagnosis of carcinoma. Carcinoma is the most far-reaching disease today, so primary detection of Breast Cancer is extremely vital. The projected paper was supplied with artificial intelligence techniques such as fuzzy logic to allow correct deciding. The fuzzy rule-based makes use of professional data to affect patient's symptom and provides associate degree correct call consistent with rules made.
Keywords: Carcinoma, Fuzzy expert system, Breast Cancer, FIS, Artificial intelligence.

I. Introduction

The medical analysis of an illness is so much reaching drawback in today's medical world. The medical space is one in all the recent branches that require engineering techniques to achieve access to inaccurate data. With new advances in medical engineering and different management systems that are non-heritable by the usage of artificial intelligent techniques. Artificial intelligence has created a progressive analysis that includes fuzzy logic, artificial neural networks and genetic algorithms. All these techniques work altogether and supply necessary data from one type to another to cope with difficult real-life problems. The most existing and widespread type of artificial intelligence that they offer to facilitate and help to physicians in the identification of illness is the development of the clinical diagnosis of decision support system[5].

The farthest-reaching disease today is the carcinoma. It is commonly found in ladies inflicting legion deaths yearly. The most important issue in the diagnosis of carcinoma is that the main cause or reason behind the disease is unknown. The patient's state of extent is improved by early detection of carcinoma [6].The detection of breast cancer at the earliest stage can improve the survival rate from 56% to 86%. Ordinarily, the diagnosis of the first stage of the disease is imprecise, as the physicians diagnose by studying the history of the patient [1]. Although numbers of strategies are used to diagnose carcinomas, such as Fine Needle Aspiration, Mammography, Biopsy and Magnetic Resonance Imaging (MRI), however, these techniques don't seem to be reliable due to human errors. The medical experts notice breast cancer based mostly on their past expertise and data which sometimes may lead to wrong selections [7]. Recent studies reported that for the diagnosis of breast cancer, the fuzzy expert system is one of the advantageous applications with the aptitude to handle unclear and inaccurate in prognosis and diagnosis of breast cancer. Due to their robust behavior within the impact of noise and uncertainty, yields higher results [1]. Breast cancer tumors are of two types: Malignant Breast Tumor and Benign Breast Tumor. Malignant breast tumors are those that once seemed in any part of the body can unfold within the whole body and is extremely tough to get rid of. Benign breast tumors do not unfold within the whole body and it is straightforward to detect as compared to malignant.

The Fuzzy set theory was introduced by Prof. LoftiZadeh in 1965 [9], build it attainable to define uncertain medical attributes into human understandable form [5]. The yielding performance of the fuzzy logic has been employed in many different applications. The most important advantage of the fuzzy expert system lies within the undeniable fact that researchers can model uncertain, complex system into straightforward human intelligible kind by using human experience and knowledge as fuzzy rules as the set of linguistic variables [2]. The present paper mentioned an expert system by creating use of fuzzy logic to spot breast cancer tumor from its prescribed symptoms. The accuracy reasoning is determined using patient data set a record having 5 totally different attributes. By using medical expert knowledge fuzzy rules are developed that can be employed in deciding. This present paper planned knowledge-based expert system for the identification of breast cancer.

The designed system was given data processing artificial intelligent techniques like fuzzy logic techniques to offer correct and active decision system. Detection of breast cancer at a primary stage is essential to increase people's survival rate. The medical industry using the sphere of artificial intelligence has with success moved from clinical laboratory to real-time applications. The fuzzy expert system can be employed as a decision -making tool for observance varied diseases using fuzzy relationships. During this half, designing andimplementing results for the identification of illness breast cancer using fuzzy inference system are designed.

Once evaluating the degree of accuracy is earned from a health center knowledge set. Using 6 numbers of input parameters (symptoms) fuzzy inference systems is developed. The fuzzy rule-based system utilizes health Worker data for understanding patient's symptoms and provides accurate decisions according to fuzzy rules are created.

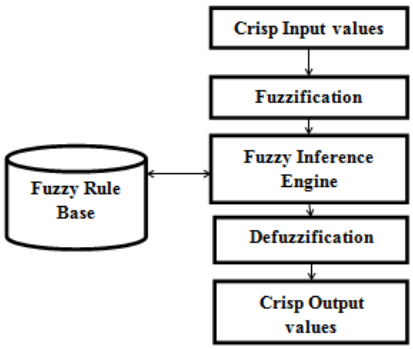

Fig. 1: Fuzzy Expert System [12]

II. Related Work

In this part, we have a tendency shall discuss some work associated with the fuzzy expert system. There are various works wiped out a literature that illustrate the implementation and model of health workers system.

Muhic I. (2010) planned a replacement approach for diagnosis of breast cancer using Fuzzy-C-Means clustering and pattern reorganization. The fuzzy-c-means clustering (FCM) algorithm has been tested on clinical instances obtained from Wisconsin University. This information set 683 clinical instances of which 444 are benign and 239 are malignant breast cancer patients. By using FCM, the clinical attributes are divided into two clusters, one with malignant cluster and alternative with the benign cluster. Authors concluded that this approach yield 100% true positive, 87% true negative [4].

Balancia V. et al. (2011) proposed a decision support fuzzy skilled system for breast cancer risk. Authors introduced fuzzy rules which can be used to predict breast cancer risk and fuzzy results are compared with clinical results. Authors concluded that the outlined fuzzy rules are close to the agreement with clinical results [2].

Surendiran B. (2011) introduced Hue Saturation Value (HSV) weight perform for classifying malignant lots and benign lots based on statistical features. The HSV weight function is powerful against noise and entraps the gray content of the image. To effectively differentiate between malignant masses and benign masses, the gray weight value is used instead of gray weight function. The digital database for screening mammogram (DDSM) dataset had been used in which 233 mammograms are used. Authors concluded that classification rate is highly encouraging and are related to BI-RADS classification [3].

Tintu P. et al. (2013) proposed an alternative approach for breast cancer disease diagnosis and classifying benign and malignant breast cancer using fuzzy c-means. This proposed approach was based classification of input data, training data and test data. Results on breast cancer diagnosis dataset from UCI machine learning repository show that the proposed FUZZY C Means would be capable of classifying cancer cases with the high accuracy rate in addition to adequate interpretability of extracted rules [6].

Nagarajasri B. et al. (2013) planned a threshold neuro-fuzzy skilled system for designation of breast cancer. Authors introduced ARM Cortex M-3 neuro-fuzzy skilled system for diagnosis of breast cancer for classifying malignant and benign mammography findings. Authors concluded that this technique increases a wide range of accuracy and potency for diagnosis of breast cancer [8].

Khezri R. et al. (2014) proposed a fuzzy expert system for the threat development of breast cancer scenario. This model uses Mamdani fuzzy inference system which has more competence to interact with humans experts during diagnosis stage. The main benefit of this implementation is that it can admission risk developing in breast cancer even in normal females. The results of a fuzzy expert system were compared with medical specialist choices. Authors concluded that results of a fuzzy expert system were 95% accuracy as compared to previous work. This model is employed for predicting breast cancer risk and hence increases the survival rate of the patient [1].

Walia N. et al. (2015) proposed a decision support system for diagnosis of tuberculosis using a fuzzy expert system. Authors briefly explained the implementation of completely different input attributes and their

symptoms. Authors concluded that proposed a fuzzy expert system for diagnosis of tuberculosis offer an accuracy of 78% and this system can offer aid to pulmonary physicians [5].

Nehra E. etal. (2015) introduce how artificial intelligence affects our modern life and from what artificial intelligence is got or branches of artificial intelligence. Investigates of artificial intelligence that are made and what is its future scope. Author conclude that artificial intelligence have simplified our life in every aspect it can be article writing or game planning or taking any important decision [13].

Berbar A. et al. (2016) proposed two techniques are based on statistical and LBP features using support vector machine (SVM) and the k-nearest neighbor (KNN) classifiers. The evaluation of the system was applied on Digital Database for Screening Mammography (DDSM). The system classifies normal from abnormal cases with high accuracy rate [14].

Johra F. et al. (2016) introduced a pipeline for breast cancer cell detection and feature extraction using open source image analysis software named Cell Profiler. Observed an algorithm based on fuzzy inference system for classification of the benign and malignant state. Author Compare the parameters such as accuracy, sensitivity and specificity shows that in this proposed approach performs better than the Artificial Neural Network (ANN) and Support Vector Machine (SVM) based classification. The sensitivity, specificity, and accuracy of the proposed method is 95.6%, 90.63%, and 94.26% respectively [15].

Ohri k. et al. (2016)observed artificial intelligent technologies such as fuzzy logic to give correct decision making. The fuzzy rule-based makes use of expert knowledge to deal with patient symptom and give an accurate decision according to rules constructed [12]. It is clearly understood from higher than literature review on fuzzy logic that fuzzy logic has been with success applied to the varied medical field for diagnosis and prognosis of varied diseases. In this, fuzzy rules are developed to predict the carcinoma tumor.

III. Proposed System

This part explains the approach adopted in constructing the general fuzzy framework for call creating the system. The fuzzy inference system could be a framework that relies on fuzzy set theory, gains a fuzzy illustration of patient's symptom and consequently induces fuzzy relationship. In order to accomplish fuzzy description to fullest i.e. to achieve terribly high interpretability, the potential to know generalization is of extremely important. The word generalization, we have a tendency to mean that ability to express the state-action agreement as compact as possible. Generalization rules grant extra compact rule base, rapid inference and higher fuzzy interpretability. A fuzzy dependent decision support system attains skilled information and skill and understanding of IF-ELSE rules to design fuzzy inference. Thus, a fuzzy expert system permits an easy method for designing a correct solution with help from an unsure region. The given fuzzy set corresponding to a membership function defines the input attribute to its correct membership and it must in a range of (0, 1). A fuzzy set could be a set that has no crisp value and has fuzzy borderline. The trapezoidal membership plot could function having four variables a, b, c, d wherever a and d represent feet of the trapezoid with membership degree zero and b and c represent shoulders of the trapezoid with membership degree 1 is illustrated by the equation (1):

$$f(x;a,b,c,d) == \begin{cases} 0, x < a \\ \frac{x-a}{x-b}, a \le x \le b \\ d-x, c \le x \le d \\ 0, d \le x \end{cases} \quad (1)$$

IV. Fuzzy Modelling and Working

Fuzzy rules and fuzzy analysis is that the keystone to the fuzzy inference system that converts input variable (crisp value) into the fuzzy variable for the prediction of actual stage of a malady.

Fuzzy IF-ELSE rules are the foundations made victimization input (antecedents) variable and output (consequent) variable within the manner IF A (INPUT) THEN D (OUTPUT) wherever A and D contain some explicit info associated with each input and output parameters. This current paper is simulation connected paper and medical decision-making system is performed victimization fuzzy toolbox in MATLAB 2013B software. This projected system is employed to predict the breast cancer tumor. The system consists of 6 numbers of input variables and 1output variable taken throughout diagnosis of carcinoma. The amount of input attribute changes in skin color, breast lump, nipple discharge, family history and abnormalities. Every input attribute is related to two or three trapezoidal membership function. Mamdani inference system is employed for diagnosing due to its ability maybe expert knowledge in an exceedingly progressive manner and works just like mortals. Also has a capability to handle real-world applications.

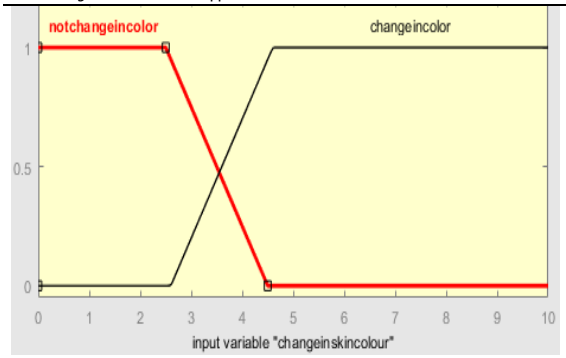

Fig. 2: Membership Plot for Change in Skin Colour

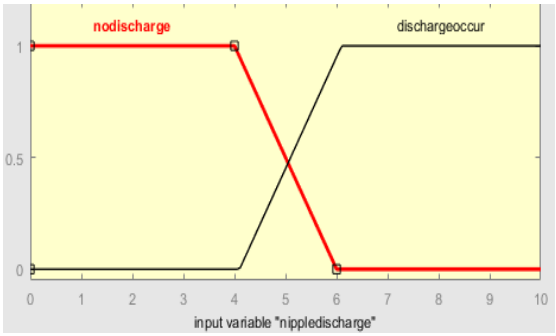

Fig. 3: Membership Plot for Nipple Discharge

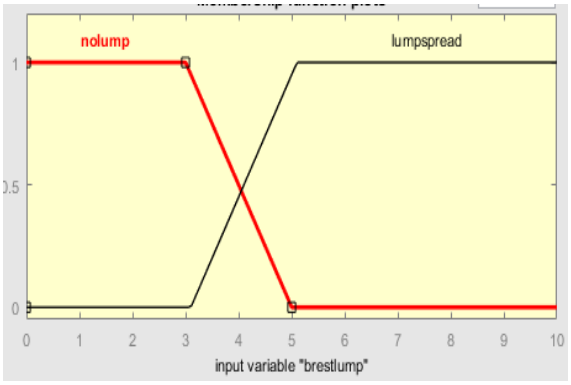

Fig. 4: Membership Plot for Breast Lump

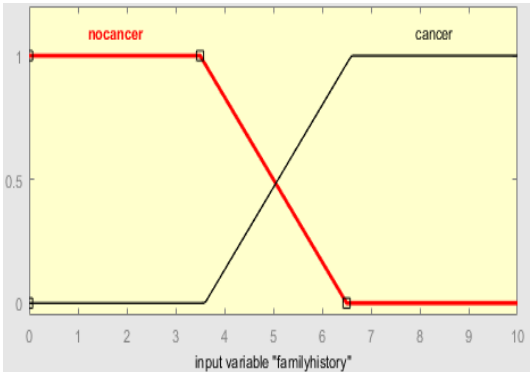

Fig. 5: Membership Plot for Family History

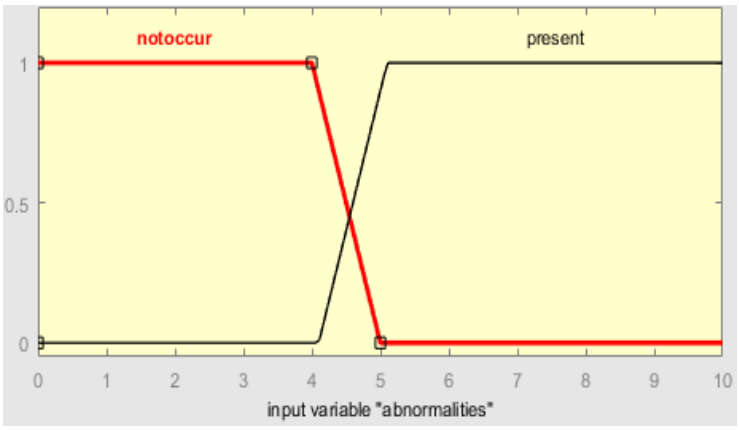

Fig. 6: Membership Plot for Abnormalities

Fig 2 displays the membership function of a change in the skin color which consists of two membership plots not change in skin color and change in color. A trapezoidal membership function is used for this input attribute.

Change in the skin occurs having membership parameter [2.6 4.6 10 10] and change in skin color not occurs having membership parameter [0 0 2.5 4.5]. Fig 3 displays the membership plot for nipple discharge which consists of two membership functions, discharge occur and no discharge. Occur membership function uses trapezoidal membership function and having membership parameter [4.1 6.1 10 10] and not occurs membership function also uses trapezoidal membership function and parameter value [0 0 4 6]. Fig 4 shows the membership plot for breast lump which consists of two membership functions, lump spread and no lump. The breast lump occurs having parameter value [3.1 5.1 10 10] and not occurs having parameter value [0 0 3 5]. Fig 5 displays the membership plot for family history which consists of two membership functions, cancer and no cancer. Cancer membership function uses trapezoidal membership function and having membership parameter [3.6 6.6 10 10] and no cancer membership function also uses trapezoidal membership function and parameter

value [0 0 3.5 6.5]. Fig 6 displays the membership plot for abnormalities which consists of two membership functions, present and not occurs. Present membership function uses trapezoidal membership function and having membership parameter [4.1 5.1 10 10] and not occurs membership function also uses trapezoidal membership function and parameter value [0 0 4 5].

The Defuzzification performs the reverse of fuzzification method. The Defuzzification converts the fuzzy output obtained from inference system into the crisp variable. The common Defuzzification technique used is the center of the area. It is drawn as (2):

$$X_d^t = \int \mu\, d'(x).xdx/\mu d'(x)dx \qquad (2)$$

Fig. 8 displays the rule viewer of the projected system. It indicates the results of the entire projected system. From the left side at the highest we have a tendency to get defuzzified values, we have the tendency get tumor=4.88 which implies the person is stricken benign tumor. Fig 9 displays the surface plot of the change in skin color and the Breast lump. As the graph indicates that as the change in skin color increases and breast lump is becoming more occur, there is equally increase in the tumor. The graph displays that patient has 5.5 tumor means the person is stricken by the benign tumor. Fig 10 displays three-dimensional surface plot between family history and the breast lump. From the graph, it is clear that as possibilities of family history are occur, there will be probably more chances of the malignant tumor. As the graph indicates that the person is having the tumor of 6.3 as the breast lump starts increasing and the chances of family history are more which means that person is stricken by the malignant tumor.

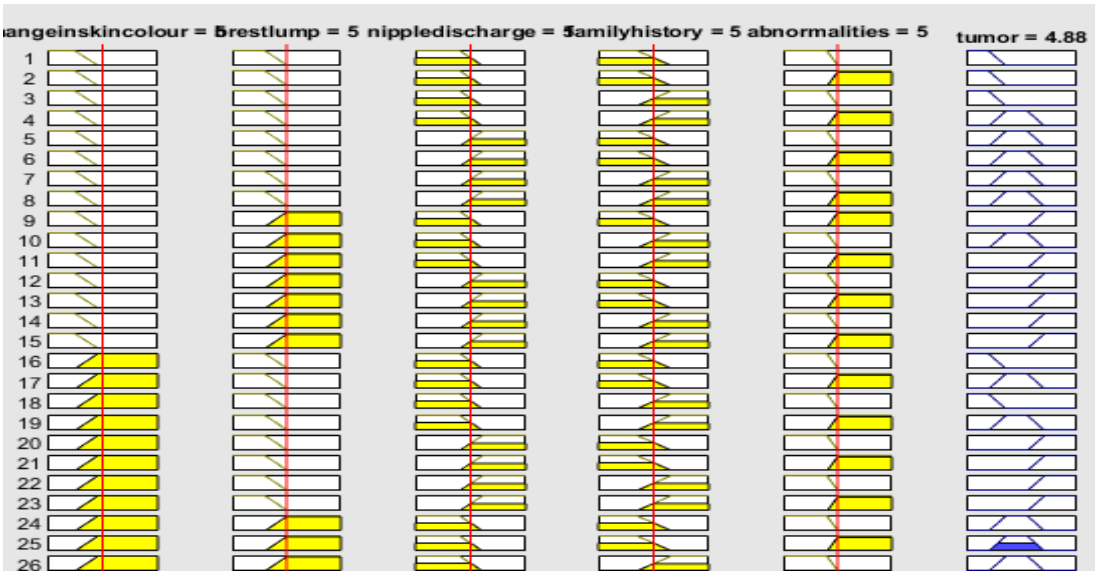

Fig. 7: Rule Viewer

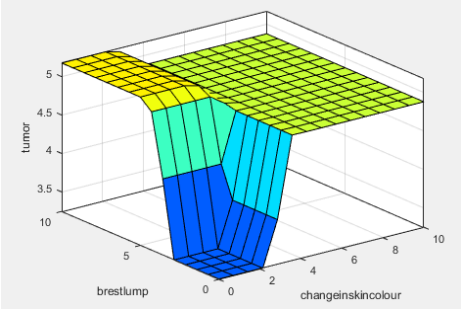

Fig 8: Membership Plot for Abnormalities

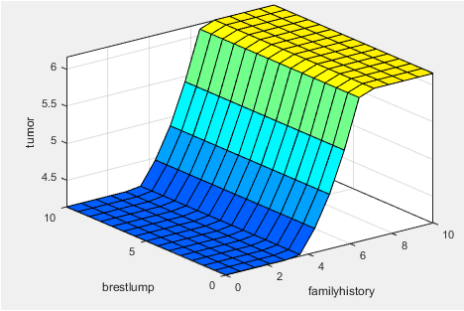

Fig 9: Membership Plot for Abnormalities

V. Conclusion

Breast cancer is most way reaching malady nowadays, therefore early detection is incredibly necessary to prevent people suffering from breast cancer. Early diagnosis is that the highest fidelity decision which provides medical physicians to differentiate malignant and benign cancer tumors. During this paper, we have got incontestable a fuzzy framework on decision support system for the diagnosis of carcinoma tumor. The projected fuzzy inference system predicts the carcinoma tumor. Also, the projected fuzzy system offers essential and vital conditions for the diagnosis of breast cancer. The projected technique will cope with varied inputs which may be much better than to handle uncertainty during diagnosis process. This present system will be extended by increasing variety of inputs. The long run work is that researchers will increase input attributes supported symptoms to form the system additional helpful for that individual malady. It can also be extended that system to possess a info which may be used for future use and references and also for storing patient's data.

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