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Breast Cancer Classification using SVM Classifier

E. Karthikeyan , S. Venkatakrishnan

Abstract: ***Early detection of breast cancer is believed to enhance the chance of survival. Mammography is the best available breast imaging technique at present which uses low-dose x-rays for detecting the breast cancer early before the symptoms are experienced. The most commonly present abnormalities in mammograms that may indicate the breast malignancy are masses and microcalcifications. The prime objective of this research is to increase the diagnostic accuracy of the detection of breast cancer malignancy in Computer Aided Diagnosis (CAD) systems by developing image processing algorithms and to categorize the women into different risk groups. The evaluation of SVM classifier has been considered. Initially, tumors have been detected from mammograms with the aid of morphological processing of breast images. Then classification is done by SVM classifier using the most dominant features namely GLRLM and Difference of Gaussian (DoG) features, which have been extracted from the selected region. The algorithm has achieved an accuracy of 89.11% using SVM classifier.***

Keywords*: CT, SVM, GLRLM , DoG*

I. INTRODUCTION

Breast cancer in urban areas of India is three times higher when compared with that in rural parts of the country (Dhillon et al. 2009).GLOBOCAN 2012 (Ferlay et al. 2015) reveals mortality has increased by 14%. The cancer burden is expected to grow in the less developed countries in which 82% of world population resides. Breast cancer falls under the category of lifestyle disease. .In India, around 3,56,256 women have been analyzed to have breast cancer. Around 9 out of 10 women have breast lumps. Around 270 women die because of breast cancer every year in the wide population group of Chinese, Malays and Indians. Due to the result of urbanization and changes in individual life style made India to be the most frequent growth of breast cancer in Asia. Detection of breast cancer through mammogram is the traditional strategy being followed for cancer identification through clinical examination. The frequencies of applying these strategies are unrealistic for various information and it's not reproducible because the people with thick breast have sometimes being detected with cancer which creates a stress among the human being so we require an additional system to assist the radiologist from false prediction. Digital mammography is considered as one of the reliable technique for detection of breast cancer.

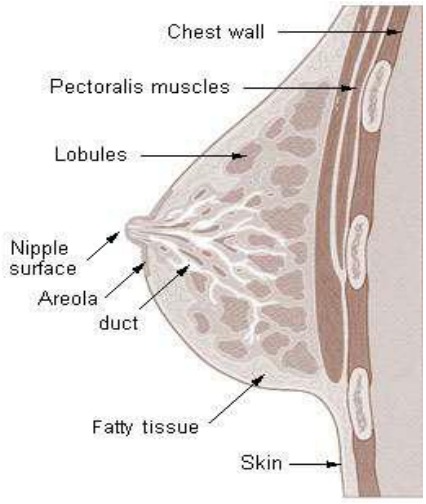

Figure 1 Breast Anatomy

Uncontrolled growth of cells is commonly referred as cancer. Breast cancer develops in the breast tissue due to the uncontrolled growth of breast cells. It commonly occurs almost entirely in women and there are chances for men to get the disease. There are two main types of breast cancer: 1. Ductal carcinoma 2.Lobular carcinoma.

II. LITERATURE REVIEW

Hu et al. (2011) proposed a adaptive threshold method to detect suspicious in mammograms.. Jawad Nagi et.al explored mammogram segmentation based on automatic technique. This makes use of seeded region growing (SRG) along with morphological pre-processing steps. S.Thamarai Selvi et.al introduced an algorithm for tumor detection. The work focuses on two things: detection of suspicious region of tumor with lower contrast and method to extract features from these regions to categorize tumors'. Converting the quality of image into better one and to the level of more understandable is in the enhancement of the image. The segmentation process helps in improving the detection and diagnosis of cancer. Thresholding is used for the image segmentation and features are extracted from the segmented part. SVM is used for classification.

Satish Saini and Ritu Vijay designed a system for detecting breast cancer using ANN. Its effect is checked for different number of layers and chooses numbers of layer for optimum result.

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The ANN is trained by the GLCM features of known mammogram images. The designing of the system is divided into two phases: learning phase and recognition phase.
Sudha and Selvarajan [2016], applied low pass filter to reduce the noise present in the input mammogram. The noise reduced image was used to identify and to remove the background information and the artifacts by basic cropping process. The cropped image further implemented for contrast enhancements for higher level of identification of masses present in the digital mammogram which is used to classify the severity of its own.

III. PROPOSED WORK

The proposed system includes pre processing, segmentation, feature extraction and classification.

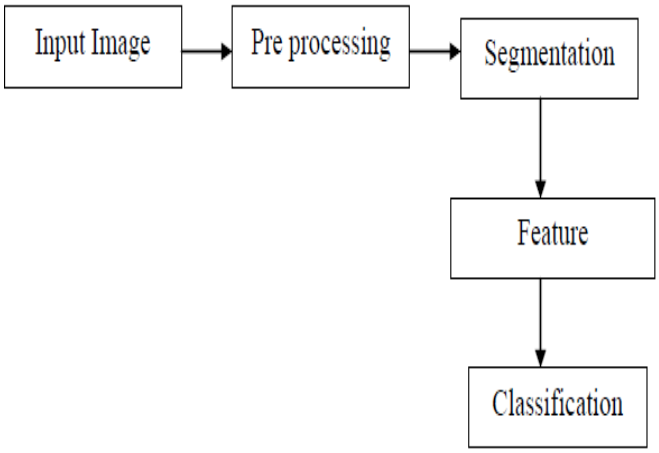

Figure 2 Proposed system Block diagram

The medical Images are pre-processed to ensure a better interpretation of the same towards a proper diagnosis. It also improves accuracy of the segmentation results. It reduce the complexity involved in color processing, resizing of image to the standard size and removing noise from image.
Image segmentation plays very important role in identification and partition of region of interest. Morphological technique is used to select the region of interest. This involves the process of selecting a certain fixed gray scale value called as threshold value and classifying the pixels of an image based on this threshold value. Then the image is normalized and is processed in two levels. In the initial level, the normalized image is dilated using structural element and subtracts the dilated image from normalized image. Then the resultant region obtained in the image is considered to be Region of Interest.

DoG filtering

The main focus of using Difference of Gaussians is to highlight the regions that are suspicious in the mammogram. The difference of Gaussian algorithm works by applying Gaussian blur of two types on the image, and different radius of blurring and the result is obtained by subtracting them. The algorithm is utilized for artificial vision and is an efficient method. The blurring radii which are the key parameters are set by using preview. It helps us to recognize the thicker edges obtained by increasing the smaller radius and thresholding is increased for edge detection by decreasing the larger radius.

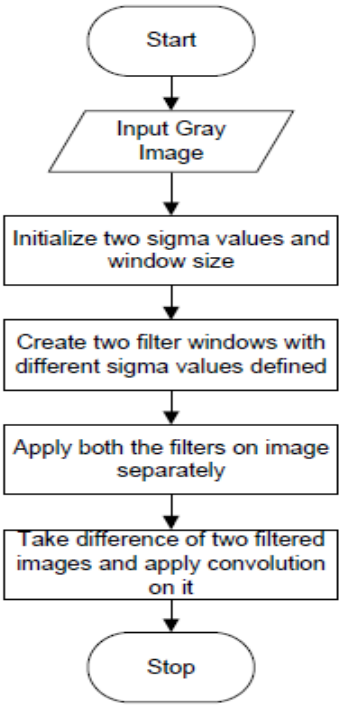

Figure 3 Flowchart of DOG Filter

GLRLM based Features Extraction

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SRE

$$SRE = \left(\frac{1}{n}\right) \sum_{i,j} (p(i,j)/(j)2)$$

LRE

$$LRE = \sum_{i,j} (j)2 \; p(I,j)$$

GLN

$$GLN = \frac{1}{n} \sum_{i} \left(\sum_{j} P(i,j)\right)_2$$

RLN

$$RLN = \frac{1}{n} \sum_{j} \left(\sum_{i} P(i,j)\right)_2$$

RP

$$RP = \sum_{i,j} \left(\frac{n}{p(i,j)_j}\right)$$

Low Grey Level Run Emphasis

$$LGRE = \sum_{i,j} (p(i,j)/(i)^2)$$

Support Vector Machines (SVM)

SVM achieves classification by generating an abstraction in the form of vectors called as support vectors, which belongs to the training set of vectors. SVM is very useful for classifying the data. There are situations where the data has to be segregated into testing set and training sets for achieving classifications. Each occurrence in the training set includes target value and numerous features. The purpose of the SVM is to come up with a model based on the training data. The model forecast the target values of the test data with the use of test data features. SVMs were essentially developed for classification tasks but now there scope has been extended to regression and preference learning tasks.

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SVM is generally viewed as binary classifier, where there will be positive or negative output of learning function. It abstracts a linear decision boundary from the data uses it to classify pattern belonging into the two classes.

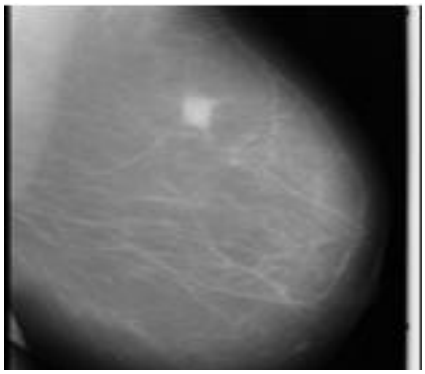
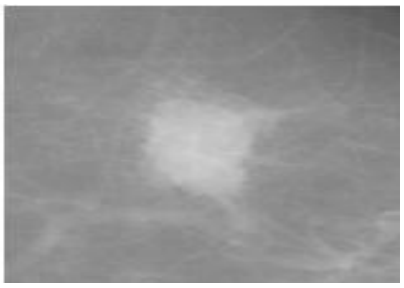


Figure 4 (a) Original Image



(b) Extracted ROI

Table 1. Number of images used to train SVM Classifier

Images	Normal	Abnormal	Benign	Malignant
Training	54	40	26	14
Testing	60	45	24	21

IV.EXPERIMENTAL RESULTS

Table2. Success rates of for the categorization of images as normal and abnormal.

GLRLM +SVM classifier			
Scale	Accuracy	Sensitivity	Specificity
1	100	1	1
2	100	1	1
3	98	0.89	1
4	90	0.81	1

Table3. Success rates for the categorization of images as benign and malignant.

GLCM +SVM classifier			
Scale	Accuracy	Sensitivity	Specificity
1	100	1	1
2	96	0.91	0.90
3	86	0.72	0.69
4	68	0.63	0.63

V. CONCLUSION

MIAS data set are utilized in the exploration work for examination. These databases involve 105 mammograms, out of which 60 are ordinary and 45 are malignant. This paper describes the CAD system for detecting breast cancer in the ROI of digital mammography. The study also examined system performance using the GLRLM and SVM methods. These results indicate that the GLRM and SVM transformations are useful methods and are widely used to distinguish mammographic images as normal, benign and malignant.

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