

Detection of Tumor in Ultrasound Images



T.Sathies kumar, T.Sheela

Abstract--- Breast carcinoma is one of the most commonly occurring problem among women, which even leads to the end of the victim. Sonogram is widely used in imaging breast abnormalities. The paper is mainly concentrated in detecting lesion in breast sonogram images. The proposed scheme automatically identify the abnormalities without manual intervention. The ultrasound image is preprocessed by equalizing the histogram of the image followed by Gaussian filtering. The filtered image is then segmented using watershed technique which identifies the abnormal region both benign and malignant.

Keywords— ultrasound, breast lesion, biopsy Segmentation, region of interest

I. INTRODUCTION

One of the most serious and commonly affected health related problems in women is Breast Cancer. Research works are carried out all around the world against the breast cancer. Better quality in the treatment, early detection leads to lower death rate from this kind of diseases. Many International agency undergone a survey on cancer death proves most of the deceased is due to breast cancer during the year 2002, the research agency also evaluated that about 1.15 million new cases diagonised and out of that nearly 411,000 died due to breast cancer.

Early detection using preliminary test called as screening test greatly reduces the risk of death using breast cancer. Diagnosis using non invasive procedure is of great challenge sonography and mammography are the two most widely used modalities for breast cancer detection. Dense breast is the major factor for false finding in mammogram images [1].

Ultrasound images is used for automatic detection algorithm. The features of benign and malignant lesion override each other in the sonogram images. The above limitations in mammogram and sonogram leads to missing of malignancy lesion in the early stage. Hence the invasive procedure biopsy is performed for both malignant and benign lesion which leads to discomfort and painful procedure for the subject under test in addition to cost expenditure. Hence utmost needful and necessary methods is required to complement existing biopsy procedure.

The recent and important modality in determining the breast cancer is the ultrasound imaging which atmost used

currently for diagnosis. Diagnostic ultrasonic procedure uses the acoustic waves with range of frequency varying from 1 to10 MHZ. the frequency range used is much above the human hearing threshold level[2]. Hence these waves are not audible to human ears.

The equipment used to capture ultrasound image produces a harmless, painless sound waves which by the echo produced able to visualize the picture of the object under examination. The quality of the ultrasound image is very poor due to accumulation of speckle noise which in turn reduces the information content in the image. The accurate result of the ultrasound examination not only relay on the ultrasound scanner but also depends on the radiologist examining the ultrasound. The automated result is validated with an trained radiologist with greatest knowledge regarding echo anatomy of the breast[11].

II. MOTIVATION

The early detection of abnormality in the breast is diagnosed by mammography which is the standard imaging modality. This imaging modality has false positive in diagnosis due to unalterable image contrast or brightness. The major problem arises when tumor located in the soft tissue and dense grandular tissue. Sonographic techniques tends to capture the areas missed by mammograms especially the dense grandular tissue. Sonographic imaging modality uses non-ionising radiations, non invasive procedures and less expensive compared to other procedures.

Segmentation plays a very important role in ultrasound imaging schemes. Some of the segmentation algorithm depends on information of pixel intensities such as thresholding, group clustering's intensity based edge detection which is unsuitable for ultrasound imaging and gives very poor result [3].

A segmentation technique which greatly emphasize on inhomogeneity which in turn account of non- uniformity of tissues classes. The computer aided diagnosis is based on the region of interest marked by the radiologist. Hence manual intervention is needed before the automatic analysis. The proposed work is to fully automate by combining Gaussian filtering, watershed segmentation and morphological function in segmenting the lesion [4].

III. MATERIALS AND METHODS

3.1 Ultrasound Images

Sonogram images are complex in terms of intensity due to noise accumulation. Speckle noise is the most accumulated noisy information in the sonographic images. These noise has high gray level intensities ranging from hyper echoic to hypo echoic.

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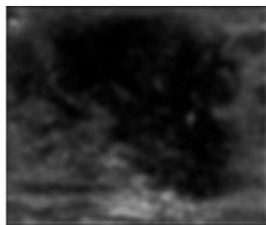
Automatic diagnosis system is specially designed to diagnose abnormal areas from the normal ones by considering all the artifacts mentioned above.

In the propose work the Ultrasound image is preprocessed by a suitable filtering method and the tumor region is detected by watershed segmentation method.

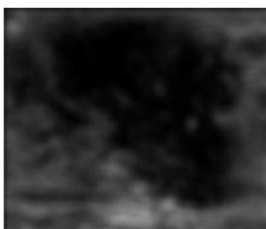
3.2. Preprocessing

Preprocessing is the first and foremost fundamental steps in order to remove noise and provide enhancement to the original image by clearly showing the subtle portions of the image. Noise filtering in medical images take into account of many considerations namely, no information loss from the object boundary and the subtle details, effective removal of noise from the homogeneous regions, enhancements of morphological parameters by enhancing the discontinuities. In this work Gaussian filtering is used which had greatly reduced the noise and image artifacts, while preserving (or even enhancing) important features, such as edges or discontinuities.

The figure 1.a shows the ultrasound image of size 425 x 295. The high level intensity shows the malignancy portion which is the region of interest whose part is to be segmented. Figure 1.b shows the preprocessed image after removal of noise using Gaussian filter and the gray level intensities are equalized using histogram equalization.



(a)



(b)

**Figure 1. (a) original image
(b) Preprocessed Image**

3.2 Watershed segmentation method

This method utilizes visual perception of an image in its spatial coordinates versus gray levels. Let V_1, V_2, V_m denotes the coordinates in regional minima of the image $f(x,y)$.

Let $A(V_i)$ denotes coordinate points of the catchment basin. The Max and Min terms are used to signify the Maximum and Minimum value of $f(x,y)$.

Let $T[n]$ be the set of Coordinates of (s,t) for which $f(s,t) < n$.

$$T[n]=\{ (s,t) \mid f(s,t) < n \} \text{-----(1)}$$

The topological region flooded in increments from

$$n = \text{Min} + 1 \text{ to } \text{Max} + 1 \text{-----(2)}$$

At any point in 'n' the flooding algorithm needs to identify the number of points below the flood depth. The flooded region below 'n' are marked as black and the flooded region above 'n' are marked as white. Thus the entire image is converted to binary image which has white and black points corresponding to planes below and above the flooding region $f(x,y)=n$.

Watershed method is the most prominent methodology for segmentation of images. This method uses the gradient image rather than the image pixel directly. Watershed is an elongated region which divides areas drained by various river system. A catchment basins is the place draining into ariver. The catchment basin and ridges are applies to gray scale image to solve numerous segmentation problems [9]. Markers are applied to the gradient image to avoid over segmentation. A set of markers namely internal marker and external marker are selected with the object foreground and background. These connected components reduces the noise and other irregularities in the image. Both the markers are placed on the gradient image and the modified gradient image undergoes morphological operations yield to segment result shown in figure 2.

IV. RESULTS AND DISCUSSION

The implementation of this method is done using MATLAB. The above algorithm is tested on 20 ultrasound images (10 benign and 10 malignant). The processing takes tens of seconds to process an image of size 425X295. Figure 2 shows the output of the proposed algorithm for both benign and malignant ultrasound images.

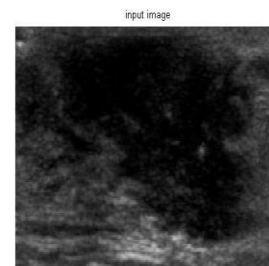


Figure 2 (a) Input image (ultrasound breast image – malignant tumor)

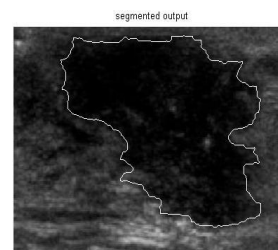


Figure 2 (b) segmented output (ultrasound breast image – malignant tumor)





Figure 2 (c) Input image (ultrasound breast image - benign tumor)



Figure 2 (d) segmented output (ultrasound breast image - benign tumor)

The proposed algorithm works well in identify and detecting benign and malignant lesion in ultrasound images.

V. CONCLUSION AND FUTURE WORK

In the proposed system, ultrasound images are initially preprocessed using Gaussian filtering and then watershed segmentation method is employed to segment the tumor region from the normal part in the ultrasound image. This automatic procedure helps in aid the physicians with an automated tool for segmentation diagnostically useful information quickly and accurately for all most cases, and allowing full control over the results. In future we aim to increase the accuracy by extracting Gabor based texture features (Gabor energy features) and classify the tumor using neuro-fuzzy logic with the optimum features.

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