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MICRO CALCIFICATION DETECTION IN MAMMOGRAM IMAGES USING ARTIFICIAL NEURAL NETWORK

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ABSTRACT

In present work, the approach for detection of micro calcification clusters in mammogram images is presenting. Two stages applied in the proposed micro calcification algorithm. First stage explores, find out the difference between texture of cluster of normal tissues and the micro classification tissue. MIAS (Mammographic image analysis society) database with 322 dense mammographic images are used in the complete process. Fractal analysis is done which is based on local texture. Local texture is depending on the estimated value of neural network. Thensecond stage explores, the ability of these features in detecting micro calcification is done using Artificial Neural Network (ANN). A graphical user interface is design to detect training set data and test set data. For the purpose of training the ANN, the images are randomly selected from the database. 12 images are used for training the network and 5 images are used for testing. Finally, a neural network classifier is used to reduce the number of false positives. The average mean square error of our data base is 10.9021.

KEYWORDS: Micro Calcification Detection, Mammogram Image, Feature Extraction, MIAS Database, Training Set, Accuracy, Artificial Neural Network.

In 2015 WHO (world health organization) reported approximately one million patient suffering from breast cancer and half of then resulted in death [1] Micro calcifications are dormant minute bits of calcium, look like cluster form and deposit extra cell activity in breast tissue. Generally, treatment of initial phase of breast cancer is easy and extra cell growth in breast area is not considered as cancer. But rigid cluster of micro calcification consider as cancer (Lu, Zhi , 2016).

In X-rays technique, white speckles represent micro calcification in the breast. There are two types breast tumor benign and malignant breast tumor and the same are on the basis of shape, size and density and distribution pattern (Chen, Zhili, 2015).The different types of breast cancer can obtain with or without mass. Micro calcification detection involves various training set which involve various mammogram images. These images can be taken from a recognized hospital or a particular standard data. In present work, use MIAS database. This database contains 322 mammogram images (Gubern, Mérida ,2016).

Therefore, it is difficult for radiologists to provide both accurate and uniform evaluation for the enormous mammograms generated in widespread screening. Micro calcification clusters (MCCs) and masses are the two most important signs for the breast cancer, and their automated detection is very valuable for early breast cancer diagnosis (Chan, Heang-Ping, 2015).

The present paper is organized as follows. The previous work presented by authors is demonstrated in Section II. Section III presented the framework of the implementation the proposed work. Presented result and discussion in following conclusion remarks in section V.

LITERATURE REVIEW

This section will provide the brief description and highlights the contibutation, remarks and factors of the work done earlier by the researchers. The authors and researchers offered different methods to detect the micro calcification as presented.

Nakayama, Ryohei, et.al. in2014 presented the mean square error and different calcification. The different values of calcification achieved by author numeral value of p. offered as0.670, 0.802 and 0.819 respective.

Lu, Zhi, et al. in 2016demonstrated an idea about mammography, the efficacy of computer-aided detection methods. Their approach presented a true positive rate (TPR) for individual μCs of 40% at one false positive per image (FPI) and a TPR of 80% at 10 FPI(false positive per image).

Rinaldi, Pierluigi, et al. in 2016proposed the sensitivity of the image and the author used DCIS database was used for micro calcification of images. Histogram equalization was used to extract out the

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features of the images. Furthermore, distrigunisation analyzed on the basis of filtering techniques.

Mohamed, Hayat et al. in2014 offered three techniques such as KNN (cluster nearest neighbor), SVM(support vector machine) and ANN(Artificial neural network). The performance parameter i.e.predication accuracy for these techniques was obtained 73 %, 83% and 77 % respectively.

Chen, Zhili, et al. in 2015 described MIAS and DDSM(digital database for screening mammography) digital dataset. The technique used was mammogram clustering. The performance parameter was region of convergence achieved up to 0.96.

Gubern, Mérida et al. in 2016 utilized a powerful classification method extracted from convolution neural network. It has been presented that sensitivity of the image was which parameter and range of this parameter was 0 to 0.1.

Chan, Heang-Ping, et.al. in 2015demonstrated the system that include an initial prescreening of potential micro calcifications by using one or more 3D calcification response function (CRF) values modulated by an enhancement method to identify high response locations in the DBT volume as potential signals. The system might be include object segmentation that uses region growing guided by the enhancement-modulated CRF values, gray level voxel values relative to a local background level, or the original DBT voxel values.

Wang, Juan, et al. in 2014 offered similarity of mammogram images. The main focus was on variability of position of the malicious part. The two different breast tumors were discussed and the technique involved fuzzy clustering means .

Duarte, Marcelo A.et al.in2015different segmentation methods to detection of micro calcification.. MISAS data base was used for 2136 images. The diameter of micro calcification was460 μm. The proposed method was best for small micro calcification.

Zhang, et al. in 2014 proposed a novel method for the detection of micro calcifications using mathematical morphology and a support vector machine (SVM). The performance of support vector machine was evaluated using the MIAS database. The experimental results was demonstrated the efficiency and effectiveness of the proposed method.

De ,Cea, et al. in 2017 offered the statistical estimation to determine the number of FPs(false positive)present in a detected MC lesion. The results demonstrated that the fraction of FPs in detection was varied from 20% to 50%, both the mean and median values of the estimation error were within 11% of the total number of detected MCs in a lesion. Further, when the number of FPs was increased to as high as 11.38 in a cluster on average, the error was 2.51 in the estimated number of FP.

This section has provided the brief introduction of the work done earlier. it also highlighted the factors, contribution an remarks on the achievements

FRAMEWORK OF THE IMPLEMENTATION

Mammography is the most effective method that is used in the early identification of breast cancer, The CAD system is developed for identification of micro-classification from mammogram images. The main objectives are to differentiate normal breast tissue and micro calcification. It involves various stages. First of all, the original image is decomposed using Discrete Wavelet Transform. Then the features are extracted from the decompose image. In the next stage, extracted image is compares using artificial neural network. Thereby present the micro calcification detection clusters using this technique (Zhang,2014).

Anovel method as our knowledge is proposed for the identification of micro calcifications using image morphological techniques and neural network system. Morphological image processing is a set of processes associated to the shape of available features in an image (Mammogram for proposed) (De, Cea, 2017). The system performs the identification in multiple phases. In the first phase, enhancement on mammogram images is done to remove noise and background removal by using Histogram equalization and morphological filtering (Duarte, Marcelo A, 2015). Morphological techniques can search input mammogram image with a structuring element or template. This template is used for searching calcifications present in mammogram image. This template is placed at all possible positions in the mammogram image and can also be evaluated with the neighborhood of pixels in mammogram image. There is

proposing morphological operations that can test whether the template finds micro calcification within the neighborhood of pixel currently being searched. Therefore by this novel method, use two carefully planned morphological templates that can used to search any micro calcifications present in the image. Next, the potential regions are extracted using threshold based technique. Lastly, Neural Network based classifier is to be used to minimize the false positives (Wrong identification). The performance of the proposed method is evaluated by applying on a mammogram database.

RESULTS AND DISCUSSION

Micro calcification of mammogram images is offered by different segmentation techniques. Fig.2 describes various levels of segmentation through the complete process.

Fig.2 Shows breast calcification of levels through segmentation technique with threshold levels. After apply the segmentation technique, result comes from a training set of neural network operation. Table.1 incorporate the comparison between various performance techniques such as training accuracy, test accuracy, MSE training and MSE test. So, the following value, a bar graph is obtain which show comparison of data set is to be analyzed i.e microcalcification cluster. The different segmentation and classification in iterative manner are performed. The result shows the image number incorporate 9 takes more iteration as compared to other images from the data sets. As shown in Fig. 3The given data set is trained from the neural network trainer. It have been put different images from MIAS data set. Different iterations are comes up. The iterations of images are basically depending upon the pixel size of image & extraction methods. Mean square error is also an important parameter for detection of breast tumor. It has been calculate these values from training set and the test set. There are two different values of mean square error obtained from tests and training. Fig.3 shows the iteration taken for segmentation and classification The Fig. 4 shows the compassion of MSE between training set and Test Set. In fig.4 Shown the compassion of MSE between training set and Test Set that observed micro calcification detected from mammogram image.

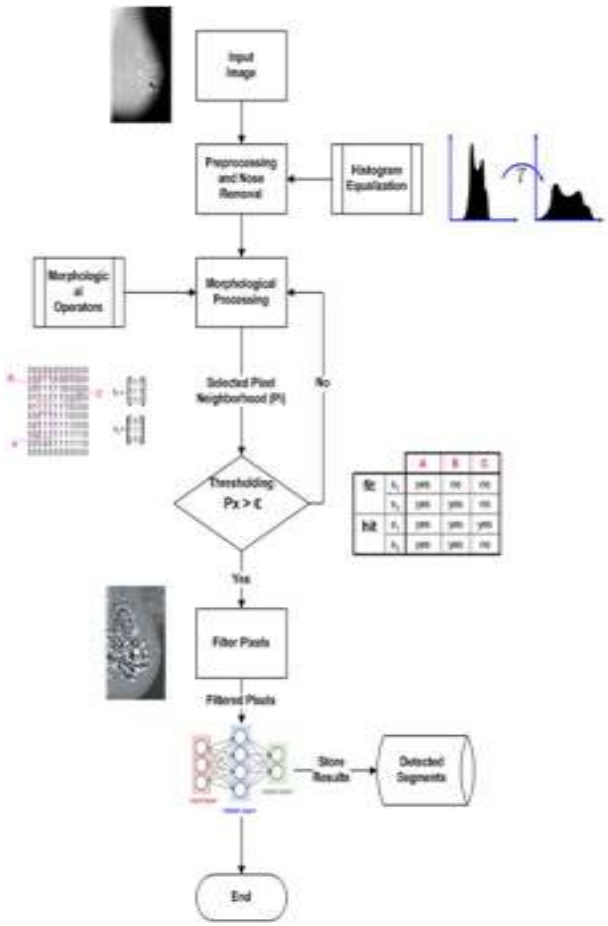

Figure 1: Flow Chart of the proposed work

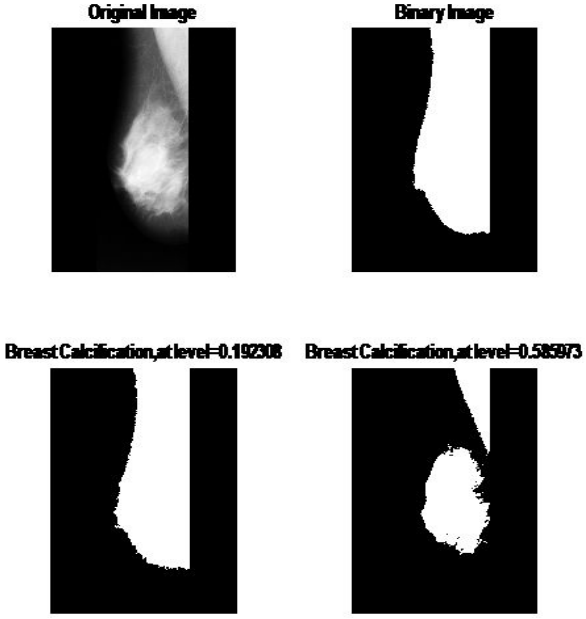

Figure 2: Various levels of breast calcification during segmentation process with threshold levels

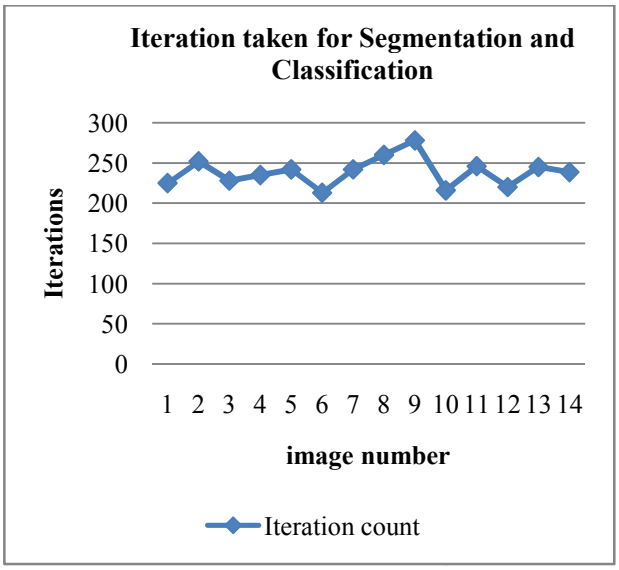

Figure 3: Segmentation and Classification Iteration

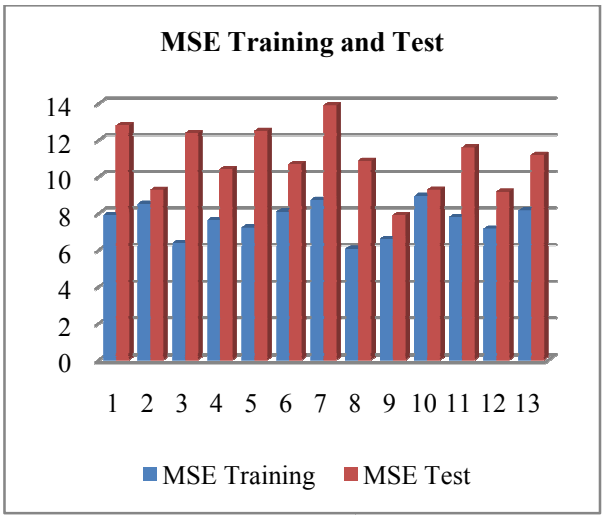

Figure 4: MSE Training and Test

Table 1: Performance comparison of various techniques

Image No	count	Time	Training Accuracy	MSE Training	Test Accuracy	MSE Test
mdb001	225	1.7	92.1	7.88	87.20	12.79
mdb002	252	0.37	91.4	8.52	90.71	9.28
mdb003	228	1.01	93.6	6.37	87.62	12.3
mdb004	235	0.57	92.3	7.63	89.58	10.41
mdb005	242	0.75	92.7	7.22	87.49	12.50
mdb005	213	1.44	91.9	8.09	89.30	10.69
mdb006	242	1.33	91.2	8.72	86.10	13.89
mdb007	260	1.17	93.9	6.06	89.14	10.85
mdb008	278	0.04	93.3	6.60	92.11	7.88
mdb009	216	0.77	91.0	8.95	90.70	9.29
mdb010	246	0.20	92.2	7.79	88.40	11.59
mdb011	220	0.82	92.8	7.16	90.82	9.17
mdb012	245	1.37	91.8	8.16	88.80	11.19
Average	**238.61**	**0.90**	**92.3**	**7.63**	**89.07**	**10.92**

CONCLUSION

The microcalcification detection in mammogram image by artificial neural network in this paper, is based on processing sample images of tumor and normal tissues, and enables the exploration and analysis by automatic means of large quantities data from large number of patients. Mean square error of training set is much lesser than test set of data. The tasks that can derive from this work include the integration of features derived from Fractal Analysis which describe Local Texture or Ruggedness in terms of an estimated value of neural networks. These results are expected to be used in conjunction with Wavelet Multi resolution. Moreover, a classification performance analysis based on mean square error is also needed to complete the study. The average mean square error of our data base is 10.9021

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