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Review of Classification of Microcalcifications in Digital Mammograms

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***Abstract*— The most common and first method used to detect breast lesions is mammography. Due to less visibility, poor contrast and noisy nature of mammogram it is necessary to detect the small and non-noticeable cancers in early stage. In order to interpret the changes caused due to mental disorder of the breast the contrast of the images are improved while screening the mammograms. The architectural distortion is found in interpreting breast cancers as well as microcalcification and mass on mammograms. However, it is more difficult to detect architectural distortion than microcalcification and mass. This paper presents various techniques used for automatic enhancement and segmentation of microcalcifications in mammographic images. These techniques consists of three different stages which includes preprocessing stage, feature extraction stage and classification stage. The paper represents the proposed system in which these stages can be implemented using histogram equalization, contrast stretching, image segmentation and nonsubsampled contourlet transform.**

Keywords— **Mammography, Microcalcifications, Preprocessing, Feature Extraction, Classification, Histogram Equalization, Contrast Stretching, Image Segmentation, Nonsubsampled Contourlet Transfrom**

I INTRODUCTION

Breast cancer is a type of cancer which is generated from breast tissue. Breast cancer occurs in humans and other mammals while the majority of human cases are in women. Breast cancer is a type of malignant tumor that begins in the cells of the breast. A malignant tumor is a collection of cancer cells that can grow into surrounding tissues or spread to different areas of the body. The disease occurs almost entirely in women. As compared to developing nation Breast cancer is highly occurred in developed ones. The major reason behind this is the amount of time one is expected to live. Due to different lifestyles and eating habits of females in rich and poor countries breast cancer is mostly occurred in elderly women because women in the richest countries is expected to live for longer duration than the women in poor country.

Breast cancer is the major cause of cancer death among women. The most secure detection of early and curable breast cancer is mammography. Early detection of breast cancer is more efficient because mammography is the most standard exam to first detect breast cancer. Mammography is the method which can be used to detect different infections that are breast cancer characteristics such as microcalcifications. Classification of microcalcifications in digital mammogram consists of three main stages preprocessing stage, feature extraction stage and classification stage.

A. Preprocessing

In the preprocessing stage the mammogram image is improved by enhancing the features of the mammogram image. In the step all the unnecessary distortion are removed from the image. In preprocessing stage the contrast of the image is enhanced and the noise from the image is removed improving and enhancing the image data. Due to this step image data is improved and ready for feature extraction stage.

B. Feature Extraction

Feature extraction is an essential step required for pattern recognition. Feature extraction is used to extract features from a large amount of data. In other words it simplifies the amount of features required to describe the large set of data accurately. The features which represent important information for the classification are defined using feature extraction process. Feature extraction is a process which is used for identification of target data by extracting spatial data such as texture,size,etc. It is also used to restructure the data to improve the performance and remove the image data that is redundant or of very less value in the classification process. Hence in this way it is used for pattern recognization.

C. Classification

Classification is a process which is used to classify the features extracted in the feature extraction stage. This is one of the main process that is used for identification of data extracted with the target data. In mammogram images first the mammograms are classified into normal and abnormal. If the image consists of microcalcifications then it is classified as abnormal image. In the next step the abnormal mammogram is further classified into malignant or benign. There are various methods used for classification of microcalcifications in digital mammogram such wavelet transform, contourlet transform, etc.

II RELATED WORK

In order to improve the quality of mammogram images many image enhancement techniques have been

developed in this recent years [1][2]. Enhancement refers to improving the contrast of the mammogram images by achieving denoising and contrast enhancement. However, it is important to enhance the contrast and denoise the image at the same time. In order to increase the accuracy, a good image enhancement should enhance the contrast of mammogram images and remove or decrease the image noise simultaneously.

Contrast enhancement in used in image processing, pattern recognition and computer vision. After performing various researches on image processing many image enhancement algorithms have been developed. Histogram Equalization (HE) [3] consists of quick and easy implementation features which is used as an image contrast enhancement algorithm. In order to approximate an equal distribution by changing the intensity histogram Histogram Equalization (HE) is used.

Its different version is Histogram Specification (HS) [3] which is used for changing intensity histogram to a predefined distribution. Histogram Equalization (HE) and Histogram Specification (HS) are the contrast enhancement algorithms which can enhance the image contrast globally but over enhance the image locally specially at the higher peaks of the histogram. Therefore the noise within the image gets enhanced simultaneously which results in dissatisfactory improvement of the image.

On the other hand there are other group of contrast enhancement techniques such as Wavelet and Empirical Mode Decomposition (EMD) which are used for decomposing the original image into different subbands and then it processes the magnitude of the desired frequency components of the image. Therefore Wavelet and Empirical Mode Decomposition (EMD) are capable of enhancing the image globally as well as locally. However, existence of noise still exists in these techniques.

In order to enhance the mammogram images noise needs to be removed as due to noise existence breast cancer detection rate and accuracy is minimized. To reduce the noise and enhance the image at the same time various linear or nonlinear filters were developed. But this filters caused a lot of problems such as edge blurring and loss of details. Using wavelet and Empirical Mode Decomposition EMD the noise can be uniformly distributed in the coefficients of the wavelet because these coefficients are very small, hard and soft thresholding are used to remove those small wavelet coefficients to denoise the image. Hence wavelet decomposition with thresholding method was developed to enhance the mammogram images [1].

EMD is a technique used for processing various signals by denoising it [4]. Although there are common principles in wavelet thresholding and EMD thresholding, fixed basis functions are used in wavelet wereas in EMD the basic functions are created from the input signal.

In order to solve the various problems of wavelet, curvelet and contourlet are the two techniques that have be developed based on wavelet concept. The contourlet transform consists of two parts Laplacian pyramid with the directional filter bank which is used for multiscale and multidirectional transform respectively. The contourlet transform shows very less redundancy due to which designing good filters becomes very difficult [5][6].

In order to overcome these problems of contourlet transform a modified nonsubsampled contourlet transform (NSCT) can be proposed which solves the problem of redundancy that occurs in contourlet transform. Nonsubsampled contourlet transform provides quick implementation as it is completely shift-invariant in nature and decomposes the image into multiple directions and multiple scale.

III PROPOSED SYSTEM

The mammogram images needs to be improved as it is very difficult to classify the various disorders within that image due to the less visibility of the image. The proposed system uses the modified nonsubsampled contourlet transform (NSCT) to classify the various microcalcifications within the digital mammogram images. The proposed system can be used for performing enhancement of the image, segmentation of the disorders present within the image as well as classification of the various disorders present in the image. Therefore nonsubsampled contourlet transform can prove to be one of the most manageable and effective technique to be used for classifying the microcalcifications with the mammogram image. Fig. 1 illustrates the overall working of the proposed system.

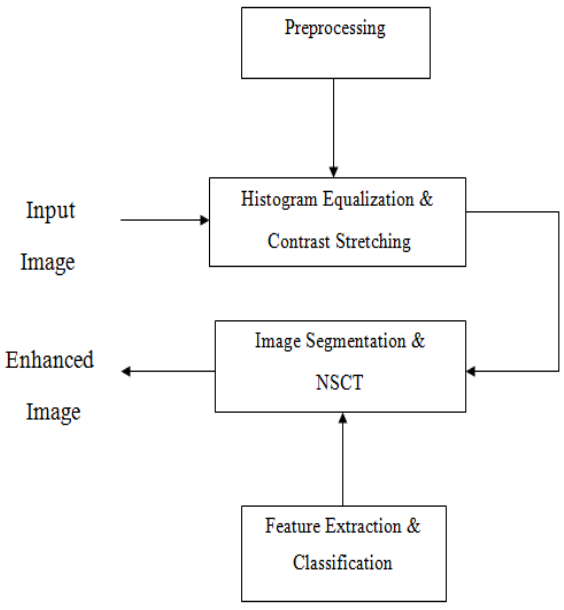

Fig. 1 Overall process of the proposed system

The overall process of the working of the proposed model consists of the following steps:

1. Histogram equalization and contrast stretching are the two steps that are used for preprocessing of the input mammogram image.
2. This steps are basically used to enhance the mammogram image by maximizing the information of the mammogram image by adjusting the gray levels of the input image and improving the visibility of the input image.

3. Nonsubsampled contourlet transform is the third step which is used for image segmentation. This step is used to perform feature extraction. The enhanced mammogram image is segmented for finding microcalcifications in it.
4. The area within the image that are found to be suspicious or faulty are segmented from the image and further classified for various disorders by decomposing the image into multiple scales and multiple directions.
5. In the last step the nonsubsampled contourlet transform is used for classification of the segmented suspicious areas into the various abnormalities such as benign or malignant tumors.

IV CONCLUSION

A variety of research has been occurred on mammography. There are lot of various techniques that are used for classification of microcalcifications in mammogram images. Each of these techniques have their own specific contribution and limitations. In order to solve the various problems that occurs in these techniques a system can be proposed which solves this problems. This system can make use of nonsubsampled contourlet transform for the classification of microcalcifications in digital mammogram images for giving improved results.

REFERENCES

[1] Laine, J. Fan and W. Yang, Wavelets for contrast enhancement of digital mammography, IEEE Engineering in Medicine and Biology, Sep./Oct. 1995, pp. 536-550.

[2] H.Wang, Y. Chen, T. Fang, J. Tyan and N. Ahuja, Gradient Adaptive Image Restoration and Enhancement, IEEE Proc. Int. Conf. Image Processing, Oct. 2006, pp. 2893–2896.

[3] R. C. Gonzalez and R. E. Woods, Digital Image Processing, 2nd edition Pearson Education, 2002.

[4] Y. Kopsinis and S. Mclaughlin, Development of EMD-Based Denoising Methods Inspired by Wavelet Thresholding, IEEE Trans. Signal Processing, Apr. 2009, vol.57, no.4, pp.1351-1362.

[5] M. N. Do, and M. Vetterli., The countourlet transform: an efficient directional multiresolution image representation, IEEE Transactions on Image Processing, 2005, vol. 14, pp. 2091-2106.

[6] D. D.-Y. Po and M. N. Do, Directional multiscale modeling of images using the contourlet transform, IEEE Trans. Image Proc., to appear, http://www.ifp.uiuc.edu/˜minhdo/publications.

[7] S. Anand and R. Aynesh Vijaya Rathna, Detection of Architectural Distortion in Mammogram Images using Contourlet Transform, IEEE International Conference on Emerging Trends in Computing, Communication and Nanotechnology, 2013.

[8] Rekha Lakshmanan and Vinu Thomas, Enhancement of microcalcification features using morphology and contourlet Transform, IEEE International Conference on Advances in Computing and Communications, 2012.

[9] Sharanya Padmanabhan and Raji Sundararajan, Enhanced Accuracy of Breast Cancer Detection in Digital Mammograms using Wavelet Analysis, IEEE, 2012.