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Optimization Of Fuzzy Membership Functions For Accurate Classification Of Abnormality In Digital Mammograms.

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ABSTRACT

Breast cancer is turning out to be a cause for increasing mortality rate in women recently. One in every eight women is being affected with breast cancer. Most of the screening techniques used lately are harmful and hence a more secure way needs to be implemented. In this work, we have implemented optimization of fussy membership functions on digital mammograms which can be considered as a harmless technique. The different parameters used in this approach are contrast, homogeneity and energy. Various kinds of mammogram Images which are affected as well as unaffected are collected and diagnosed. Many kinds of fussy memberships are used like trapezoidal, triangular etc. The obtained results determine the different stages of cancer depending on the parameters obtained.

Keywords: fussy, mammograms, contrast, energy, Homogeneity

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INTRODUCTON

Breast cancer is considered as the second deadliest cancer in the world. Signs of breast cancer may involve the size of an egg in the chest, a change in chest form, dimpling of the skin, liquid (or gas) coming from the pointed part, or a red scaly material put over damaged place of skin. In critical stages of the disease, there may be bone pain, swollen lymph, hard growths, shortness of breath, or yellow skin. In addition, there are more than 18 other sub-types of Breast cancer. Some cancers undergo growth from pre-invasive lesions such as ductal carcinoma in situ. The diagnosis of Breast cancer is made likely by taking a biopsy of the about mass, bit. The medical substances tamoxifen or raloxifene may be used to put a stop to Breast cancer in those who are at high danger of undergoing growth it. Sorts of surgery (make, become, be) different from breast-conserving surgery to mastectomy can be done. Chest remake may take place at the time of surgery or at a later day. In those in whom the cancer has put out on top of other parts of the body, treatments are mostly directed at making a better quality of living and comfort. Outcomes for Breast cancer can be different depending on the letters used for printing, size, range and degree of disease.

Everywhere on earth, Breast cancer is the leading sort of cancer in women, accounting for 25% of all examples. In 2012 it resulted in 1.68 million 24 cases and 522,000 deaths. Risk factors of breast cancer. The key reasons of breast cancer are as follows: menopause, ionizing, radiation, and early existence-stage at first menstruation, having children late or not at all, and older age. Certain Jobs - French researchers discovered that women who worked at night before to a first pregnancy had a higher danger of eventually undergoing growth of chest cancer, Estrogen exposure - women who started having periods 8 earlier or entered menopause 4 later than general have a higher danger of undergoing growth chest cancer, obesity - post menopause and overweight women may have a higher danger of undergoing growth chest cancer, getting older - the older a woman gets, the higher is her danger of undergoing breast cancer ,alcohol intake- the more alcohol a woman regularly drinks, the higher her danger of undergoing breast cancer, Radiation exposure - undergoing x-rays 12 and CT digital copy may lift a woman's danger of undergoing breast cancer, Height - women who are taller than normal have a higher risk of developing breast cancer when compared to shorter women.

OVERVIEW ON VARIOUS EXISTING TECHNIQUES

Overtime there has been a lot of researches on mammogram images. Various algorithms have been used for automatic computer aided diagnosis out of which a few are as follows Fahssi et al (2015) presented a method that was used to segment and detect the regions of different infected breast tissue regions in mammogram images using dynamic K-means clustering algorithm and Seed Based Region Growing (SBRG) methodologies. Initially, the K-means clustering was applied for dynamically and automatically generated seed points and it determined the threshold values for each region. The region growing algorithm was used with the existing input parameters which was said to divide the mammogram into homogeneous regions based the intensity of the pixel. This method was used to automatically segment and detect the boundary of different disjoint breast tissues. The disadvantage of the k-means algorithm is that the user must determine the number of clusters. Therefore, taking a fixed number of regions and the same regions for all images of database is irrelevant. The drawback of SRG algorithm is that the automating seed generation and dep

Devisuganya et al (2016), proposed a novel feature selection method with information gain to classify mammogram masses. This is because accuracy depends on relevant feature selection. Random forests (RF) have been successfully used for classification without information on reliability. The conclusion states improved detection accuracy, improve classification performance through feature selection.C4.5 technique outperforms other algorithms with increased accuracy. [7]

Mohanty et al (2016) proposed a method to increase the diagnostic accuracy of image processing and data mining techniques for optimum classification between normal and abnormalities. A new method for feature selection was proposed in which 322 images were taken for higher accuracy by generating minimum number of rules to cover more patterns. The algorithm used was based on Incremental classifier based on association rules. In order to reduce execution time FUA (Fast update algorithm) is used. It has been concluded saying that the algorithm has proved to be efficient than CBA (cost benefit analysis).And during this work a new method for association rule mining was proposed. It only scans once and does not produce candidate item sets. It stores all transaction data in binary form so less memory is required. [4]

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Kanchanamani et al (2016) proposed a method to analyze and investigate a novel approach based on Shear let transform to diagnosis the digital images. Shear let transform is a multi-dimensional version of composite dilation wavelet transform. It was specially designed to address anisotropic directional features at various scales.5 machine learning algorithms have been used namely SVM(Support Vector Matrix),KNN(K-nearest neighbor),LDA(Linear discriminant analysis),MLP(Multi-layer perception),Naïve Bayes. Evaluation is carried out using MIAS.It has been concluded saying SVM showed better accuracy but KNN and LDA also showed similar accuracy.[6]

Bhanu et al (2016) proposed a method that involves the use of neural network. The detection of tumour cells has been done in the frequency domain simulated using MATLAB. It is concluded that the intensity of the affected cells were identified using 2D-DWT.Performace measures were done by estimating parameters like standard deviation and mean. Classification is done using WGUI and multilayer perception. [5]

PROPOSED METHOD

Various mammogram images from mini-MIAS database are collected for implementing the proposed methodology. Features namely energy, contrast, entrophy and correlation coefficient are extracted from the images and are tabulated. Using PNN (Probabilistic Neural Network) and SVM (Support Vector Matrix) classifiers, the images were classified as benign, malignant and normal. Energy, contrast and homogeneity are given as the input parameters to the fuzzy interference system and the outputs are found and tabulated. The output obtained might be any one of the following namely normal, benign and malignant. A total of 27 rules have been framed .These rules show the relationship between the input parameters and the output findings.

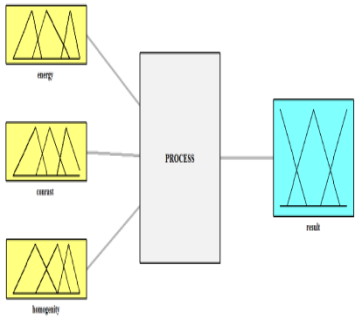

Fig 1: shows the parameters

For each input parameter three overlapping ranges are assigned and initially triangular membership function is considered. A few samples have been evaluated and their parameter list has been tabulated as follows:

Table1: shows the various parameter values and relevant cases

Energy	Contrast	Homogeneity	Result
0.9680	1.2954	0.9883	Normal
0.3265	130.09	0.6718	Benign
0.4384	116.34	0.7512	Malignant
0.7914	7.1724	0.9267	Benign
0.4832	28.98	0.7890	Benign
0.8217	12.2772	0.9362	Benign

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0.4832	28.9829	0.7890	Benign
0.2100	297.2571	0.5992	Malignant
0.2144	125.55	0.6019	Malignant
0.2098	178.13	0.6359	Malignant
0.2990	178.23	0.6848	Malignant
0.8829	6.4355	0.9591	Normal
0.8325	12.9627	0.9369	Benign

Gray Level Cooccurrence Features

- **Energy :** $E = \sum_x \sum_y p(x,y)^2$ p(x , y) is the GLCM
- **Contrast :** Contrast $I = \sum\sum (x-y)^2 p(x,y)$
- **Entropy :** $S = -\sum_x \sum_y p(x,y) \log p(x,y)$
- **Correlation Coefficient :**

$$\text{sum}(\text{sum}((x- \mu x)(y-\mu y)p(x , y)/\sigma_x \sigma$$

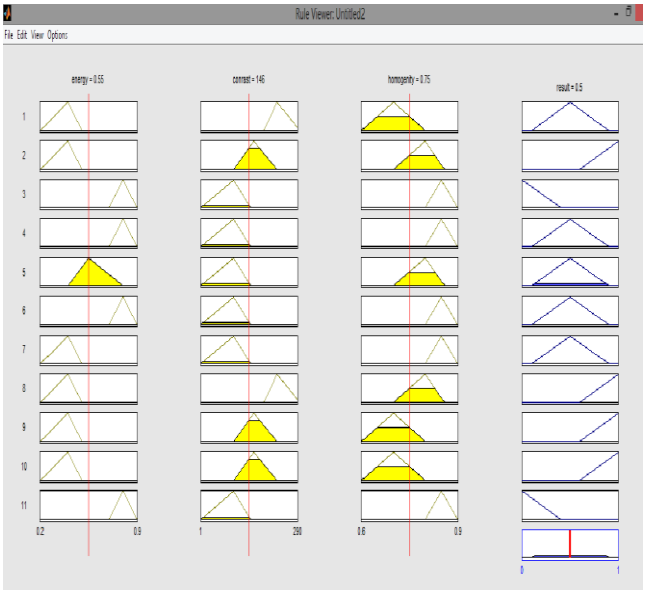

Fig 2: shows the set of rules

The set of rules are framed using fuzzy membership functions in order to predict the relevant type of breast cancer condition

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RESULT AND CONCLUSION

This table deals with the various combinations of energy, contrast and homogeneity values and the relevant cases categorized as benign, normal or malignant

The same input feature is given to the rule viewer of the developed FIS and the desired output is obtained. The same procedure is repeated by varying the type of membership function as trapezoidal, Gaussian etc. The surface view and plane view of the results are as follows

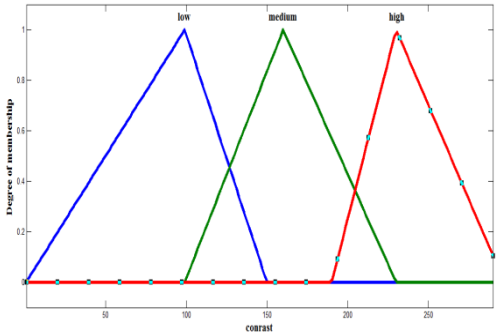

Fig 2: shows the range of the parameter contrast

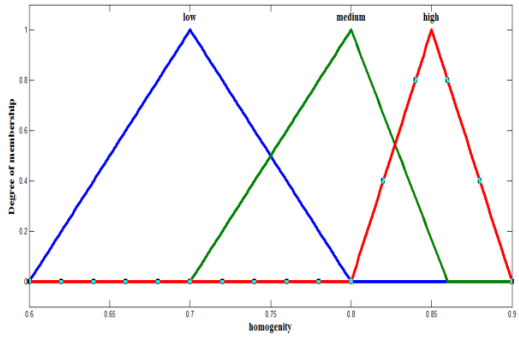

Fig 3: shows the range of the parameter homogeneity

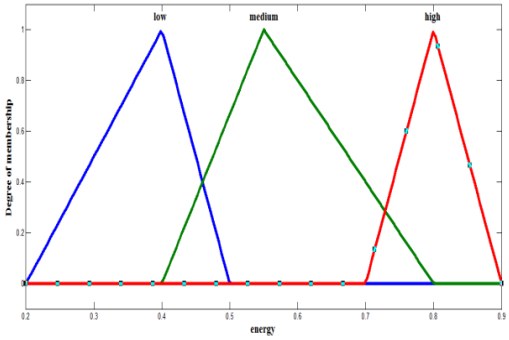

Fig 4: shows the range of parameter energy

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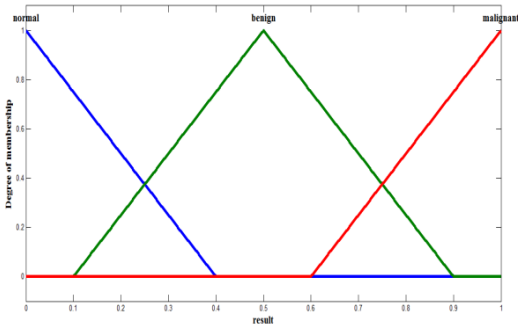

Fig 5: shows the output range of the parameters

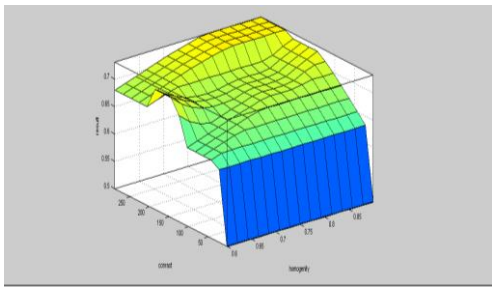

Fig 6: shows surface view of contrast vs. homogeneity

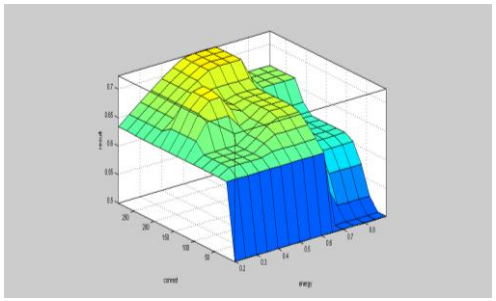

Fig 7: shows surface view of energy vs. contrast

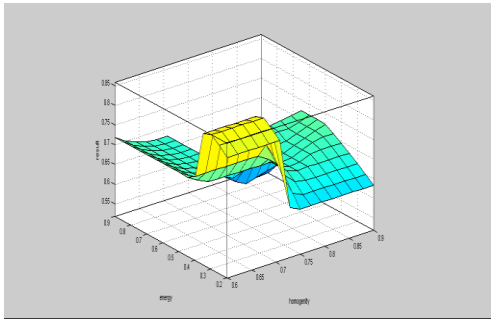

Fig 8: shows energy vs. homogeneity

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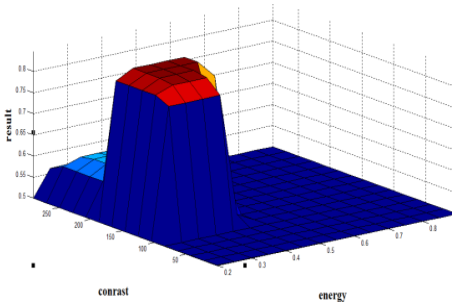

Fig 9: shows surface view of the parameters

The results obtained shows that it can segment the cancer regions from the image accurately. It is useful to classify the cancer images for accurate detection. It also helps in early stage Detection of cancer from images. Cancer has been spreading widely in the recent days and breast cancer has proved to be one of the leading type of cancer in women and the second deadly type of cancer among women. Hence the demand for mammography has been increasing.

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