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Diagnosis of Breast Cancer

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ABSTRACT-Breast cancer is one of the most dangerous types of cancer among women all over the world. Nowadays this disease is appearing commonly one in eight women. Early detection of breast cancer reduces life fatalities. This paper is to develop the system that analyze the diagnosis of breast cancer in digital mammogram using wavelet transforms. Many treatment options are available if the breast cancer is detected early. In this project transforms are applied separately in digital mammogram to detect micro calcification clusters which is used to detect at an early stage.

Key Terms- fatalities, mammogram, micro calcification

INTRODUCTION

There are many testing options beyond mammography to detect breast cancer; some of them include Magnetic Resonance Imaging (MRI), Ultrasound, X-ray etc, a mammogram is the most effective and easy tool to detect it early. Mammograms are taken from the Mini-Mias database; this is selected due to the various cases it includes. The dataset is composed of 322 mammograms of right and left breast, from 161 patients, where 51 were diagnosed as malignant, 64 as benign and 207 as normal. The abnormalities are classified into microcalcification (13), circum- scribed mass(37), spiculated mass(17), ill-defined mass, architectural distortion(15), and asymmetry(21). Although the most accurate detection method in the medical environment is biopsy, it involves some risks, patient discomfort and high cost. But radiologically some difficulties arise when interpreting X-ray because the X-ray's are images of high resolution and low contrast and they also have a great variation in their gray scales. In some X-ray's the calcifications are seen as white spots on a dark gray background, while in other they are visible as brighter gray spots on a slightly darker gray background, so it is not possible to detect the micro calcification correctly. Some automation needs to be performed on the digital mammograms. These can be overcome by using the proposed system.

TWO-LEVEL DISCRETE WAVELET TRANSFORM (DWT)

A wavelet is a mathematical function used to divide a given function or continuous-time signal into different scale components. A wavelet transform is the representation of a function by wavelets. Wavelet transforms have advantages for accurately deconstructing and reconstructing finite, non-periodic and/or non-stationary signals. Two-level DWT is any wavelet transform for which the wavelets are discretely sampled. It captures both frequency and location information.

Fig.1 illustrates the decomposition of the image into four sub bands approximation, horizontal, vertical and diagonal in the frequency domain. In this approximation detail corresponding to the lowest frequencies, the vertical high frequencies (horizontal edges), the horizontal high frequencies (vertical edges)and the high frequencies in both directions (diagonal).

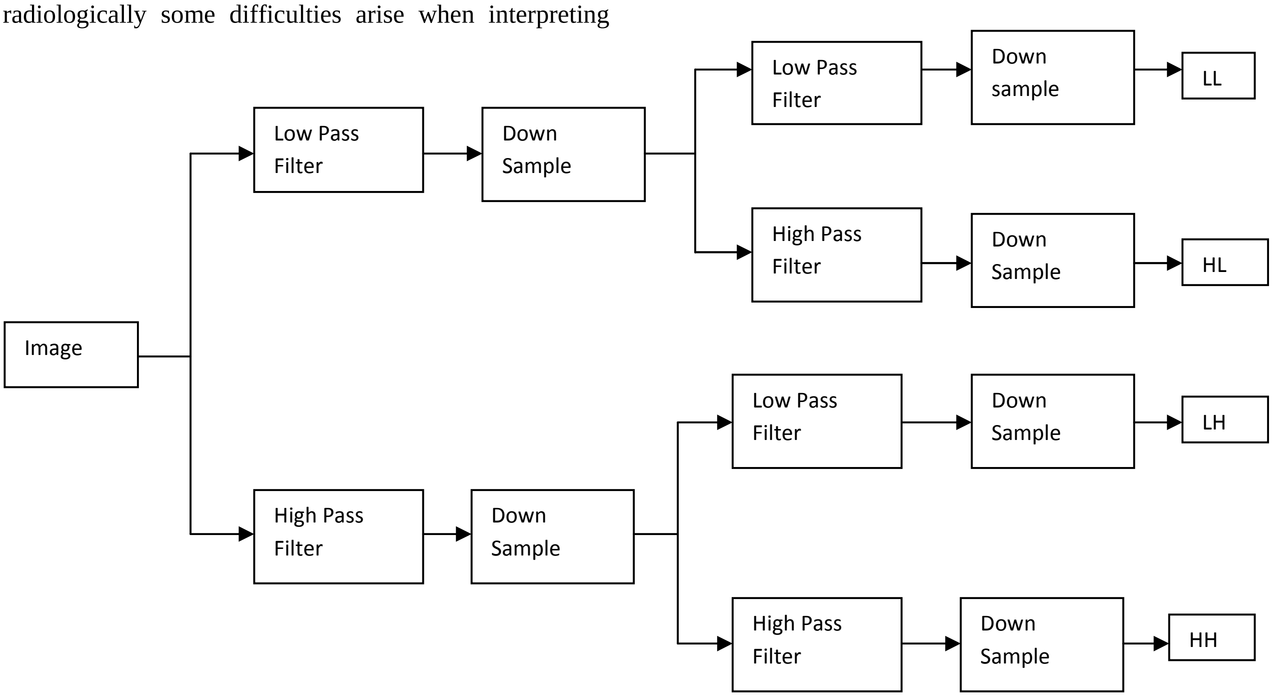


Fig.1 Two-level wavelet decomposition of an image, the outputs are approximation and details.

FEATURE EXTRACTION - Feature Extraction is the process of extracting the coefficients of the given image.
CLASS CORE VECTOR - It is the process of extracting the coefficients from the set of images and Computes the value of a particular class.

EXISTING SYSTEM

Y.Ireaneus Anna Rejani, and Dr.S.Thamarai Selvi, have presented a tumor detection algorithm from mammogram using **SVM classifier**. Mammograms are taken from a Mini-Mias database due to various cases it includes. Tumor detection methods follow three steps 1.Mammogram enhancement 2. Segmenting Tumor region and feature extraction 3.Classification of tumor type using SVM classifier. In Mammogram enhancement, conversion of image to better quality is done. Thresholding is used to segment the tumor region. Features are extracted from the segmented region and passed to classification step. SVM classifier is used to classify the type of tumor based on the extracted features. The methodology achieved a sensitivity of 88.75%.

PROPOSED SYSTEM

In order to avoid noisy data, region of Interest is cropped from the original mammogram. Both **wavelet** and **curvelet transforms** are applied separately to this mammogram images. The biggest 100 coefficients from each decomposition levels are extracted to represent the corresponding mammogram (i.e. Feature vectors). These coefficients are parsed to the classification step. The **Euclidian distance** is used to design the **nearest neighbor classifier** and then the distances between this feature vector and the class core vectors are calculated. Classification method performs two main functions. The first is to distinguish between three classes normal tissue, benign and malignant tumors. The second is to classify between tumor classes.

SYSTEM DESCRIPTION

The system is developed for identifying the type of breast cancer. For diagnosing the type of abnormality Microcalcification clusters are first identified. Brighter spots in the Mammograms are assumed as Microcalcification clusters and that region is cropped. The cropped region from the Mammograms is decomposed into 4 levels for multi resolution analysis using Discrete Wavelet Transform and Curve let Transform. 100 Biggest coefficients are extracted from each level of decomposition to form Feature Vectors. In the training phase set of abnormal regions are extracted from the mammograms which is taken from Mini-Mias database and the DWT is applied to those images and the obtained values are called as class core vectors. Nearest neighbor classifier based on Euclidean distance is built to find the difference between feature and class core vectors. Abnormality is identified based on the fact that the value which is similar to the class core vector.
System modules:

1. Feature Extraction,
2. Class core vector and classification,
3. Curve let Transform.

SYSTEM ARCHITECTURE

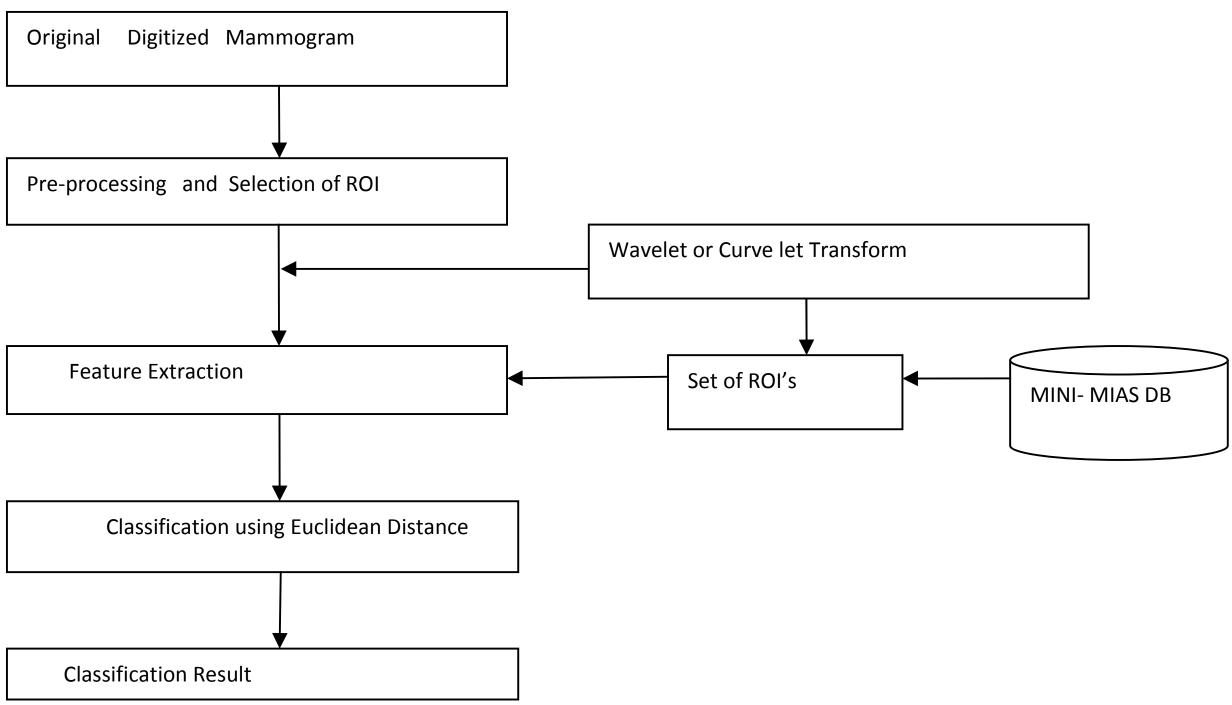
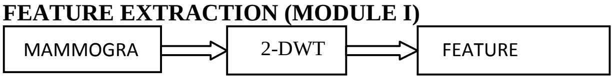


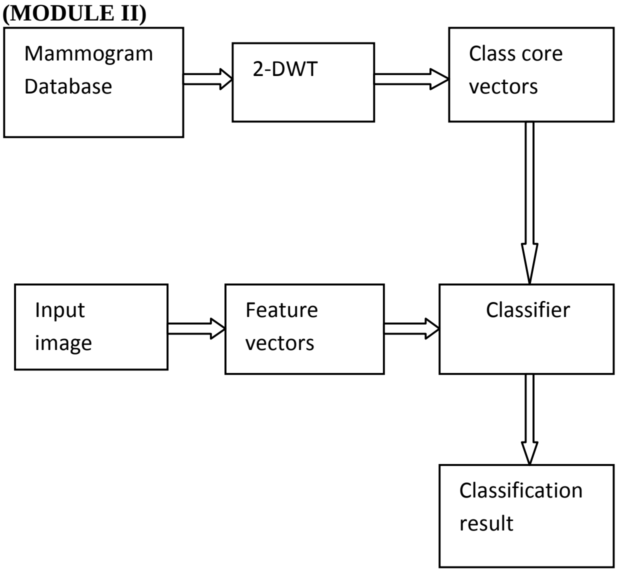
Fig.2 Detailed system Architecture diagram

FEATURE EXTRACTION (MODULE I)



The Original Mammograms consist of lot of noises in the background. Pre-processing is necessary to crop the abnormal region from the mammogram. In order to reduce dimension of the original image wavelet transform is performed. These cropped regions are decomposed into multi-dimensional representation using a two-level DWT. The number of decomposition used here is 4. With this original image is subdivided into sub bands which contain the approximation, diagonal, horizontal and vertical detail of the given image. From these decomposed sub–bands, the biggest 100 coefficients at each decomposition level are obtained. Those coefficients are called feature vectors of the test image.

CLASS CORE VECTOR AND CLASSIFICATION (MODULE II)



To test the input image, class core vectors are used. In the training phase, class core vectors are formed by extracting ROI's from a set of mammograms which is taken from a Mini-Mias database. For each class, the class core vector is calculated as the mean of set of the class vectors using equation 1,

$$V^i_{core} = \frac{1}{N}\sum_{j=1}^{j=N} V^i_j \qquad (1)$$

Where Vcore is the class core vector, i is the index of the vector, vj is the coefficient vector and N is the number of images used to produce the class core vector.

Nearest Neighbor classifier is built to calculate the difference between the class core vectors and feature vectors. Classifier matches the test image with the trained images to find the class of abnormality. Difference between the class core vector and feature vector is calculated using the equation 2,

$$Dist = \sqrt{\sum_{i=1}^{k}(V^i_{core} - V^i_{test})^2} \qquad (2)$$

Dist is the calculated distance between the tested image and the class core vector, k is the length of vector, and Vi test is the feature vector of test image.

LOAD MAMMOGRAM

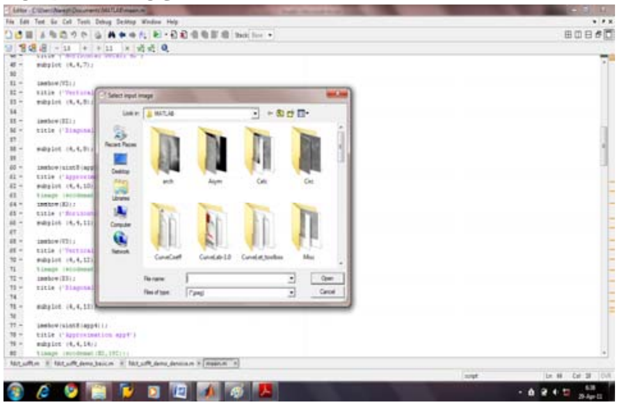


Fig. 3 Browse input image

LOADS INPUT IMAGE

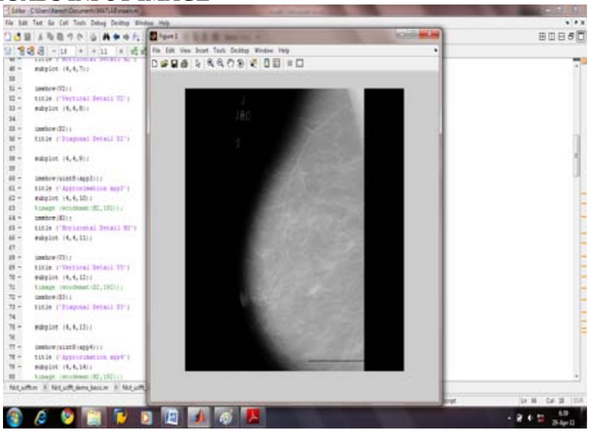


Fig. 4. Displays input image

LOCATING ABNORMAL REGION FOR CROPPING

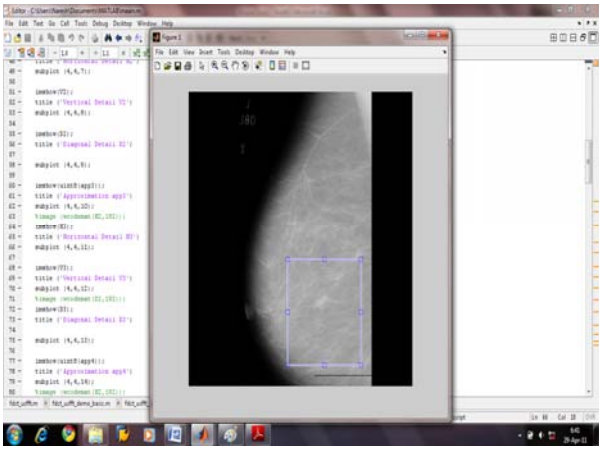


Fig. 5. cropping operation is done

DISPLAYS CROPPED IMAGE

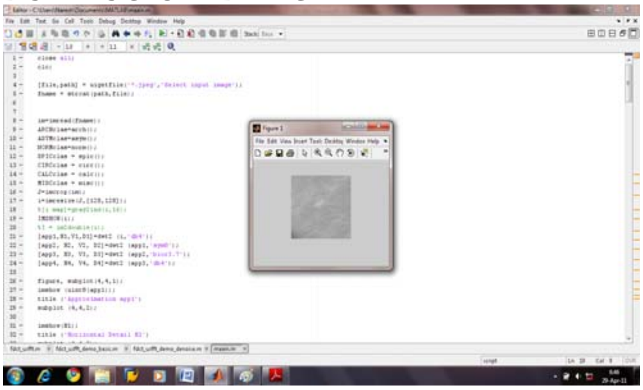


Fig. 6 displays cropped region

CONCLUSION

This paper attempts to implement the comparative method of diagnosing breast cancer using wavelet and curve let transform. Multi resolution analysis based on 2-level discrete wavelet transform is used for the detection of microcalcification clusters to help radiologists in the diagnosis of breast cancer. This multi resolution analysis of image helps to reduce noise and to view the image in different components. Coefficients are extracted from each level of decomposition and it is formed as feature vector. Nearest neighbor classifier based on Euclidean distance calculates the difference between two classes. Feature vectors are compared with the train database to classify the type of disease. For testing, Mammograms are taken from the Mini-Mias database; this is selected due to the various cases it includes. The dataset is composed of 322 mammograms.

FUTURE ENHANCEMENTS

To improve the classification of Mammograms, feature extraction can be made using statistical properties instead of taking biggest 100 coefficients from each level of decomposition. Extracting coefficients from the different levels of wavelet components can be changed by extracting it either from high frequency decomposition, or other levels, since some useful distinct information could be found from those, depending on the data tested. Classification accuracy could certainly be improved by using more powerful classification algorithms such as support vector machine and AdaBoost instead of the Euclidean distance. These classifier algorithms will improve the false positive rate.

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