BREAST CANCER DETECTION OF ULTRASOUND IMAGE USING WATERSHED TECHNIQUE

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Abstract:-

The most common disease among women is Breast cancer. The advancement in three dimensional ultrasound imaging has found a wide application in breast cancer detection. Even though 3-D ultrasounds provide structural information of abnormal tissue, manual diagnosis requires an expertise medical staff because of the extensive visual complexity. Therefore computerized diagnosis helps in solving all the challenging problems in ultrasound such as speckle noise and inhomogeneous intensity profile. In this paper we propose the use of automated detection of breast cancer using watershed segmentation. The pre-processing techniques which help in overcome the challenges which are faced in the ultrasound images. These techniques provide a detection of cancer cell which provide a better diagnosis by the pathologist.

Keywords: ultrasound, speckle noise, inhomogeneous, watershed

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I. Introduction

The second leading cause of death among women across the globe is Breast Cancer. More than 8% of women are affected from breast cancer during their life time [1]. The breast cancer has the highest death rate but still the cause of the disease is unknown.

The various clinical trials show that prior detection of treating breast cancer plays an important role in diagnosis [3]. Mammography, ultrasound, and magnetic resonance imaging (MRI)are the various diagnosis technique used by radiologist to determine the whether the individual is suffering from breast cancer or not [2]. Breast ultrasound (BUS) imaging is a non-invasive, real-time and cost effective for diagnosis early detection and classification of breast lesions. More over reading of the ultrasound image requires skilled and experienced radiologists. Hence processing of an image by computer helps radiologists in breast cancer detection.

Sonographic textural analysis has been used as simple techniques for reducingthe number of benign lesion biopsies [4]. Ultrasonography (USG) is the most popular technique for imaging organs and soft tissue structures in the human body it is noninvasive, portable, and versatile and does not produce any harmful radiations. However, the main disadvantage of medical USG is the poor quality of images, which are affected by multiplicative speckle noise. Therefore, in general, many of the image segmentation methods may not be suitable in case of USG images.

The shape of a tumor contour is important to physicians in taking diagnostic decisions.In real time using of practical manual tumor contouring in a digitized ultrasound image isdifficult and time-consuming. Automatic contouring method has becoming urgent because sonography has found a wide application.A ultrasound image segmentation provide an accuratediagnosis for breast tumor.Edge based is the most conventional segmentation methodused to detect discontinuities of image intensity butthey do not perform well whenapplied toultrasound images. Traditional region-basedsegmentation methods such as split-and-merge and region growingare more sensitive to noise and contrast in an image.The speckle, weak edges and tissue-related textures in anUS image prevent most split-and-merge and region growingmodels from being able to determine the desiredboundary of the tumor satisfactorily.The active contour model (ACM) is an extensively usedmeans of determining the boundary of an object of interest[5,6]. Determining the region boundary by applying the deformation process depends on an initial estimate ofcontours. However, automatically generating a fitted initialcontour is arduous. Moreover, the watershedtransformation, a reliable unsupervised model, was appliedto solve diverse image segmentation problems [7,8].However, the varieties of tissues in a breast ultrasoundimage are many and boundary discontinuities often causedifficulties in extracting accurate contours of a tumor [9].Hence, this study utilized to extract initial contours of abreast tumor from ultrasound images. Next, ACM isperformed to automatically produce the refined contour of tumor. The proposed approach integrates the advantages ofwatershed segmentation and ACM methods to extractcontours of a breast tumor from ultrasound images.

One very efficient technique for image segmentation that isbeing used for high quality segmentation in many compleximages is the watershed algorithm [10,11]. The algorithm isbased on watershed transform applied to the gradientmagnitude image to obtain the segmented regions. However,segmentation of noisy USG image using watershed transformalways leads to over-segmentation. This is because somefluctuations in the image gray-levels, usually due to noise asin USG image, produce spurious gradients which cause oversegmentation.To overcome this problem, many techniquesbased on watersheds have been proposed.In this paper, we now propose watershed segmentation ofUSG images combined with some pre-processing and postprocessingprocedures that overcome the inherent problemassociated with ultrasound images thereby producingmeaningful segmentation results. We propose edge preservingnoise reduction as pre-processing for the watershed transform,while a novel region merging process is applied in the postprocessingstage.We further use multi-scale morphological gradient algorithm in order to reduce small local minimacaused by noise, whatever still present after pre-processing, inthe input image.

II. Literature Review

The segmentation approach for mammogram proposed by Túlio César *et al.*[12] is Kohonen's Self-Organizing Maps (SOM). In this method the pre-processing stage and segmentation of the breast cancer is performed by SOM network. After the segmentation the diagnosis and detection of cancer is done by Multilayer perceptron trained by the back propagation algorithm.

One of the technique used by S. ESSAFIJ *et al.*[13] provides a tumour cell detection of breast cancer and help in better diagnosis for pathologist. Segmentation is initially carried out by using watershed process. The individual cells are described by using Fourier descriptors and principle component analysis is carried for further cla ssification into tumour marked and normal cell.

The automated segmentation of clustered cancer cells was proposed by Aymen *et al.*[14]. In this method cell region is detected using a modified geometric active contour based on Chan-Vese energy functional method. The touching cell regions are detected by using high concavity points along the cell contours. In this method they implement Dijkstra algorithm which identifies the shortest path that separates the touching cells.

III. Material and Methods

A. Specimen preparation and Image Acquisition

The sample of the ultrasound images has been taken. The image resolution was 431 * 380 and 24 bits per pixel. Region of interest of a tissue section was randomly selected to avoid inhomogeneous boundaries and to ensure homogeneous illumination. The RGB colour ultrasound image has been converted to gray level image using the following equation (1).

gray = 0.35* red + 0.58 * green + 0.07 * blue (1)

The converted image has been enhanced for appropriate identification of the tumor image. The implementation of the technique is shown in fig.1

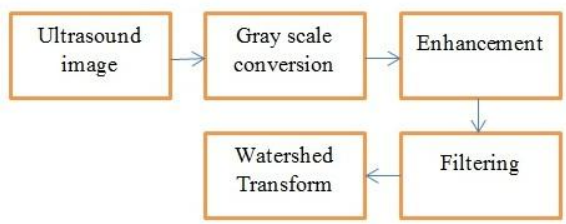


Figure.1 flow chart of watershed algorithm

B. Thresholding and Filtering

Thresholding uses intensity characteristics of objects, size of the objects, fraction of an image occupied by the objects and number of different types of objects appearing in an image. Median filter have been used to remove noises in an ultrasound image. The filter choses each individual pixel in the image and compare and decide with the neighbouring pixel. It uses median of the values instead of using mean of the neighbouring pixel values.

C. Watershed Segmentation

The overview of watershed segmentation is taken as topography of an image. The algorithm was used as a morphological by Digabel et al [10]. The approach was theoretically applied by F. Maisonneuve and found its wider segmentation application in gray-scale problems. This technique has been combined with other technique for enhancement application.

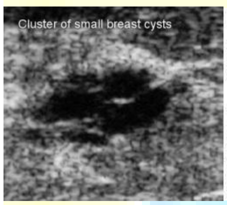
The transform when applied don't produce any changes in the image but instead it separates the images depending on the intensities level and choose the gradient image as a topographic relief and intensity as a altitude. Each pixel in the image is mapped to label during the transformation of the catchments basin of a regional minimum. The resulting network of dams defines the watershed of the digital image. Compared to the other conventional techniques the watershed has more advantages which are stated below

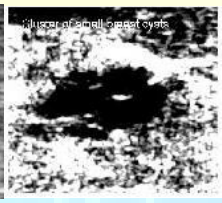
- The gaps between the images are handling carefully and keeping boundary in most significant edges.

- The resulting boundaries form the closed and connected regions in the image.

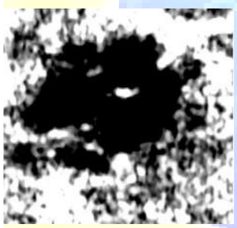
D. Experiments and Results

The experiments have been carried under the tumours ultrasound image. The Figure 2(a) shows the original ultrasound image. The Figure 2(b) shows the enhanced image which is carried by thresholding. The Figure 2(c) shows the region of interest which has tumour when compared to the other regions. The Figure 2(d) shows the segmented part using the watershed transform. The Figure 2(e) shows the boundaries region of the abnormal region which differs from the normal region. Thus the watershed transform provide an effective segmentation in detecting the abnormal cancer tissue.

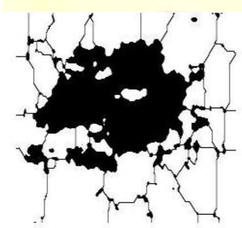
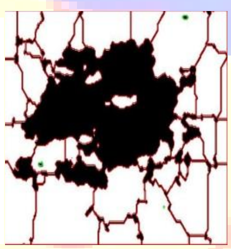




(a) (b)



(c)

(d) (e)

Figure 2 segmentation of (a) orginal image (b) enhanced image (c) region of interest (d) segmented image (e) boudaries

IV. References

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