Virtual Instrumentation Based Breast Cancer Detection and Classification Using Image-Processing

Bhagyashri K Yadav[1], Dr. Prof. M. S. Panse[2]
[1]*Student, M Tech Electronics,* [2]*Professor*
[1, 2]*Department of Electrical Engineering, Veermata Jijabai Technological Institute, Mumbai, India*

***Abstract*: Breast cancer is an important cause of death in woman. An initial symbol of breast cancer is multiplication of malignant cells in the mammogram. The projected method has been applied in five stages consisting of image preprocessing, extraction of ROI, feature extraction, normalization and classification. In this procedure, we can count the number of defected cells and find their location with image processing. To classify the cancerous region the SVM (SUPPORT VECTOR MACHINE) based classifier technique is used in this paper. The projected method has been estimated with MINI MAMMOGRAM IMAGE ANALYSIS SOCIETY (MIAS) database and validated with 200 images of MIAS database.**

***Keywords*: Breast Cancer, Mammography, Feature extraction, Support vector machine, Region of Interest**

I. INTRODUCTION

Breast Cancer cells are characterized by unrestrained division principal to abnormal growth & the ability of these cells to arrive in normal tissue locally or to spread through the body. This evolution is called metastasis. Hence early detection of breast cancer is essential in effective treatment and in reducing the number of deaths caused by it. There are mainly two types of breast cancer; Ductal carcinoma is the most common cancer in which cancer begins in the milk duct and the second one is that cancer which begins in the lobules which is called lobular carcinoma[2]. We can segregate the Cancer specimens by using risk dynamics. It may be genetic or environmental depending on Symptoms of breast cancer. Genetic factors include family history, personal health history, menstrual and reproductive history, dense breast tissue, certain genome changes, age, gender etc. The environmental factors include obesity, poor diet, alcohol consumption, and radiation, lack of physical activity etc. [3] .The initial symptom of a breast cancer is basically due to the formation of a lump which is due to tiny deposits of calcium called micro-calcifications. These tumors are generally Benign or malignant. The benign tumors are generally non-cancerous; they will not spread to other body parts. The malignant tumors on the other hand are considered as cancerous; they will spread all over the body. These cells are metastatic in nature [4].

In India, over 100,000 women are lately diagnosed with breast cancer every year and it has become the leading cause for death among women in metropolitan cities [2], also it is the second most common cancer all over the world. Mammography is the analytic broadcast procedure to detect breast cancer in the female breast using low-dose X-rays. The difference in concentration of X-rays between the various tissue components of the breast such as fat, tumor tissue, and calcifications. If the mammography is not satisfactory, then other methods can be used such as ultra sonography and MRI. Usually mammography will detect about 80–90% of the breast cancers in women. On the other hand, digital mammography takes an electronic image of the breast and stores it directly on a computer.

There are several imaging techniques for detection of the breast cancer, including magnetic resonance imaging (MRI), ultrasound imaging, and X-ray imaging. A mammogram is considered as the safest method for primary detection of breast cancer. Mammography uses low dose X-rays to produce an image that letsan imagining of the internal structure of the breast.

R. Ramani et al [6] has researched on the preprocessing procedures for breast cancer detection in mammography images. They were studied on adaptive median, mean & wiener types of filtering used for preprocessing to improve and smoothen image excellence, eliminate the noise, conserve all edges inside an image. It mainly concentrates on the MSE(Mean Square Error), PSNR(Peak Signal to noise ratio).Lastly, considering the virtual output parameters such as image quality, MSE, PSNR, operational content and standardized absolute error on the 200 mammogram images (MIAS) dataset.

D.Sujitha Priya et al [7] exploration on breast cancer detection in mammogram images using region-growing and contour-based segmentation methods. Adaptive Median Filtering technique when executed with a Median filter, shaped the best result among three with measuring MSE and PSNR value.

II. BREAST CANCER DETECTION STAGE

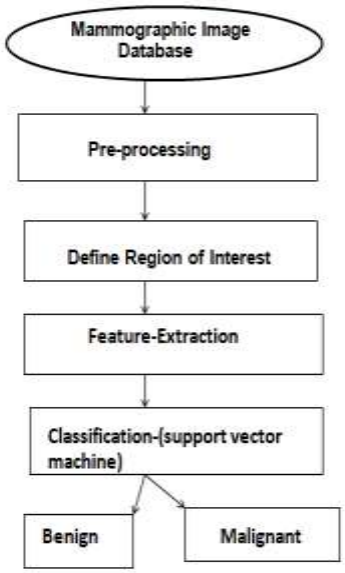

Fig 1. Algorithm of Image processing

1. Image Pre-Processing

In our planned method the first step is preprocessing using a nonlinear Median filter which is effective in eliminating salt and pepper noise, median inclines to keep the sharpness of image edges while removing noise [7]. Also in this, the quality of the image is improved and smoothed.

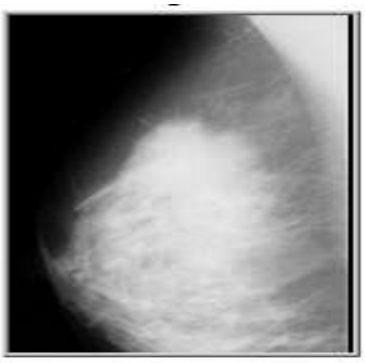

Fig 1.Original image

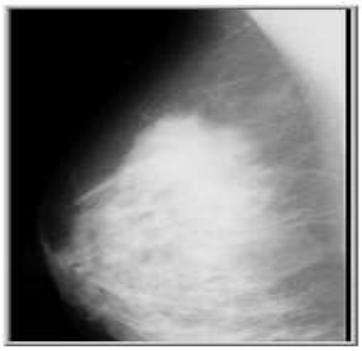

Fig 2.Median Filterd image

2. Region of Interest (ROI)

After pre-processing we define the Region of Interest (ROI) that is the specific area of the breast which shows the cancerous region on the mammographic image .The Pre-processing increases the recognition rate and it is followed by feature extraction. We search for the ROI region to locate the cancerous breast tumor using Fast Fourier Transform.

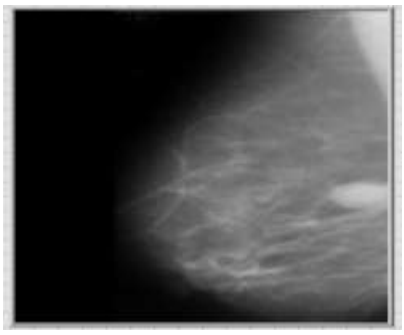

Fig 3.Cancer Image

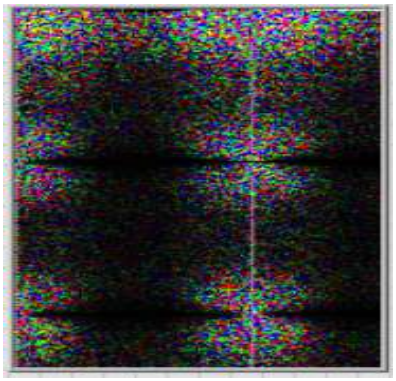

Fig 4.ROI of Cancer image

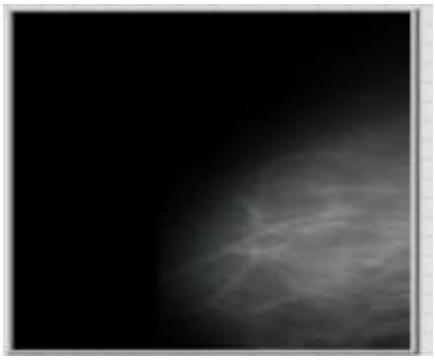

Fig 5.Filtered ROI of Cancer image

III. STATISTICAL FEATURE EXTRACTION AND CLASSIFICATION

The statistical feature extraction and classification plays an important role in the detection of cancer. The purpose of feature extraction process is to characterize raw image into its compressed form to simplify decision-making process such as pattern classification [12], to acquire high classification ratio.

The set of statistical features are extracted in order to differentiate between normal & abnormal pattern. Extracted features are used in Support vector machine classifier to sequence it for the acknowledgement of specific class; either benign or malignant. The capability of the classifier to allocate the unknown object to the correct class is in need of the extracted features [12].

Let Q be present the number of possible concentrations in an image X × Y pixels, Si, i= 0,1,2……,Q-1, their concentration values, and ni the absolute frequency of Si whicharises in the image. P is the probability of the occurrence of Si in the image.

Mean: It is the ordinary value of concentration of the image and it is well-defined as,

[1]

$$\mu = \sum_{i=0}^{Q-1} S_i P(S_i)$$

Standard Deviation: It is the square root of the variance and it is the evaluation of mean square deviation of gray pixel value P (Si) from its mean value. It is well-defined as,

[2]

$$\sqrt{\sigma^2} = \sqrt{\sum_{i=0}^{Q-1} (S_i - \mu^2) P(S_i)}$$

Entropy: Entropy is a arithmetic measure of randomness that can be used to describe the quality of the input image. It is well-defined as,

[3]

$$E = -\sum_{i=0}^{Q-1} P(S_i) \log_2^{[P(Si)]}$$

Skewness: S_k describes the degree of asymmetry of a pixel spreading in the indicated window around its mean and it is defined as,

[4]

$$S_k = \frac{E\,(S - \mu)^3}{\sigma^3}$$

Kurtosis: K measures the Peak-ness or flat-ness of a spreading relative to a normal distribution. It is defined as,

[5]

$$K = \sum_{i=0}^{Q-1} (S_i - \mu^4) P(S_i)$$

Variance: Variance is the square root of standard deviation and it is the average of squared differences from the mean. It is defined as,

[6]

$$\sigma^2 = \sum_{i=0}^{Q-1} (S_i - \mu^2) P(S_i)$$

IV. SUPPORT VECTOR MACHINE

A Support Vector Machine (SVM) is a supervised learning method that generalizes a large set of trained samples into a smaller number of support vectors to predict the class of unknown samples. The SVM algorithm then identifies a hyper-plane that separates the support vectors of each class. A good separation is achieved by the hyper-plane that has the largest distance to the nearest training data points of any class. In general larger the margin, lower is the generalization error of the classifier. An SVM training algorithm builds a model that predicts whether a given data falls into one category of cancer or the other [10]. Classification speed depends on the number of support vectors and the selected kernel function.Normalization is a method used to standardize the range of independent variables or features of data. Normalization can be performed at the level of the input features or at the level of the kernel.

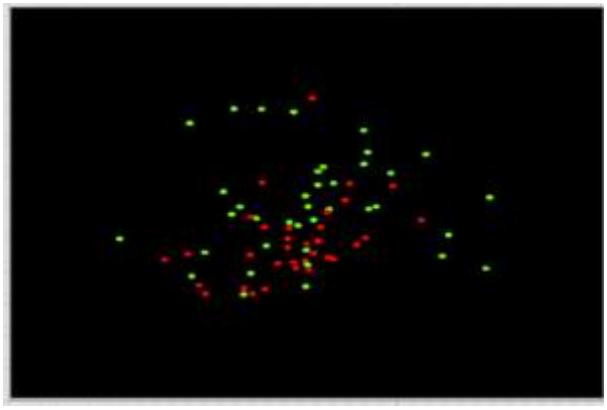

Fig.Training Data

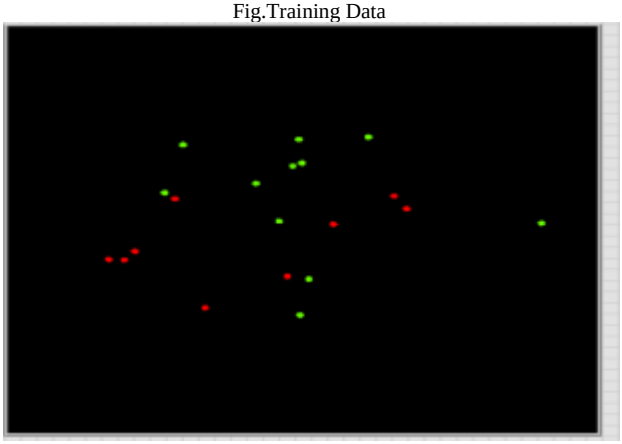

Fig. Testing Data

V. RESULT AND CONCLUSION

In this paper, we have presented the Image processing technique to improve the diagnostics of Cancer detection and classification efficiently using VI. The technique was validated by testing 200 images, out of which 100 images were normal and 100 were abnormal.We have presented the Statistical analysis tool to extract features for classification purpose.By calculating the defected cells we can monitor the effect of medical treatment on the growth of the cancer cells. The SVM classification scheme has been applied on mammography database.

Table 1: ACCURACY OF THREE TYPES OF MAMMOGRAMS

Type	Training	Testing	Sensitivity(%)	Specificity(%)	Accuracy(%)
Normal	100	40	96	98	95
Cancer	80	20	94	96	85

Accuracy =(TP+TN)/(TP+TN+FP+FN)

SENSITIVITY=(TP)/(TP+TN)

SPECIFICITY=(TN)/(TN+FP)

From the experimental results, it can be seen that the classification accuracy after normalization is much improved as compared to that before normalization for various datasets. Also, an improvement in classification accuracy can be seen for different normalization techniques on these datasets.The accuracy of recognition is about 90% .The sensitivity and specificity is also good.Our future work here is to extend the various classification technique in VI.

REFERENCES

[1]. Bhagyashri,"Different Image pre-processing and Feature extraction technique for Breast cancer detection in labview",IJSTEV4I7028, Volume : 4, Issue : 7,pp 56-58.

[2]. Every Women Counts, Resource for Health Professionals.

[3]. National Breast Cancer accounts.

[4]. A Review On Breast Abnormality Segmentation And Classification Techniques

[5]. JawadNagi , Sameem"Automated Breast Profile Seg-mentation for ROI Detection Using Digital Mammo-grams", 2010 IEEE EMBS Conference on Biomedical Engineering & Sciences (IECBES 2010), pp87-99,2010.

[6]. R. Ramani "The Pre-Processing Techniques for Breast Cancer Detection in Mammography Images**"** I.J. Image, Graphics and Signal Processing, pp 46-56, 2013.

[7]. D. SujithaPriya "Breast Cancer Detection in Mammo-gram Images Using Region-Growing And Contour- Based Segmentation Techniques" International Journal of Computer & Organization Trends ,Volume 3, Issue 8 Sep 2013,ISSN: 2249.

[8]. Ojo J. A., Adepoju T. M., Omdiora E. O., Olabiyisi O. S. and Bello O. T, 'Pre-Processing Method for Extraction of Pectoral Muscle and Removal of Artefacts in Mammogram,' IOSR Journal ofComputer Engineering (IOSR-JCE) e-Volume 16, Issue 3, Ver. V (May-Jun. 2014).

[9]. S.JulianSavari Antony, Dr.S.Ravi, 'A New Approach to Determine the Classification of Mammographic Image Using K-Means Clustering Algorithm', International Journal of Advancements in Research & Technology, Volume 4, Issue 2, February -2015 .

[10]. Chih-Wei Hsu, Chih-Jen Lin, "A Practical Guide to Support Vector Classification", Dept of Computer Science National Taiwan Uni, Taipei, 106, Taiwan.

[11]. M. L. Kyoung and W. N. Street, "An Adaptive Resource-Allocating Network for Automated Detection, Segmentation, and Classification of Breast Cancer Nuclei Topic Area: Image Processing AndRecognition," IEEE transactions on neural networks, vol. 14, no. 3, May 2003, pp.679-688.

[12]. D. L. Pham, "Unsupervised tissue classification in medical images using edge-adaptive clustering," inProc. of 25th Annual InternationalConference of the IEEE Engineering in Medicine and Biology Society,2003, vol. 1, pp. 633-638.

[13]. Padmanabhan,S ,Sundararajan,R, "Enhanced accuracy of breast cancer detection in digital mammograms using wavelet analysis," Machine Vision and Image Processing (MVIP), International Conference on , vol., no., pp.152-157, 14-15 Dec. 2012

[14]. Jinshan Tang, Yongyi Yang, "Computer-Aided Detection and Diagnosis of Breast Cancer With Mammography: Recent Advances," Information Technology in Biomedicine, IEEE Transactions on , vol.13, no.2, pp.235 &251, March 2009.

[15]. S. Deepa, Dr.V.SubbiahBharathi, 'Textural Feature Extraction and Classification of Mammogram Images using CCCM and PNN**',** IOSR Journal of Computer Engineering (IOSR-JCE) ,Volume 10, Issue 6 May. - Jun. 2013

[16]. J. Suckling, J. Parker, D. R. Dance, S. M. Astley, I. Hutt, C. R. M. Boggis, I. Ricketts, E. Stamatakis,N.Cerneaz, S. L. Kok, P. Taylor,D. Betal, and J. Savage, "The Mammographic Image Analysis Society digital mammogram database," In Proc. International Workshop on Digital Mammography, pages 211-221, 1994.

[17]. Gr´egoire Mercier and Marc Lennon, "Support Vector Machines for Hyperspectral Image Classification with Spectral-based kernels," IEEE Transactions 2003, 0-7803-7930-6.

[18]. S. Shanthi, and V. MuraliBhaskaran ,'Computer Aided System for Detection and Classification ofBreast Cancer', International Journal of Information Technology, Control and Automation (IJITCA) Vol.2, No.4, October 2012

[19]. Neeta Jog, Arvind Pandey, 'Implementation of Segmentation and Classification Techniques for Mammogram Images', IOSR Journal of Engineering (IOSRJEN), Vol. 05, Issue 2,(February 2015)