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Research paper

Tumor Detection from Mammograms using Thresholding and Morphological operations

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Abstract

According to the Statistics released by World health organization (WHO), Breast Cancer rate is growing day by day. And this disease is significant cause for death amongst women. Several image processing techniques have been developed for identification, detection and segmentation of breast cancer. Breast cancer is uncertain in nature, so prevention becomes impossible. Thus, early detection of a tumor in the breast is the only way to cure breast cancer. In this research, breast tumor detection in a Mammogram is done by Histogram, Thresholding, and Advanced Morphological Techniques and is being compared with general practitioners and specialist result.

Key words: *Breast tumor, histogram, Thresholding,Morphological operations.*

1. Introduction:

The presence of lumps in X- ray mammograms is one of the early signs of women breast cancer. Currently, mammography is the single most promising technique in the investigation of breast abnormalities detection such as

lumps. However, their detection is still a bottleneck due to the diversity in shape, size and poor contrast between the malignant and benign areas. Radiographic images obtained from mammography equipment are one of the most frequently used techniques for helping in early diagnosis. Mammogram image segmentation is useful in detecting the breast cancer areas. Due to factors related to cost and professional experience, in the last two decades computer systems to support detection (Computer-Aided Detection – CADe) and diagnosis (Computer-Aided Diagnosis – CADx) have been developed in order to assist experts in detection of abnormalities in their initial stages.

Despite the large number of researches on CADe and CADx systems, there is still a need for improved computerized methods. Nowadays, there is a growing concern with the sensitivity and reliability of abnormalities. B.Monica Jenefer et al. [1] has developed SVM based Breast cancer detection by procedures such as Image Enhancement and Tumor Segmentation. The removal of properties from the segmented tumor region and utilization .S. E. Shelton et al. [2] has developed Quantitative morphologic analysis of tumor vessels for tumor detection, differentiation or evaluation.C.Y. Chang et al. [3] has developed a method to assess the rating of breast cancer in IHC images and the method consists of four steps, including ROI extraction, feature extraction, feature selection, and a SVM classifier.P. Smitha et al. [4] has done Quality enhancement technique for gray level immunohistochemistry images through the visual inspection and manual staining method.Thangavel et al. [5] has detected Micro classification based on textural image segmentation and classification by technique of Markov Random Field method hybrid with Ant Colony System, Genetic Algorithm and Backpropagation Network.

Hichem Talbi et al.[6] has developed A QIE Algorithm for Multi objective Image Segmentation by adopting a split/merge trait that uses the result of the k-means algorithm as input for a quantum evolutionary algorithm to establish a set of non-dominated solutions.C.C. Lai et al. [7] has developed an algorithm for automatic medical image segmentation by using a hierarchial evolutionary algorithm (HEA) is proposed for medical image segmentation. J Shan et al. [8] has proposed a novel and fully automated segmentation approach for breast ultrasound (BUS) images by process such as first an efficient region-of-interest (ROI) generation method is developed and trained by an artificial neural network .D. Dmitriev et al. [9] has proposed an algorithm for registration using a multi- resolution approach to speed up the process and to minimize the probability of converging to local minima. R. W. Holt et al [10] has proposed an automated implementation which encodes the gray-scale prior image directly into the regularization term, eliminating the need for direct prior image segmentation, which is extendable to any spatially defined prior data.P. Skaane et al [11] has prospectively compared performance indicators at screen-film mammography (SFM) and full-field digital mammography (FFDM) in a population- based screening program.S. Marrone et al [12] has proposed a method based on a Support Vector Machine trained with dynamic features, taken after a suitable pre-processing of the image, from an area pre-selected by using a pixel-based approach. R. Fusco et al [14] has proposed an algorithm which includes breast mask segmentation via intensity threshold

S.Marrone et al.[13], Roberta Fusco[15] Roberta Fusco have discussed the classification of dynamic and textural features, for breast lesions segmentation and classification using Dynamic Contrast Enhanced-Magnetic Resonance Imaging data. Ayyaz Hussain et al [16] has proposed a filter based on noise detection, fuzzy parameter identification, fuzzy mean estimation, intensity estimation, fuzzy decision making and embedded intelligent fuzzy control. C. Villarreal-Garza et al [17] has done a statistical approach on the women who are suffering with breast cancer in Latin America. S. Lee et al [18] a nonbiased, precise after-processing scheme was employed to eliminate background X- ray absorbance from the extra-vascular tissue. The revised binary image stacks were compiled to reveal the Microfilm- casted neo vasculature as 3D reconstruction

Mohammed T. GadAllah [19] proposed a wise automated method for wisely improving the visualization of hepatic abscess sonogram, a modest trial is being done to denoise and reduce the ultrasound scan speckles wisely and effectively.

2. Methodology:

2.1. Resampling of Input Image

Input image is taken and given for resampling .The input image which may be of any size is resampled to 256*339 pixels. This resampled image is fed to Histogram**.**

2.2. Histogram

It is a plot between number of pixel and pixel intensity. Histogram of the comparison output of two images (with and without tumor images of a breast) is taken. Using histogram graph, we can measure mean, standard deviation. The mean and standard deviation will give the measure of the tumor in a sample image. Image functions are a generic class for dealing with all image types. Histogram Image consists of different regions of a certain gray level value, those gray level values can be found out with the help of histogram.

2.3. Colour plane extraction

The histogram of the input image is fed to Color plane extraction. Colour plane extraction is used to extract one of the colour planes depending upon the image type like 32 bit /16 bit .This effectively converts a colour image into a Gray scale one.

2.4. Thresholding:

After the color plane has been extracted then Thresholding technique has applied on the image. Thresholding means which converts a grayscale image into a binary image. In this technique choosing a threshold value is the key for the segmentation of the image.

2.5. Advanced Morphology

The morphology technique has been developed to perform operations on binary image. These transformations have been used to observe geometry of regions. In this procedure for the tumor detection in Breast Morphological Segmentation is applied By using advanced morphology border objects have to be removed and then we have to plug gaps .Finally morphological operations have been done to remove unwanted regions existing in the image .Depending on the regions detected in the image Length and Area Measurement is calculated.

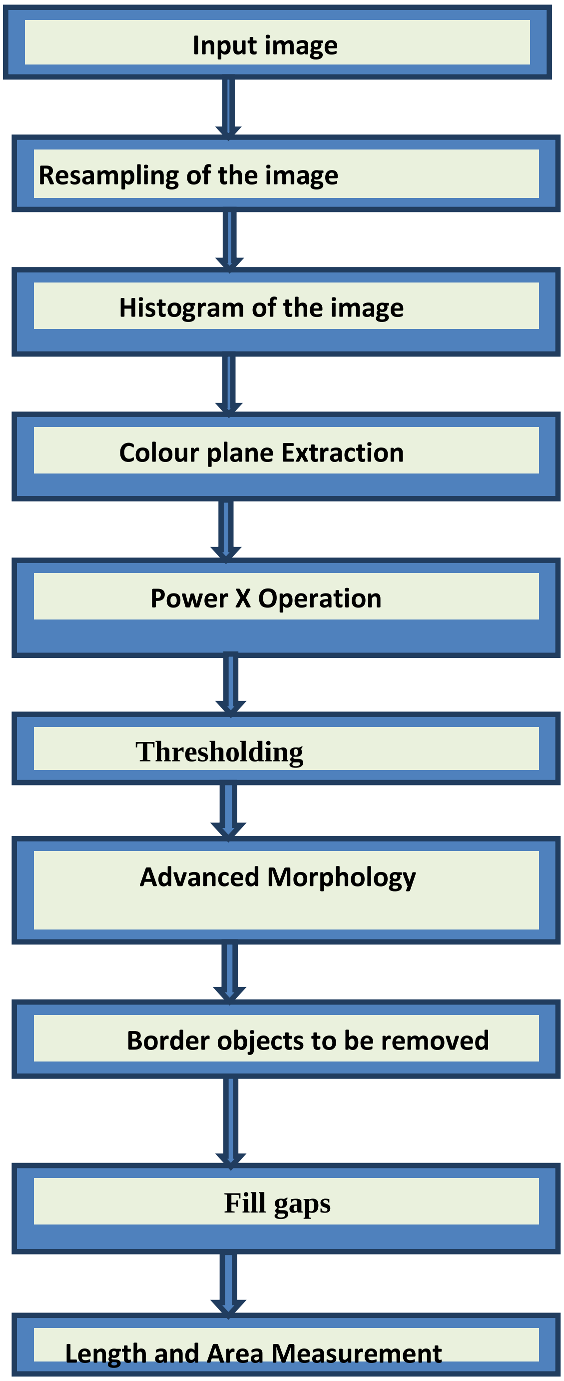
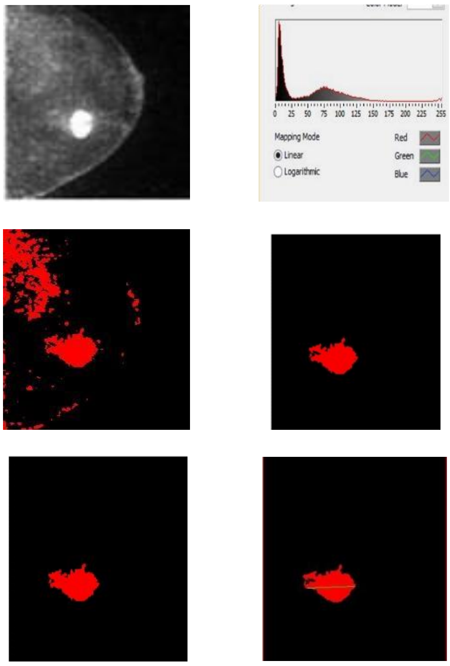


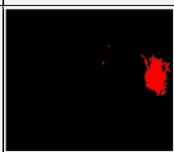
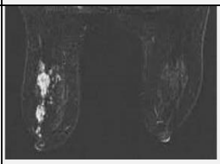
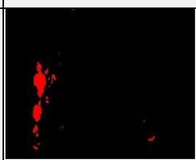
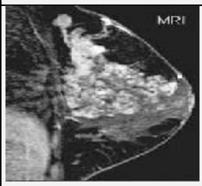
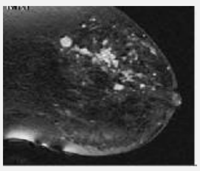
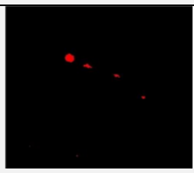
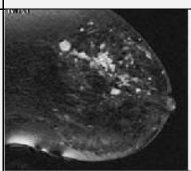
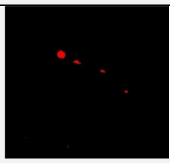
Fig.1: Methodology

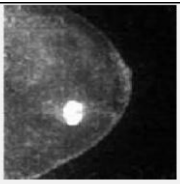
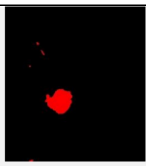
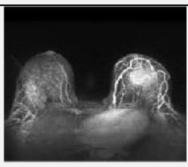
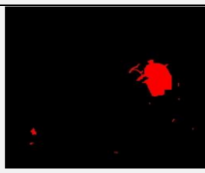
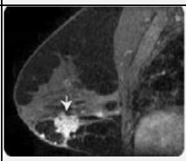
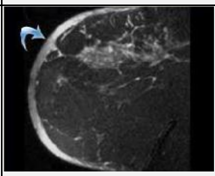
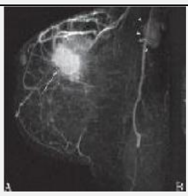
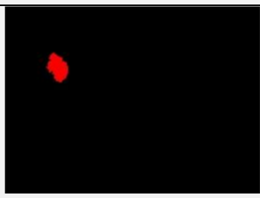
3. Result

In this section shows the outcomes achieved by the proposed Advanced Morphological based Breast cancer detection, detection and segmentation steps applied for mammographic images. Total 80 breast images have tested with this algorithm.70 images are the breast tumor images and 10 images are No breast tumor images. For each image Length and area have been calculated and shown in the table.



a)Input Image b) Histogram of the Image
c) power X operation d) Thresholding
Morphological Operation (remove small objects) Fill holes

S.No	Input Image	Output Image	Length (pixels)	Area (pixels)
1			32	2124
2			16	1020
3			164	16018
4			19	290
5			24	1621

6			41	1514
7			43	1955
8			35	1215
9			63	2263
10			20	850

Statistical parameters calculations:
Total Images: 80 Tumor images: 70, No Tumor Images: 10

Table 2: Statistical data

	Tumor	No Tumor
Tumor	True Positive=68	False Negative=2
No Tumor	False Positive=0	True Negative=10

Statistical performance parameters viz., the sensitivity, specificity, positive prediction value and Negative prediction value have been calculated. The results are presented in **Table** 2**.** All these parameters are highly significant and are greater than 85 %. The statistical parameters of the proposed method have been compared with the General Practioners results and with Cancer specialists. With this method Sensitivity is more than other two results. Fig. 2 shows the graphical representation of the statistical data.

Table 3: Consolidated Outcome of the Logical Identification of breast tumors:

S. No	Referred by General practioners	Referred by Specialists	Proposed Method
Sensitivity	92.5	91.6	97.14
Specificity	97.8	97.7	100.0
(PPV)	60.2	76.0	98.55
(NPV)	99.9	99.7	83.3

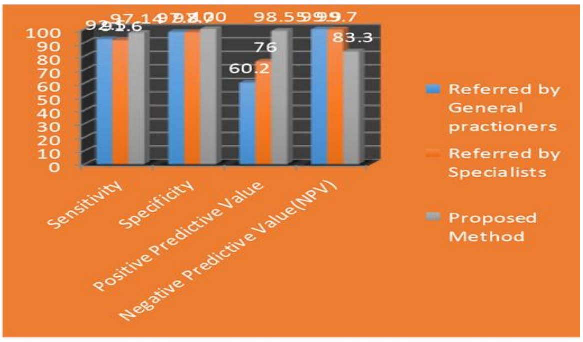


Fig.2: Graphical Representation

4. Conclusion:

Breast Cancer detection using histogram, thresholding and morphological techniques has been performed. The algorithm has been tested with 80 images out of which 70 are tumour and 10 are notumour in nature. The sensitivity of the proposed method is 97.17% and the result of the proposed method has been compared with general practitioners (92.5%) and specialist (91.6%). So from this the sensitivity for our method is more than the other techniques and specificity is 100% for proposed method and 97.9% and 97.7% for other two techniques. Positive predictive value (PPV) is very much higher that is 98.55% and for other two results are 60.2% and 76.0%.Negative predictive value (NPV) is 83.3% for the proposed method and for other two results are 99.9% and 99.7 %.

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