RESEARCH ARTICLE OPEN ACCESS

Feature Extraction in Mammograms Using NSCT and LAWS Texture Analysis Approach.

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ABSTRACT
Breast cancer is one of the significant reasons of deaths among women. Many techniques have been developed to detect and diagnose the disease, but it have not improved any results among the number of deaths this disease have been caused. Thus the early detection and diagnoses is the only way to prevent from death. Earlier the radiologist used to manually check for the signs of cancer in the mammogram images, but it never provided with efficient results. Hence in this paper we have implemented a new technique to detect and diagnose the breast cancer using image processing techniques such as LAWS texture technique and KNN technique for classification purpose which provide us with much reliable results.
Keywords: Breast Cancer, KNN Classifiers, LAWS, Micro calcifications, Mammograms;

Date of Submission: 14-08-2017 Date of acceptance: 31-08-2017

I. INTRODUCTION

Studies have shown that around 80% percentage of women death has been caused due to breast cancer. Every one in ten women is diagnosed with breast cancer. Although we cannot completely cure the breast cancer; but early detection could be quite effective. Until now the most commonly used technique to detect breast cancer is by using mammogram screening by the radiologist, by making use of low cost and radiation technique; But the main drawback in this method is that the radiologist has to observe all the mammogram screened images and hence the presence of micro calcifications being detected is not visible through naked eye and hence there are high number of interpretational errors by the radiologist. Image processing technique is of the best way to detect and diagnose the breast by reducing the noise and using the filtering technique along with feature extraction. In this work, we have used median Filter, K-means clustering for segmentation, LTEM texture analysis technique for feature extraction and finally KNN for classification of cancerous and non-cancerous breasts.

II. LITERATURE SURVEY

The main goal of our paper is to propose a system for prediction of breast abnormality based on technique using NSCT (Non Subsampled Contourlet Transforms) preprocessing method, LTEM (Law's Texture Energy Measure) texture analysis method,. Three major approaches are taken in this study; pre-processing, Feature extraction and KNN Classifier approaches. The first approach entails the pre-processing step for breast profile extraction, carried out by eliminating the low frequency components of the mammogram, leaving behind sub bands containing high frequency coefficients, based on the idea that micro calcifications signify high frequency coefficients. The next approach involves features extraction derived from wavelet decomposition analysis and LAWS texture technique. The final approach is Author A Karahaliou, et.al, [1] proposed a work, in this paper, MCs were pre-processed using a wavelet based contrast enhancement method, followed by local thresholding to segment MCs; Later the remaining area was subjected to texture analysis. Four categories of textural features were used such as first order statistics, co-occurrence matrices features, run length matrices features and Laws' texture energy measures and finally the classification was made using a k-nearest neighbour (kNN) classifier.

Author Arthur L. da Cunha [02], this paper is based on a nonsubsampled pyramid structure and nonsubsampled directional filter banks. They have implemented a design framework based on the mapping approach that allows for a fast implementation based on a lifting or ladder structure.
Author J. Dheeba et.al [03], proposed a work, in this paper the author has used computer detection technique along with the wavelet neural network approach. Here in the pre-processing phase they have

used texture features to extract Laws Texture Energy Measures (LTEM) from the ROI containing abnormality and normal tissue patterns. These measures are calculated by initially applying convolution kernels to the ROI and then performing a windowing operation.

We know that for any input image first we need to remove the noise from the image, the original image consists of various unwanted data such as label markings, tape artifacts and so on. For that purpose we need to perform pre processing phase. In our work we have used NSCT (Non Subsampled Contourlet Transform) and (LTEM) Laws Texture Extraction Method for feature extraction purpose.

III. METHODOLOGY

The main goal of our paper is to propose a system for prediction of breast abnormality based on NSCT and LTEM feature extraction technique. Three major approaches are taken in this study; pre-processing, Feature extraction and KNN Classifier. The first approach entails the pre-processing step for breast profile extraction, carried out by eliminating noise and performing image enhancement [8]. The next approach involves features extraction derived from LAWS texture technique. The final approach is referred to as the classification stage that utilizes K Nearest neighbor technique to distinguish abnormal tissue from normal ones.

3.1 Pre-processing stage:

Image pre-processing is the first phase of the image processing technique. Here first we take a mammogram image as a input of 1026*1026 bit image. The pre-processing process is done in two phases (i) Noise Removal (ii) Image Enhancement.

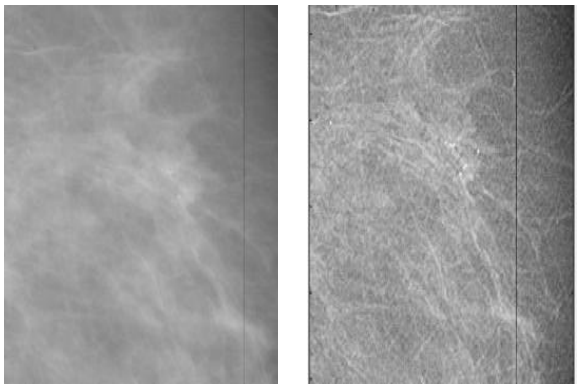
3.1.1 Noise Removal: Removal of noise is a very important function in image processing. For noise removal, the NSCT technique is applied to gray scale image which leads to smoothening the edges of the image. The input MIAS digital mammogram image consists of noise present in the form of fine lines, these lines could be eliminated using NSCT approach [7].After noise removal another important technique is extracting the Region of Interest (ROI) which consists of an image having pixel value 256*256. This obtained ROI will help stimulate the image enhancement technique.

3.1.2 Image Enhancement: The main aim of image enhancement is to improve the interpretibity of information in images for better human understanding. Without modifying the image [7]. There are various methods of image enhancement, in our work we have used Non Subsampled Contourlet Transform that improves the contrast of the image by expanding the intensity values to a preferred range values.

3.1.3

3.2 Feature Extraction:

In feature extraction phase we need the information to classify between the normal and abnormal breast tissues. The presence of micro calcifications or the calcium deposits in the mammogram image will help detect that the mammogram is cancerous. So, to extract this information we need to use feature extraction. In this paper we have used LAWS texture energy measures as a feature extraction technique. LAWS technique uses a 5x5 mask of convolution matrix to compute the texture energy. The four main characteristics which are considered in this technique are: Level, Edge, Spot and Ripple [2]. Based on these values the characteristic features could be easily extracted.



(a) (b)

Fig 1: (a) ROI image of 256*256 (b) Enhanced Image obtained after performing NSCT technique.

3.3 KNN Classifier:

The last phase is the classification phase, in this phase we have used KNN approach. KNN stands for K Nearest Neighbour. KNN is a classifier which uses K value to calculate the collection of nearest data. Mostly the K value is selected as a odd one, but depending upon the various methods and techniques it can differ. The main principle of KNN theory is to first count the Euclidian distance between the dots equal to K value, which is nearest to the training value. The smallest Euclidian distance will be calculated by the amount of K value, whose average will determine the class of training value.

IV. RESULTS

Our proposed method has used MIAS dataset which consists of 322 images [9]. The dataset is available in portable gray image (PGM) format, but for our analysis purpose we require the data to be present in .jpg or .jpeg format. The original MIAS Database has been reduced to 200 micron pixel edge and clipped/padded so that every image is 1024 × 1024 pixels. Cross-Validation technique is evaluated for classification purpose. By using cross-validation technique is that each coefficient can be used as a training sample and testing sample. Based on its

values obtained the images are classified as Benign, Malignant or Normal tissue. Below Figure shows the results of the final mammogram classification along with the result stating whether the given mammogram image was Benign, Malignant or Normal. The result also displays the analysis of various features extracted such as Skewness from S5L5TR Mean from R5L5TR Mean from L5L5T, RSTD from S5L5T, and RSTD from W5L5TR [4]. The implementation of this system is using MATLAB program with interface and preprocessing method using source code and GUI

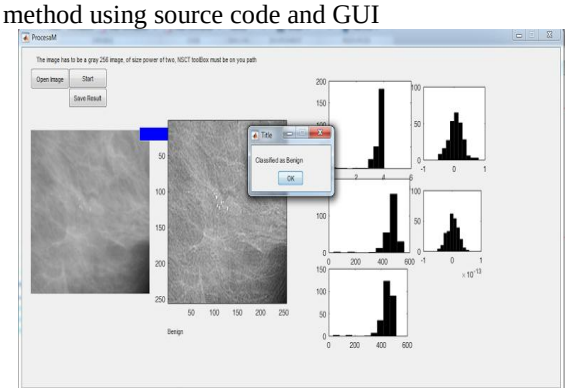


Fig. 2 screenshot of the observed results

V. CONCLUSION

In this paper a new breast cancer detection technique was implemented using the NSCT and LAWS approach. The current scenario of detecting the abnormality in mammogram is done using screening and observations made by radiologists. But this approach has lot of shortcomings which results in the detection are not being accurate. Hence by using image processing techniques the feature extraction and classification approach will automatically help the patients to get more accurate results quickly and effectively.

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Michelle Dcruz. "Feature Extraction in Mammograms Using NSCT and LAWS Texture Analysis Approach." International Journal of Engineering Research and Applications (IJERA), vol. 7, no. 8, 2017, pp. 61–63.