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Early Breast Cancer Detection

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Abstract

The disease is curable if it is detected in early stage [1][8]. Breast cancer is a malignant tumour that starts in the cells of breast, which is group of cancer cells that grow into surrounding tissues. Breast cancer occurs in human and other mammals also [5]. Mammography is reliable tool for detection breast cancer before clinical symptoms appears in digital mammography which is currently considered as a standard method for breast cancer diagnosis. Various types of features are extracted from digital mammogram like position features, shape features and texture features etc. [2]. Feature extraction of an image is important in tumour classification [10]. In proposed method the suspected region is identified using various features as above and segments it into suspected regions and then classifies them into normal and abnormal regions [11]. Seed point detection algorithm used for segmentation followed by region growing using pixel aggregation and Sigm function used to enhance an image [11]. An efficient technique is proposed for early detection of tumour which uses decomposition property of wavelet transform and is subjected to statistical analysis which involves skewness and kurtosis of decomposed image. These helps to determine the depth of tumour
Keywords- Digital Mammography, DWT, Micro calcification, Skewness, Kurtosis

I. Introduction

Breast cancer is one of the leading cause of death in women [4][6]. Screening methods are carried out using mammograms, x-ray images for lump detection in the breast. Digital mammography is latest and most widely used technique for breast cancer detection; several techniques are used for tumour classification problem in the field of medical diagnosis [14]. Feature extraction of an image is important in tumour classification [10]. Positional features, shape features, texture features and morphological features etc. are extracted using Digital Image Processing. The disease occurs almost entirely in women, but men can get it, too. The characteristics of cancer determine the treatment, which may include surgery, medication (hormonal therapy and chemotherapy) radiation and immunotherapy [4, 7]. Variation in prognosis and survival rates of breast cancer is depending on the early detection of cancer types, stages, treatments, and geographical locations of the patient [6].

II. Related work

Detection of micro calcification in digital mammogram, Mr. K. Sambasiva, Ms. T. Renushya Pale, Mr. G. Nagarjuna Reddy (ISSN NO: 2454-1958 Volume 1: Issue 1 April 2015, page no 4-7) [1] provided the recent advancement and an efficient technique for earlier detection of tumours are carried out in two methods. The first uses the decomposition property of DWT and is subjected to statistical analysis. The statistical analysis involved by finding skewness and kurtosis on the spatial coordinates of the decomposed image. This statistical analysis removes the complexity in edge detection and becomes a pure numerical approach of finding the tumour. In the second method the input image may be classified into benign and malignant based on the shape of the boundary by using Hough Transform. A CAD system becomes a routined clinical work for the detection of breast cancer in mammograms. This system act only as a second reader and final decision is made by the radiologists [1].

Tumour Segmentation from Magnetic Resonance Imaging by Learning Via One-Class Support Vector Machine (Jianguo Zhang, Kai-Kuang Ma*, MengHwaEr, Vincent Chong, 2014) [7] proposed**,** segmentation or extraction of a concerned region from medical images which is a challenging yet unsolved task due to large variations and complexity of the human anatomy and pathological lesions. Currently, there is no universally accepted method on quantifying tumour size in clinical practice. In this paper, the proposed approach is based on one-class SVM has demonstrated great potential and usefulness in MRI tumour segmentation. This approach has the ability of learning nonlinear distribution of medical data without prior knowledge.

Experimental results showed that the segmentation results of this approach are better than the supervised two-class SVM learning algorithm [7].

Breast Tumour Segmentation and Classification Using Svm and Bayesian from Thermogram Images (Dinsha D1*, Manikandaprabu N2, 2014) [6], gives mammography is so far the great modality for the screening and detection of breast tumour. However, mammography has limitations too specially in young women with dense breasts and this necessitated the development of novel, more sensitive and specific strategies. There is no effective way to prevent cancer and the only possible way of saving lives is early detection. Breast thermograph uses thermal images which help in the earlier diagnosis. Abnormal thermogram has proven to be a reliable indicator of high risk of breast cancer at early stages. Initially the pre-processing of the thermogram images are done wherein they are enhanced using the CLAHE method. The enhanced images after filtering are segmented using k-nn and fuzzy. The features were extracted and those are used for classification for both the segmentation methods. Finally, a comparison made by using the SVM and Bayesian classifiers [6].

III. PROPOSED SYSTEM

Mammography are the key tools used for capturing images and is used in the medical systems. Digital Mammogram images are specially recorded for processing, examination and analyzing the human breast [3]. These images are used to the radiologists for investigation of drawing out conclusion relating to the Possibility of presence of abnormality [5]. Mammography can classify tumour in the breast and is widely used, as it is cheaper and less complicated. This method assures detection of 93% - 97% of breast cancers [1]. The breast part image is extracted and processed and is visualized on a film. All the observations are subject to patient’s age, heredity and constraints; it differs from patient to patient [3]. A comparison is made between a normal and an abnormal breast and calculating ratio for finding the suspected region or the set of pixels were the abnormality lies [2][3].

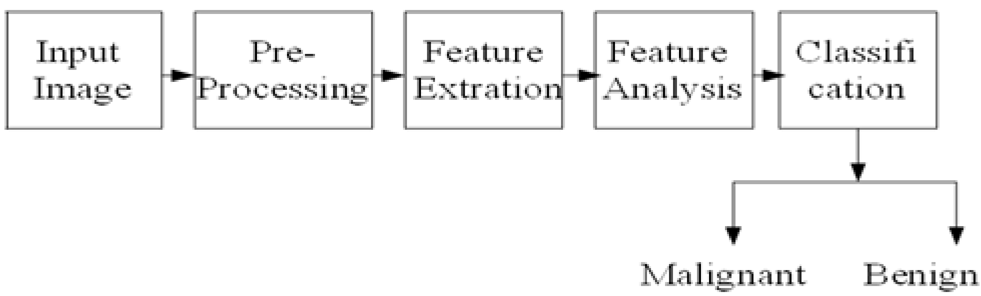

Fig. 2.1: Block Diagram of Proposed System

A. *Input Image*

Input image is a digital mammogram images which are taken from mammography machine. Database used for system evaluation which is collected from Manavata Curie Cancer Center.

B. *Preprocessing*

Digital mammogram images are processed in such a way that they can further used for segmentation. Preprocessing done for removal of unwanted area by using setting the threshold value and also increasing in contrast to make it embossed area to detect. [2][3]. Pre-processed images are commonly involving removal of low frequency component from background noise; this normalizes the intensity of the individual particle of images [4]. Pre-processing method use a small neighbourhood of a pixel to get a new brightness value in output image. [3][8]

C. *Feature Analysis and Feature Extraction (Post Processing)*

In method the suspected region is identified using various features like position feature, shape feature and texture features and segments it into suspected region and then classifies them into normal and abnormal regions [1]. Seed point detection algorithm used for segmentation followed by region growing using pixel aggregation. Image is decomposed using two channel filter bank for the detection of nodular components and linear components and enhanced using Sigm function. These processes are applied without 2-factor down sampling from wavelet transforms coefficients. It is used to reduce lost information and maintains size of images. The tumour detection algorithm is proposed by using statistical methods such as skewness, kurtosis [1].

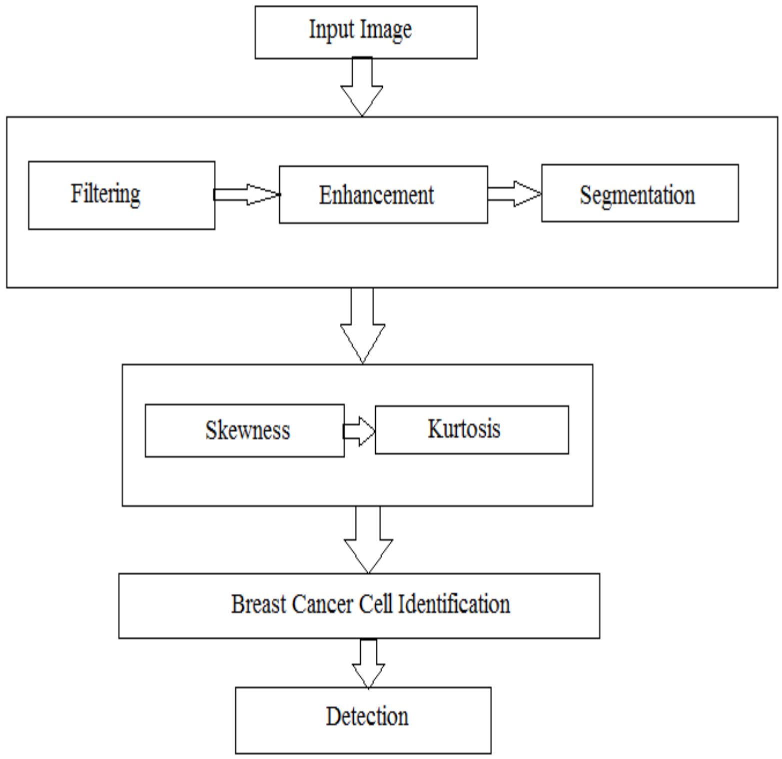

Fig. 2.2: Flowchart for Proposed system

If suspected region contains the symmetric distribution of detailed image coefficients are destroyed [3]. The whole image is divided into overlapping square region, i.e. N*N pixels for which statistical parameters such as skewness & kurtosis are estimated. A region with high positive skewness & kurtosis is marked as a Region of Interest (ROI) [1]. The bar graph can give a general idea of the shape but two numerical measures of shape will give more precise evaluation, they are

1) Skewness

Skewness is a measure of asymmetry of a histogram. A distribution is said to be symmetric if it looks the same on both sides of the centre point [9]. If longer tail occurs to right then it is skewed to right, while if the tail occurs to the left it is skewed to left. Skewness can be defined as the ratio of the third cumulate K3 and the third power of the square root of the second cumulate [1-3].

$$\gamma_1 = \frac{K_3}{K_2^{3/2}} \qquad K_2 = \sum \frac{(x - M)^2}{n}$$

$$K_3 = \Sigma \frac{(x - M)^3}{n}$$

Where
$\gamma 1$ = Skewness M = Mean
K2 = Variance n= sample size K3= third moment
-- Positive skewness indicates a long right tail
-- Negative skewness indicates a long left tail
-- Zero skewness indicates symmetry around the mean. [1]

2) Kurtosis

Measure of the degree of peakedness of a distribution. In some cases, its values concentrated near the mean so the distribution has large peak. In other cases, distribution may be relatively flat [7]. It gives the idea about the central peak is high & sharp or short & broad. Kurtosis is more commonly defined as the fourth cumulate divided by the square of the variance of the probability distribution [1],

$$\gamma_2 = \frac{K_4}{K_2^{\,2}}$$

The kurtosis for normal distribution is 3 [1].
Positive excess kurtosis indicates flatness (long, fat tails)

Negative excess kurtosis indicates peakedness [1]

$$T_X = \begin{cases} 0 & \gamma_1 \le T_1 \quad OR \quad \gamma_2 \le T_2 \\ 1 & \gamma_1 \ge T_1 \quad and \quad \gamma_2 \ge T_2 \end{cases}$$

Classification*:* The detection problem is posed as hypotheses given by
Where
T1 and T2 are Skewness & Kurtosis threshold values respectively [1].
Value „0" signs there are no micro calcifications in the regions. Value „1" signs there are micro calcifications in the regions [1].

IV. Implementation and Results

The simulation can be carried out by using the following conditions:

1) Test digital mammogram images are obtained by scanning raw format. These mammograms have been chosen by radiologists and suspected as mammograms with micro calcification.
2) The chosen wavelet basis function is the Daubechies with four coefficients as a filter bank. It is used to reduce lost information and maintains size of image.
3) Image enhancement procedure is applied only on 4-level decomposed detail sub band image (high pass components) using multi scale adaptive gain method. In this, high pass components will be suppressed if it's value less than the threshold and will be increased if it's greater than threshold.
4) The detection of micro calcification algorithm will be done as given above

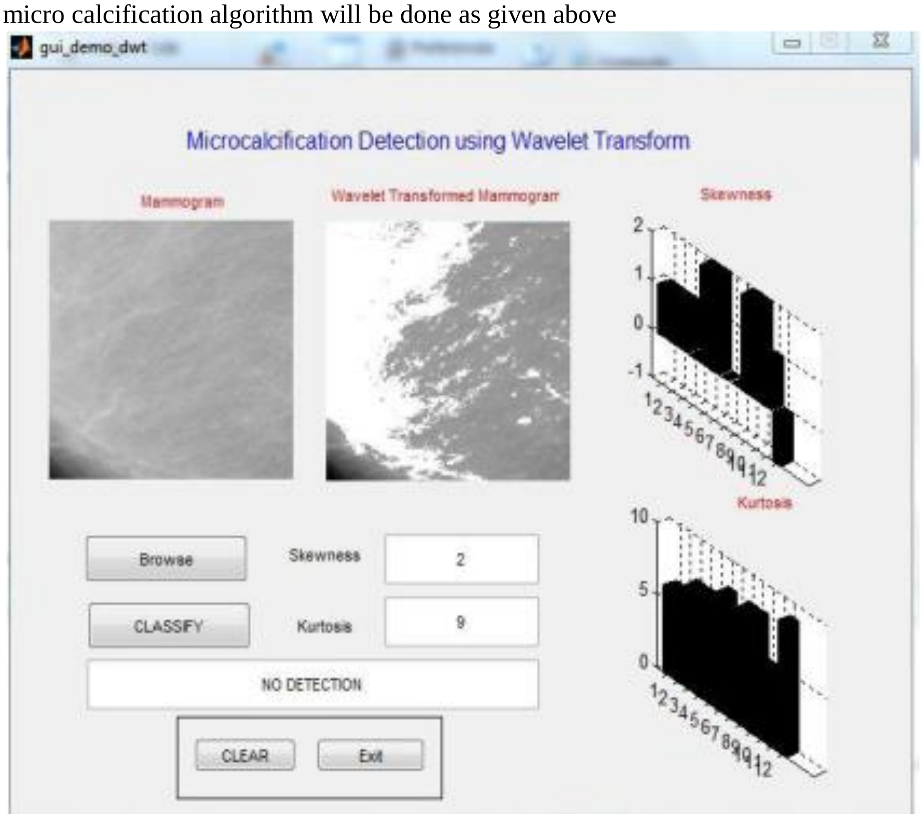

Fig. 4.1: GUI for tumour detection using wavelet transform without micro calcification

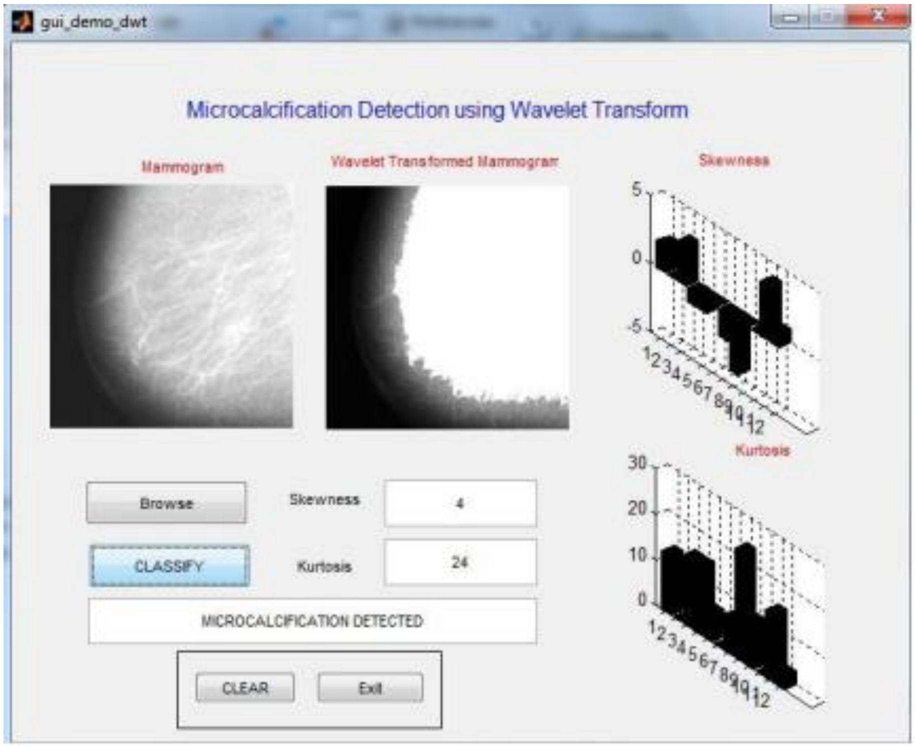

Fig. 4.2: GUI for tumour detection using wavelet transform with micro calcification

V. Conclusion

Breast Cancer is most dangerous diseases in the world. Correct Diagnosis and early detection of breast cancer can increase the survival rate. The present techniques include study of X-ray, CT scan, MRI, PET images. The expert physician diagnoses the disease and identifies the stages of cancer by experience. The treatment includes surgery, chemotherapy, radiation therapy and targeted therapy. These treatments are lengthy, costly and painful. Hence, an attempt is made to atomize this procedure to detect the breast cancer in earlier stages. These images introduce less noise as compared to X-ray and MRI images. The time factor is taken in account to detect abnormalities in target images. The captured images are processed and Tumour is identified accurately from the original image. From the extracted region of interest, three features are extracted. The results indicate that the Tumour is of different dimensions. By evaluating the skewness and kurtosis of the Tumour, the breast cancer stage can be detected accurately using the proposed method. The results show good potential for breast cancer detection at earlier stage.

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