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DETECTION OF MICROCALCIFICATION IN MAMMOGRAM

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***Abstract*—The presence of microcalcification clusters is a primary sign of breast cancer, however, it is difficult and time consuming for radiologists to classify microcalcification as malignant or benign. In this paper, We present highly accurate method based on a morphological image processing and Wavelet Transform technique to detect the microcalcifications in mammograms. The microcalcifications are firstly enhanced by using multistructure elements morphological processing. Then, the candidates of microcalcifications are refined by a multilevel wavelet reconstruction approach. The objective of this project is to improve the Segmentation, Sensitivity, and Specificity. The purpose of this Synopsis is by using HAAR Wavelet Transform comparing with state of art method we will try to achieve better result.**

***Keywords*—**: BREAST CANCER, MICROCALCIFICATIONS, SEGMENTATION, MAMMOGRAPHY, WAVELET TRANSFORM, CLASSIFICATION

I. INTRODUCTION

Breast cancer is currently the most common cancer affecting Women worldwide.
In European women, it is the leading cause of cancer death, causing one in six of all deaths from cancers.
In the U.S., a woman has 12.15% (about one in eight) risk of developing breast cancer during her lifetime. Mammography is one of the most reliable and effective methods for detecting breast cancer. The presence of microcalcification clusters is a primary sign of breast cancer. Microcalcification are small deposits of calcium salts within breast tissues that appear as small bright spots in mammograms. Microcalcification clusters are very difficult to diagnosis for radiologist when microcalcifications form within dense tissue which has high and homogeneous intensity.

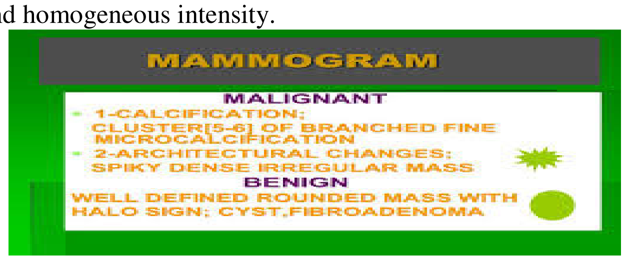


Fig showing difference between Malignant and Benign

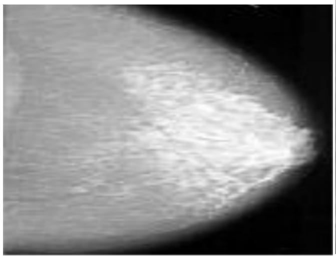


Fig.(b) Malignant tumours

Are cancerous

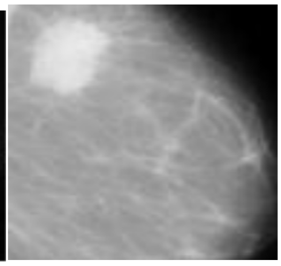


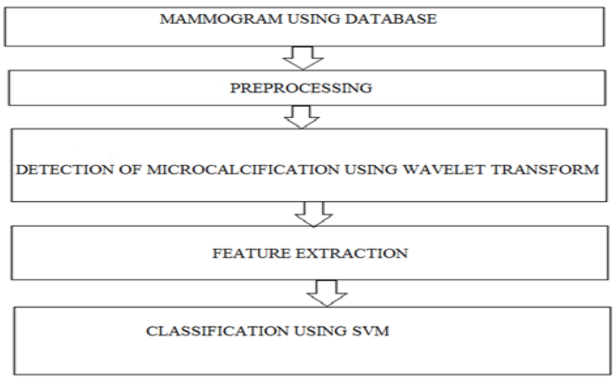
Fig.(b) Benign tumours

are not cancerous

Malignant: Malignant tumours are cancerous and are made up of cells that grow out of control. Cells in these tumours can invade nearby tissues and spread to other parts of the body. Sometimes cells move away from the original (primary) cancer site and spread to other organs and bones where they can continues to grow.Benign: tumours are not cancerous. They can often be removed . Benign: tumours are not cancerous. They can often be removed, and in most cases, they do not come back. Cells in Benign tumours do not spread to other parts of the body.

II. DETECTION OF MICROCALCIFICATION IN MAMMOGRAM USING WAVELET TRANSFORM

FLOWCHART



Mammogram using database: The material we will use mammogram from local hospital

The work will be divided into two phases: 1. Training

2. Testing

Training: Here we will train the system based on the input images.

Testing: Testing of system, here we will test the system based on knowledge obtain from the training data. In both training and testing system we will first segment the input image, then find feature of the image and perform training or testing. For segmentation we can use FCM.

Preprocessing: A great volume of mammography images have dark background, these parts are not important in processing of mammography images. We can decrease the picture size an increase the processing speed by deleting these parts, To achieve the segmentation we propose a "three-phase" based method Stage A : Omit the excessive parts of the image

Excessive background parts which do not cover breast region, are the Right and left part of the image. Where as the backgrounds are dark and ,Their gray level are near zero and these gray level do not have any difference with each other.Stage B: Diagnose the image direction and put it to one direction MIAS's database images are belong to both right and left breast. To make Processing easier we put whole the breast image to the left side of the image. To this work, first we should find the breast direction, First we divide the image to two halves in comparison with vertical axis then we calculate the grey level of the threshold limit of each two image halves. Surely the threshold limit under the image which the breast is in it, Is more than the under of the other image which is the background. After finding the breast direction we put it to left direction .This work is done by 180 degree direction with regard to vertical axis.

Stage C: Omit labels and breast region from background For finding the tissue boundary of the breast, we act as follow first we change the image from unsigned region of unit 8 to double decimal, then we obtain the image energy which is equal to the second power of decimal image.

Detection of microcalcification using wavelet transform:

we use HAAR transform method The Haar transform is one of the oldest transform functions, proposed in 1990 by the Hungarian mathematician Alfred Haar. It is found effective in applications such as signal and image compression in electrical and computer engineering as it provides a simple and computationally efficient approach for analyzing the local aspects of a signal.

The Haar transform is derived from the Haar matrix, An example of a 4x4 Haar transformation matrix is shown below

$$H_4 = \frac{1}{2}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ \sqrt{2} & -\sqrt{2} & 0 & 0 \\ 0 & 0 & \sqrt{2} & -\sqrt{2} \end{bmatrix}$$

Property:

The Haar transform has the following properties:

1. No need for multiplications. It requires only additions and there are many elements with zero value in the Haar matrix, so the computation time is short. It is faster than Walsh transform, whose matrix is composed of +1 and −1.
2. Input and output length are the same. However, the length should be a power of 2, i.e. $N = 2^k, k \in \mathbb{N}$
3. It can be used to analyse the localized feature of signals. Due to the orthogonal property of the Haar function, the frequency components of input signal can be analyzed.

Feature extraction: When radiologists need to diagnose a mass in mamogram, they look for some significant features that discriminate malignant from benign masses.These visual features -which are based on shape, size and margin - could have different interpretation based on radiologist's opinion and experience.To solve the problem of these different interpretations, more discriminative feature should be extracted. Computer provides multiple methods for obtaining these discriminative features, which are done in two steps:

Feature extraction: this step is responsible for extracting all possible features that are expected to be effective in diagnosing a ROI in mammogram, without concerning the disadvantages of excessive dimensionality.

Feature selection: this step is responsible for reducing the dimensionality by removing

redundant features and searching for the best significant features to avoid the curse of dimensionality.

Classification using SVM: Review of linear classifiers:

- Linear separability
- Perceptron

Support Vector Machine (SVM) Classifiers:

- Wide margin
- Cost function
- Slack variables
- Loss functions revisited
- Optimization

WHY WAVELET TRANSFORM:

The method is to use a set of top-hat transforms based on multi-structuring elements of which sizes and shapes are fitted to the individual microcalcifications to enhance them.

In mathematical morphology and digital image processing. Top-hat transform is an operation that extracts small elements and details from given images.

The top-hat transform of gray-scale image f is defined as f minus its opening by structuring element b:

$T = f - (f \mathrm{I}\, b)$,

where I denotes the opening operation; the difference operation yields an image in which only the components fitting to the SE remain.

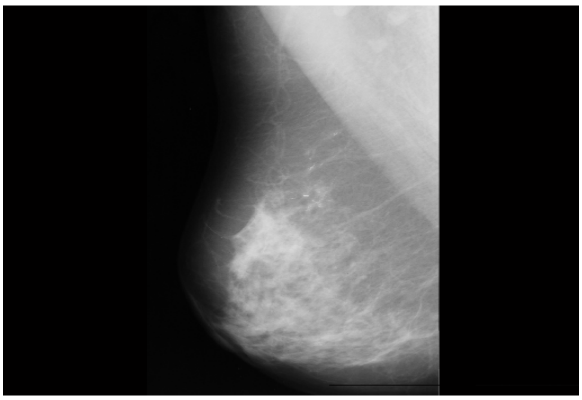


Fig. A mediolateral-oblique(MLO) mammogram

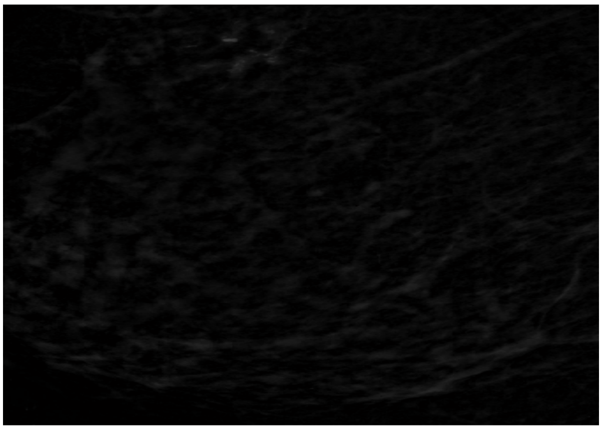


Fig. Expanded view showing the microcalcification

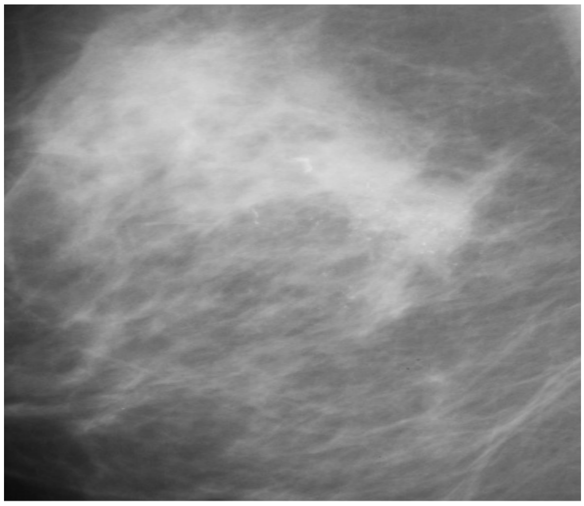


Fig. Original image (ROI)

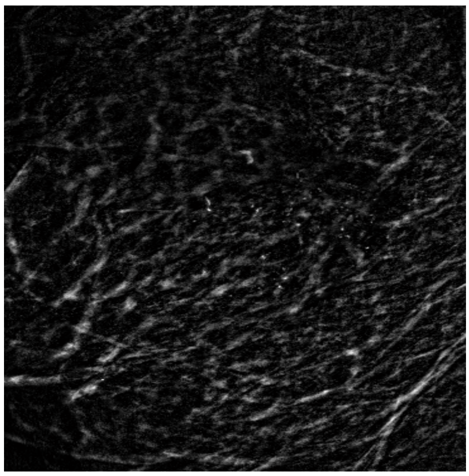


Fig. The results of the top-hat transform

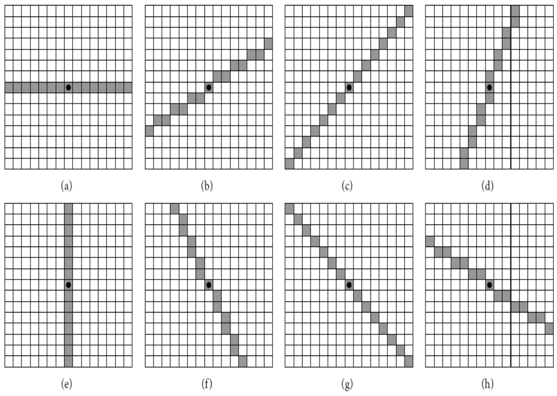


Fig. Multi-SEs converted to rectangular arrays. The dots denote the centre of the SEs. These SEs are designed for

fitting to the individual microcalcifications with different shapes.

III. LITERATURE REVIEW

[1] Zhili Chen,Harry Strange,Arnau Oliver, Erika R. E. Denton, Caroline Boggis, and ReyerZwiggelaar "**Topological Modeling and Classification of MammographiMicrocalcification Clusters"** IEEE TRANSACTIONS ON BIOMEDICALENGINEERING ,VOL.62, NO. 4, APRIL 2015

We have presented a method for classifying microcalcification clusters in mammograms based on morphological topology analysis. This is a novel approach to analyze microcalcification in terms of the connectivity and topology for discriminating malignant from benign clusters. A representation of microcalcification clusters covering the multiscale characteristics was developed in this paper. The topology/connectivity of microcalcification clusters was analyzed using multiscale morphology. The proposed method has been evaluated using three datasets: MIAS, DDSM, and Digital. Good classification results have been obtained for all the datasets. By investigating a set of S values for the number of scales and using a range Of k values for the classifier, The obtained, best CA was 95% for MIAS with manual annotations, 95% for MIAS with automatic detections, 96% for for Digital, 86% for DDSM using LOOCV, and 85.2 *±5.7%* for DDSM based on ten-fold cross-validation and the largest area under the ROC curve was 0.96, 0.96, 0.96, 0.90, and 0.91 ± 0.05, respectively. Segmentation of microcalcification accuracy is less.

[2] Gua Jinghuan,(1974), fmale, Liaoning Changtu Country, Doctor, Associate proffessor,Research on Image processing and pattern Recognition "**Study on Microcalcification Detection using Wavelet Singularity"** International Journal of Signal Processing, Image Processing and Pattern Recognition. Vol.7.No.1, 2014.

How to effectively detect the microcalcification is very important significance toSubsequent detect in the diagnosis of breast cancer. Microcalcification detect Method based on wavelet singularity was presented because the microcalcifications. Is tiny, and the contrast of background is small. A choosing method was studied in the paper. The wavelet transform method was contrasted with the morphology method, and it was proved that the wavelet transform method was more effective in the relevance ratio. But because False positive object was to much.

3] Xiaoyong Zhang, Noriyasu Homma, Shotaro Goto, Yosuke, Kawasumi, Tadashi Ishibashi, Makoto Abe, Norihiro Sugita, and Makoto Yoshizawa "**A Hybrid Image Filtering Method For Computer-Aided Detection of Microcalcification Clusters in Mammograms"**

In this paper, we presented a high-accuracy method of for the detection of microcalcification in mammograms. The proposed method combined a multi-segments. Top-hat transform and a wavelet-based denoising approach to enhance the individual microcalcifications in mammograms. The sensitivity is less.

IV.CONCLUSION

From the above related paper, we come to the conclusion that segmentation of microcalcification accuracy is less.

Sensitivity is less and false positive rate is too much.

Detection of Microcalcification in Mammogram Using Wavelet Transform we can improve segmentation,sensitivity and specificity.

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3] Xiaoyong Zhang, Noriyasu Homma, Shotaro Goto, Yosuke, Kawasumi, Tadashi Ishibashi, Makoto Abe, Norihiro Sugita, and Makato Yoshizawa "A Hybrid Image Filtering Method for Computer-Aided Detection of microcalcification clusters in mammograms" *Research Article* Hindawi Publishing Corporation Journal of Medical EngineeringVolume 2013,

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