International Journal on Emerging Technologies (Special Issue on ICRIET-2016) **7**(2): 92-96(2016)

ISSN No. (Print) : 0975-8364
ISSN No. (Online) : 2249-3255

Breast Cancer Prevention and Early Detection using Different Processing Techniques

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(Received 16 September, 2016 Accepted 19 October, 2016)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT*:* This paper presents a breast cancer prevention and early detection using some techniques. Beast cancer is a malignant tumor that starts in the cells of breast. A malignant tumor is a group of cancer cells that can grow into (invade) nearby tissues or spread (metastasize) to distant pats of the body. Breast cancer happens mostly in women, but men can get it, too. The signs and symptoms of breast cancer can be identified widespread use of screening mammograms, still some breast cancers are not found by mammograms either because the west was not done or because even under ideal conditions mammograms do not find every breast cancer detection algorithm from mammogram. The proposed system focuses on the solution of two problems. One is how to detect tumors as suspicious regions with a very weak contrast to their background and another is how to extract features which categorize tumors. The tumor detection method follows the scheme of (a) mammogram enhancement. (b) The segmentation of the tumor area. (c) The extraction of features from the segmented tumor area. (d) The use of SVM classifier.

The enhancement can be defined as conversion of the image quality to a better and more understandable level. The mammogram enhancement procedure includes filtering, top hat operation, DWT. Then the contrast stretching is used to increase the contrast of the image. The segmentation of mammogram images has been playing an important role to improve the detection and diagnosis of breast cancer. The most common segmentation method used is thresholding. The features are extracted from the segmented breast area. Next stage include, which classifies the regions using the SVM classifier. The method was tested on 75 mammographic images, from the mini-MIAS database. The methodology achieved a sensitivity of88.75%.

I. INTRODUCTION

Breast cancer is the most common non skin malignancy in women and the second leading cause of female cancer mortality [1]. Breast tumors and masses usually appear in the form of dense regions in mammograms. A typical benign mass hasa round, smooth and well circumscribed boundary; on the other hand, a malignant tumor usually has a speculated, rough, and blurry boundary[2],[3].

Computer aided detection (CAD) systems in screening mammography serve as a second opinion for radiologists by identifying regions with high that CAD technology has a positive impact on early breast cancer detection [5], [6]. There is extensive literature on the development and evaluation of CAD systems in mammography. Most of the proposed system follows a hierarchical approach. Initially the CAD system prescreen samammogram to detect suspicious regions in the breast parenchyma that serve as candidate location for further analysis.

In this the first stage is an algorithm of Gaussian smoothing filter, top hat operation for image enhancement in which the combined operations are applied to the original gray tone image and the higher sensitive lesion site selection of the enhanced images are observed. Then the second stage develops a thresholding method for segmenting tumorarea.SVM is a learning machine used as a tool for data classification, function approximation, etc, due to its generalization ability and has found success in many applications [7-11]. Feature of SVM is that it minimizes and upper bound of generalization error through maximizing the margin between separating hyper plane and dataset. SVM has an extra advantage ofautomaticmodelselectioninthesensethatboththe optimal number and locations of the basic functions are automatically obtained during training. The performance of SVM largely depends on the kernel [12],[13].

II. METHODS

Detection of tumors in mammogram is divided into three main stages. The first step involves an enhancement procedure, image enhancement techniques are used to improve an image, where to increase the signal to noise ratio and to make certain features easier to see by modifying the colors or intensities. Then the intensity adjustment is an image's intensity values to a new range. After the mammogram enhancement segment the tumor area. Then the features are extracted from the segmented mammogram. Then the next stage involves the classification using SVM classifier. The ultimate goal of CAD is to indicate such locations with great accuracy and reliability. Thus far, most studies support the fact. Presently breast cancer is a leading cause of death among women and second main cause of death after lung cancer [1-7]. Breast cancer is the one of the important factors of mortality in women over the world. In 2010, 2, 10,203 women's in the United States diagnosed with breast cancer, and 40,589 women's in the United States died from breast cancer. In 2011, 2, 30,480 cases of non-invasive cancer and 56,650 cases of invasive cancer have been diagnosed in the year 2011. Occurrence and death counts cover approximately 100% of the U.S. population. In the year of 2012, about 2, 27,000 women's in the United States may diagnose with breast cancer [6]. According to the international agency for research on cancer, around 79,000 women's per year affected by breast cancer in India [4]. The National Cancer Institute estimates that one of the eight women in the United States breast cancer will develop at some point duringherlifetime . The mortality rates of 30% in the and 45% in Europe have been demonstrated by the repeated, randomized, and controlled trials. Mammography is one of the effective tools in early detection of breast cancer[8]. Mammography is alow dose x-ray procedure for the visualization of internal structure of breast. Mammography has been proven the most reliable method and it is the key screening tool for the early detection of breast cancer. Mammography is highly accurate, but like most medical tests, it is not perfect. On average, mammography will detect about 80–90% of the breast cancers in women withoutsymptoms.

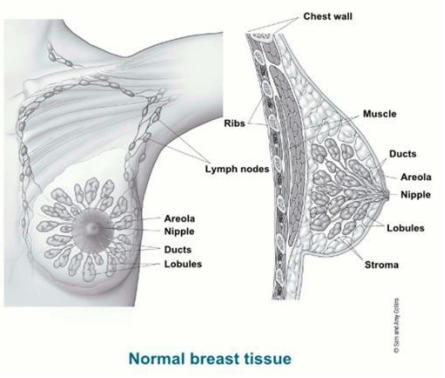
Breast lump or mass

The most common symptom of breast cancer is a new lump or mass. A mass that's painless, hard, and has irregular edges is more likely to be cancer, but breast cancer can be tender, soft, or rounded. They can even be painful. For this reason it's important to have any new beast mass, lump, or change checked by a health care provider experienced in diagnosing breast diseases.

Other symptoms

Other possible symptoms of breast cancer include:

- Swelling of all part of thebreast
- Skin irritation ordimpling
- Beast or nipplepain
- Nippleretraction
- Redness, scaliness, thickening of the nipple or breastskin



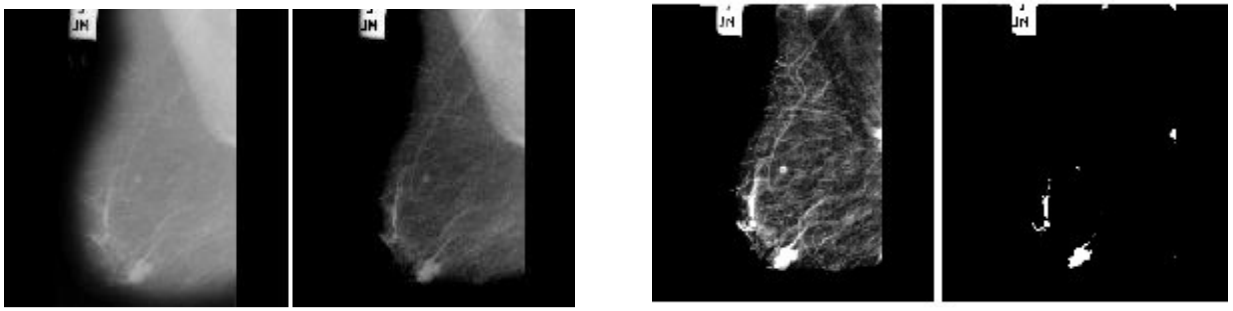
Normal breast tissue

The importance of finding breast cancer early. The goal of screening tests for breast cancer is to find it before it causes symptoms. Screening refers to tests and exams used to find a disease in people who don't have any symptoms. Early detection means finding and diagnosing a disease earlier than might have happened. Breast cancers found during screening exams more likely to be smaller and still confined to the breast. The size of the breast cancer and how far it has spread are some of the most important factors of predicting the prognosis of a woman with this disease.

Pre-Processing. Pre-processing is an important issue in low-level image processing. It is possible to filter out the noise present in image using filtering. A high pass filter passes the frequent changes in the gray level and a low pass filter reduces the frequent changes in the gray level of an image. That is; the low pass filter smoothes and often removes the sharp edges. A special type of low pass filter is the Median filter. The Median filter takes an area of image (3 x 3,5 x 5, 7 x 7 etc), observes all pixel values in that area and putsit into the array called element array. Then, the element array is sorted and the median value of the element array is found out. We have achieved this by sorting the element array in the ascending order using bubble sort and returning the middle elements of the sorted array as the median value. The output image array is the set of all the median values of the element arrays obtained for all the pixels. Median filter goes into a series of loops which cover the entire imagearray.

Some of the important features of the Median filter are: It is a non-linear digital filtering technique. It works on a monochrome color image. It reduces "speckle" and "salt and paper" noise. It is easy to change the size of the Median filter. It removes noise in image, but adds small changes in noise-free parts of image. It does not require convolution. Its edge preserving nature makes it useful in many cases. The selected median value will be exactly equal to one of the existing brightness value, so that no round-off error is involved when we take independently with integer brightness values comparing to the other filters.

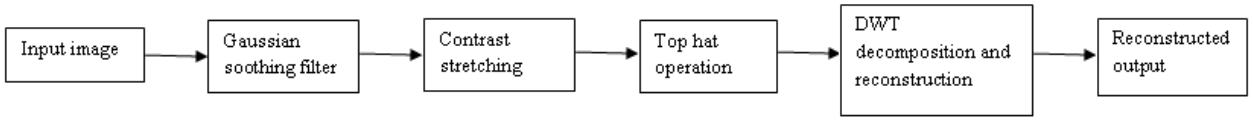
Image Segmentation. Image segmentation refers to the process of partitioning a digital image to multiple segments or set of pixels. The goal of segmentation is to simplify the representation of an image into different segments that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries in images. It is also the process of assigning a label to every pixel in an image such that pixels with the same label share certain visualcharacteristics. The result of image segmentation is a set of segments that collectively cover the entire image. Image segmentation is nothing but the process of dividing an image into disjoint homogenous regions. These regions usually contain similar objects of interest. The homogeneity of the segmented regions can be measured using pixel intensity. Image enhancement. Image enhancement can be defined as conversion of the image quality to a better and more understandable level. The enhancement procedure is the mammogram images are filtered by Gaussian smoothing filter based on standard deviation. (b) Perform morphological top hat filtering on the gray scale input image using the structuring element. The top hat filtering is used to correct uneven illumination when the background is dark. The top hat filtering with a dark shaped structuring element to remove the uneven background illumination from an image. (c) The top hat output is decomposed into two scales using discrete wavelet transform and then the image isreconstructed.

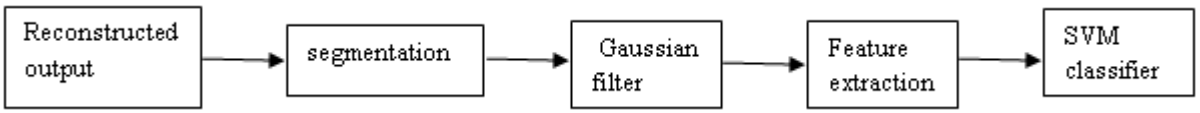


(a) (b) (c) (d)

Fig. 1. (a) Original mammogram. (b) Filtered image. (c) Second level DWT reconstructed mammogram. (d) Tumor segmented output.

Block diagram of image enhancement





Block diagram of the proposed method.

Segmentation and Feature extraction. The enhanced mammogram images are converted to binary images through thresholding at different values. The segmented images are filtered again with Gaussian smoothing filter to eliminate noise. The thresholding is an important step to improve the detection of breast cancer segmentation subdivides an image into its constituent regions. The feature extraction is used to measure the properties from the segmented image are,

1. Area, 2.Centriod, 3.major axis length, 4.minor axis length, 5.eccentricity, 6.orientation, 7.filled area, 8.extrema, 9.solidity, 10.equivdiameter. The area is the scalar value; it computes the actual number of pixels in the region. Then the centroidisthevectorandit computes the centre of the tumor region.

SVM classifier. Consider the pattern classifier, which uses a hyper plane to separate two classes of patterns based on given examples $\{x(i), y(i)\}\ i=1^n$ ·Where (i) is a vector in the input space $I=R^k$ and y (i) denotes the class index taking value 1 or 0.A support vector machine is a machine learning method that classifies binary classes by finding and using a class boundary the hyper plane maximizing the margin in the given training data. The training data samples along the hyper planes near the class boundary are called support vectors, and the margin is the distance between the support vectors and the class boundary hyper planes. The SVM are based on the concept of decision planes that define decision boundaries. A

decision plane is one that separates between assets of objects having different class memberships. SVM is a useful technique for data classification. A classification task usually involves with training and testing data which consists of some data instances. Each instance in the training set contains one "target value" (class labels) and several "attributes" (features).Given a training set of instance label pairs $(x_i,y_i),i=1,\ldots,l$ where $x_i \in R^{un}$ and $y\in(1,-1)^l$,the SVM require the solution of the following optimization problem.

$$\text{Min}_{w,\ b,\ £}\ 1/2w^Tw + c\sum_{i=1}^{l}\varepsilon_I$$

$$\text{Subject to } y_i(w^T\emptyset(x_i)$$

$$+b)>1-\varepsilon I,\ \varepsilon_i>=0.$$

Here training vectors x_i are mapped into a higher dimensional space by the function Ø. Then SVM finds a linear separating hyper plane with the maximal margin in this higher dimensional space>0is a penalty parameter of the error term. Furthermore, $k(x_i,x_j)=\emptyset(x_i)\emptyset(x_j)$ is called the kernel functions. There are number of kernels that can be used in SVM models. These include linear polynomial, RBF and sigmoid

$$\emptyset=\{x_i*x_j\text{linear}(\gamma x_ix_j+\text{coeff})^d$$

polynomial

$$\text{Exp}(-\gamma|x_i-x_j|^2)\ \text{RBF}$$

$$\text{Tanh}(\gamma x_ix_j+\text{coeff})\ \text{sigmoid}\}$$

In this way, non linear SVMs can be created. Support vector machines are an innovative approach to constructing learning machines that minimize the generalization error. They are constructed by locating a set of planes that separate two or more classes of data. By construction of these planes, the SVM discovers the boundaries between the input classes; the elements of the input data that define these boundaries are called support vectors.

For Gaussian radial basis

function: $K(x, x') = \exp(-|x-x'|^2/(2\sigma^2))$.

More on MRI as a screening test. It's recommended that women who get a screening MRI do so at a facility that can do an MRI-guided breast biopsy at the same time if needed. Otherwise, the woman will have to have a second MRI done at another facility when she has the biopsy. There's no evidence right now that MRI is an effective screening The tool for women at average risk. While MRI is. The kernel is then modified in data dependent way by using the obtained support vectors. The modified kernel is used to get the finalclassifier.

Laws requiring coverage for breast cancer screening

Federal law. Coverage of mammograms for breast cancer screening is mandated by the Affordable Care Act, which provides that these be given without a co-pay or deductible in plans that started after August 1, 2012. This doesn't apply to health plans that were in place before the law was passed (called grand fathered plans). You can find out the date your insurance plan started by contacting your health insurance plan administrator. Even grandfathered plans may still have coverage requirements based on state laws, which vary, and other federal laws.

State laws. Many states require that private insurance companies, Medicaid, and public employee health plans provide coverage and reimbursement for specific health services and procedures. The American Cancer Society (ACS) supports these kinds of patient protections, particularly when it comes to evidence-based cancer prevention, early detection, and treatment services.

The only state without a law ensuring that private health plans cover or offer coverage for screening mammograms is Utah. Laws on coverage vary slightly from state to state more sensitive than mammograms, it also has a higher false-positive rate. (This means it's more likely to find something that turns out not to be cancer.) This would lead to unneeded biopsies and other tests in many of the women screened, which can lead to a lot of worry and anxiety. The American Cancer Society believes the use of mammograms and MRI (in women at high risk), according to the recommendations outlined above, and offers women the best chance to reduce their risk of dying from breast cancer. This approach is clearly better than anyone exam or test alone.

RESULT

In this paper, a breast cancer prevention and early detection using some techniques. Breast cancer is a malignant tumor that starts in the cells of breast. A malignant tumor is a group of cancer cells that can grow into (invade) nearby tissues or spread (metastasize) to distant pats of the body. The methods includes the mammogram image was filtered with Gaussian filter based on standard deviation and matrix dimensions such as rows and columns. Then the filtered image is used for contrast stretching. Then the background of the image is eliminated using top hat operation. Then the top hat output is decomposed into two scales and then use DWT reconstruction. The reconstructed image is used for segmentation. Thresholding method is used for segmentation and then the features are extracted from the segmented tumor area. Then the final stage is classification using SVM classifier.

CONCLUSION

To know about the breast cancer prevention and early detection methods we need to summarize the developed methods, the initial step, based on early detection screening mammogram enhancement and the segmentation of tumor area and use of methods and also based on gray level information of image enhancement and segments the breast tumor. For each tumor region extract, morphological features are extracted to categorize the breast tumor. Finally the SVM classifier is used for classification.

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