R.Ramani, Dr.S.Suthanthiravanitha, S.Valarmathy / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 5, September- October 2012, pp.1124-1129

A Survey Of Current Image Segmentation Techniques For Detection Of Breast Cancer

R.Ramani[*], Dr.S.Suthanthiravanitha[**], S.Valarmathy[***]
[*] (Assistant Professor, Vmkv engineering college)
[**] (Professor/EEE, Knowledge institute of technology)
[***] (Assistant Professor, Vmkv engineering college)

Abstract
Breast cancer is one of the most common forms of cancer for women. Accuracy rate of breast cancer in mammograms depend on the segmentation of images. Mammography is especially used only in the breast tumor detection Mammogram breast cancer images have the ability to assist physicians in detecting disease caused by cells normal growth. The goal of segmentation is to simplify and or change the representation of an image into something that is more meaningful and easier to analyze, but the same time image segmentation is very difficult job in the image processing. The main aim of this paper is to review existing approaches of preprocessing and current segmentation techniques in mammographic images. The objective of preprocessing is to improve the image quality, removing the irrelevant noises and unwanted parts in the background of the mammogram. There are different types of segmentation algorithms for mammogram image. Their advantages and disadvantages are discussed.

Keywords: ***Breast Cancer, Mammogram, Preprocessing, Segmentation algorithms***

I.INTRODUCTION
The many of research works conducted in the area of breast cancer detection and classification much university, commercial institution and research centers are focused on this issue because of the fact that breast cancer is becoming the most common form of cancer disease of today's female population. Breast cancer is the second most common cancer in Indian women. in the united states alone a most recent survey estimated 2, 07,090 new cases of breast cancer and 39,840 death in women during 2010[1].the average incidence rates varies from 22-28 per 10,00,000 women per year in urban setting to 6 per 1,00,000 women per year in rural areas' X-ray mammography is the most common investigation techniques used by radiologists in interpretation of the mammograms. It is necessary to detect the presence or absence of lesions from the mammograms [2-3].however the appearance of breast cancer is very subtle and unstable in their early stages. Therefore doctors and radiologists can miss the abnormality easily if they only diagnose by experiences. Computed aided detection technology can help doctors and radiologists getting a more reliable and effective diagnoses there are numerous tumor detection techniques have been analyzed [4-5]. The key task in designing such image processing and computer vision application is the accurate segmentation of medical images. Image segmentation is the process of portioning different regions of the image based on different criteria[6].breast cancer image segmentation from mammography images is complicated and challenging but its precise and exact segmentation is necessary for tumor detections and their classification of tissues for early detection of abnormalities in breast. Mammography imaging is most efficient imaging techniques. Mammography is highly accurate but like most medical tests, it is not perfect [7].on average mammography will detect above 80% - 90% of the breast cancer in women without symptoms. To accurate segmentation of breast images challenge, however, accurate image segmentation of the mammography images is very important and crucial for the exact diagnosis by computer aided clinical tools lot of Varity of image segmentation algorithms have been developed for mammography images. In this paper we present a review of the methods used in mammography image segmentations. The review covers mammography images and noise reduction and image segmentation approaches. The paper concludes with a discussion on the upcoming trend of advanced researches in breast cancer image segmentation.

II LITERATURE REVIEW
Segmentation is the process of partitions an image to several small segments the main difficulties in image segmentation are, noise, bias field, partial volume effect (a voxel contributes in multiple tissue types)

A.De-noising methods [Decreases the noise]
In image pre-processing techniques are necessary in order to find the orientation of the mammogram to remove the noise and to enhance the quality of the image[8].the pre-processing steps are very important in order to limit the search for

abnormalities without undue influence from back ground of the mammograms. The main objective of this process is to improve the quality of the image to make it ready to further processing by removing the unrelated and surplus parts in the back ground of the mammograms [9].

1. Adaptive median filter

Adaptive median filter works on a rectangular region Pxy, it changes the size of Pxy during the filtering operation depending on certain conditions such as

Zmin = minimum pixel value in Pxy
Zmax = maximum pixel value in Pxy
Zmed = median pixel value in Pxy
Pmax = maximum allowed size of Pxy

Each output contains the median value in 3 by 3 neighborhoods around the corresponding pixel in the input images. The edges of the image however are replaced by zeros [10].adaptive median filter has been found to smooth the non repulsive noise from 2D signals without blurring edges and preserve image details. This is particularly suitable for enhancing mammograms images.

2. Mean filter

The mean filter replaces each pixel by the average value of the intensities in its neighborhood. It can localy reduce the variance and is easy to implement [11].

3. A markov random field method

In this method spatial correlation information is used to preserve fine details [12].in this method regularization of the noise estimation is performed. The updating of pixel value is done by iterated conditioned modes.

4. Wavelet methods

In frequency domain these method is used for de-noising and preserving the signal application of wavelet based methods on mammography image makes the wavelet and scaling coefficient biased. This problem can be solved by squaring mammograms images by non central chi-square distribution method [13].

5. Median filtering

A median filter is a non linear filter is efficient in removing salt and pepper noise median tends to preserve the sharpness of image edges while removing noise. The various of median filter are i) centre-weighted median filter ii) weighted median filter iii) max-median filter, the effect of increasing the size of the window in median filtering noise is removed effectively.

6. Max-Min filter

Maximum and minimum filter attribute to each pixel in an image a new value equal to the maximum or minimum value in a neighborhood around that pixel. The neighborhood stands for the shape of the filter, maximum and minimum filters have been used in contrast enhancement.

B. IMAGE SEGMENTATION

The main objective of image segmentation is to extract various features of the images which can be merged or split in order to build objects of interest on which analysis and interpretation can be performed. Image segmentation refers to the process of partitioning an image into groups of pixels which are homogeneous with respect to some criterion. The result of segmentation is the splitting up of the image into connected areas. Thus segment is concerned with dividing an image into meaningful regions. The image segmentation techniques such as thresholding, region growing, statistics models, active control modes and clustering have been used for image segmentation because of the complex intensity distribution in medical images, thresholding becomes a difficult task and often fails [14-15].

1. Region growing segmentation

Region growing is an approach to image segmentation in which neighboring pixels are examined and added to a region class if no edges are detected. This process is iterated for each boundary pixel in the region. If adjacent regions are found, a region merging algorithms is used in which weak edges are dissolved and strong edges are left intact. The region growing starts with a seed which is selected in the centre of the tumor region. During the region growing phase, pixels in the neighbor of seed are added to region based on homogeneity criteria thereby resulting in a connected region [15].

2. Random walk method

The random walk method is used to segment the breast tissues for detection of cancerous cells. Random walk is defined as discrete random motion in which a particle repeatedly moves a fixed distance up, down, east, south and north. This is a region growing based image segmentation method based on random walk of a particle. In this method the initial position at which a particle is initially present is known as seed point movement from one position to another is based on the probability calculation. After the seed point has been detected random walk method is to be performed for segmentation and ten fine segmented [16].

3. Watershed algorithm

The watershed is a powerful tool for image segmentation in watershed the image is considered as a topographic surface. The watershed algorithms have been developed and tested on Varity of mammogram breast cancer images [17]. It has been found that the result of segmentation gives very

good suggestion to a radiologist and doctors to further investigate on the presence of micro calcifications in the breast tissue. Various steps involved in watershed algorithms such as
Input image.
Input image converted to gray scale image.
Filter is used for noise removed.
Median filter is used to enhance the quality of image.
Apply threshold segmentation.
Apply watershed segmentation.
Morphological operation.
Finally output will be a tumor region.

4. Adaptive mean shift algorithm

Adaptive mean shift algorithm is obtained from mean shift clustering mean shift algorithm. The
Basic mean shift clustering algorithm maintains a set of data points the same size as the input data set. A mean shift algorithm that is similar then to k-means called likelihood mean shift, replaces the set of points undergoing replacement by the mean of all points in the input set that are within a given distance of changing set. One of the advantages of mean shift over k-means is the there is no need to choose the number of cluster, because mean shift is likely to find only a few clusters if indeed only a small number exist. However, mean shift can be much slower than K means. Mean shift has soft variants much as K-means does.

$$m_{h,G}(x) = \frac{\sum_{i=1}^{n} x_i g\left(\left\|\frac{x-X_i}{h}\right\|^2\right)}{\sum_{i=1}^{n} g\left(\left\|\frac{x-X_i}{h}\right\|^2\right)} - x \quad \text{---1}$$

This is the difference between the weighted mean and x, known as mean shift vector. Since the gradient of the density estimator always points towards that direction in which the density rises most quickly, from the above Equation the mean shift vector always points towards the direction in which the density rises most quickly. This is the main principle of mean shift-based clustering. This equation is generalized into

$$m_G(x) = \frac{\sum_{i=1}^{n} \frac{1}{h_i^{d+2}} x_i g\left(\left\|\frac{x-X_i}{h_i}\right\|^2\right)}{\sum_{i=1}^{n} \frac{1}{h_i^{d+2}} g\left(\left\|\frac{x-X_i}{h_i}\right\|^2\right)} - x \quad \text{---2}$$

This is referred to as adaptive mean shift vector. The adaptive mean shift vector always points towards the direction in which the density rises most quickly, which is called the mean property. This is the basic principle of adaptive means shift based clustering [18].

5. Wavelet based adaptive windowing method

The wavelet based adaptive windowing method is used for the segmentation of bright targets in an image. In these method two types of segmentation is used for mammogram to detect tumor. Coarse segmentation is implemented by using wavelet based histogram thresholding, where the threshold value is chosen by performing in wavelet based analysis of pdf of wavelet transformed images at different channels and second one is fine segmentation which is obtained by choosing threshold by using windowing method. The wavelet based adaptive windowing method is effective to segment the tumor in mammograms and it can also be used in other segmentation applications. This method of segmentation yield significantly superior image quality when it's compared to the global threshold method and window based adaptive thresholding method [19].

6. K-Means clustering method.

The k-means algorithms are an iterative technique that is used to partition an image into k-cluster. In statistics and machine learning, k-means clustering is a method of cluster analysis which can to portions n observation into k cluster in which each observation belongs to the cluster with the nearest mean [20-21]. The basic algorithms is given below

- Pick k cluster centre's either randomly or based on some heuristic.
- Assign each pixel in the image to the cluster that minimum the distance between the pixels cluster centre.
- Re-compute the cluster centre's by averaging all of the pixels in the cluster.

Repeat last two steps until convergences are attained. The most common algorithm uses an iterative refinement technique; due to this ambiguity it is often called the k-means algorithms.

7. Fuzzy c-means

The fuzzy c means algorithms also known as fuzzy ISODATA is one of the most frequently used methods in pattern recognition fuzzy c-means is a method of clustering which allows one piece of data to belong to the two or more cluster[22]. It is based on the minimization of objective function to achieve a good classification. J is a squared error clustering criterion and solutions of minimization are least squared error stationary point of J in the following equation

$$J_m = \sum_{i=1}^{K}\sum_{j=1}^{C} u_{ij}^{m} \left\|x_i - c_j\right\|^2 \quad 1 \le m < \infty \quad \text{---3}$$

Fuzzy partitioning is carried out through an iterative optimization of the objective. The clustering method for both k means algorithms and fuzzy c means algorithms is same but in k means algorithm when it cluster, it takes the mean of the weighted cluster so as easy to identify masses or the origin point of cancer and tumor. Similarly in FCM, it considers that each point has weighted value associated with cluster. Doing this were able to find out how much the cancer has spread out, this is helped to us to find out the stages of breast cancer[23].

8. Vector Quantization

The main objective of the vector quantization segmentation method to detect cancerous mass from MRI images. In order to increase radiologist's diagnostic performance, computer-aided diagnosis (CAD) scheme have been developed to improve the detection of primary signatures of this disease: masses and micro calcifications. During the past many researchers in the field of medical imaging and soft computing have made significant survey in the field of image segmentation. Image segmentation techniques can be classified as based on edge detection, region or surface growing, threshold level, classifier such as Hierarchical Self Organizing Map (HSOM), and feature vector clustering or vector quantization. Vector quantization has proved to be a very effective model for image segmentation process. Vector quantization is a process of portioning an n-dimensional vector space into M regions so as to optimize a criterion function when all the points in each region are approximated by the representation vector associated with that region. There are two processes involved in the vector quantization: one is the training process which determines the set of codebook vector according to the probability of the input data, the other is the encoding process which assigns input vectors to the code book vectors [24].
Tumors or calcifications are embedded in an inhomogeneous background. In mammograms, background objects may even appear brighter. Therefore, global threshold methods suffer considerable drawback. Vector quantization segmentation algorithm attempts to overcome such drawbacks. Vector quantization is based on clustering algorithm. Clustering is the process of grouping a data set in a way that the similarity between data within a cluster is maximized while the similarity between data of different clusters is maximized and is used for pattern recognition in image processing. Quantization methods are used for tumor detection in MRI images. From results it is observed that proposed method gives far better results compared to morphological Segmentation. The Algorithms are Identification rate for vector quantization method is 71.5%
and for Morphological Segmentation Identification Rate is 66.7%.**[25]**

9. Segmentation by Morphological Algorithm

Mathematical morphology is used as a tool for extracting image components such as boundaries in image segmentation. Since language of mathematical morphology is set theory, this segmentation approach is based on binary image. This algorithm includes two major steps: preprocessing and segmentation. Thresholding is used to convert input image into binary image. Since tumor tissue tends to have maximum intensity in mammograms, normally closed to 1 in gray level, a global threshold could serve as the first cut in the process and convert the image into binary image. Dilation and erosion are two basic morphological operations defined by equation (2) and (3) respectively [26].

$$A \oplus B = \{z \mid (B)_z \cap A \neq \varnothing\} \quad (2)$$

$$A \Theta B = \{z \mid (B)_z \subseteq A\} \quad (3)$$

The simplest way to realize boundary extraction of a binary image A is given by equation (4) [26],

$$\beta(A) = A - (A \Theta B) \quad (4)$$

where B is a suitable structuring element. However, there could be noise present by this method, instead of using original binary image A; dilation of A, that is, A⊕B could be
used. Equation (5) is the resulting edge detection formula.

$$\beta(A) = (A \oplus B) - ((A \oplus B) \Theta B)) \quad (5)$$

10. Level Set Model

Many of the PDEs used in image processing are based on moving curves and surfaces with curvature based velocities. In this area, the level set method developed by Osher and Sethian[27] was very influential and useful . The basic idea is to represent the curves or surfaces as the zero level set of a higher dimensional hyper surface. This technique not only provides more accurate
Numerical implementations but also handle topological change very easily. It has several advantages; its stability and irrelevancy with topology, displays a great advantage to solve the problems of corner point producing, curve breaking and combining etc. Since the edge-stopping function depends on the image gradient, only objects with edges defined by gradients can be segmented. Another disadvantage is that in practice, the edge-stopping function is never exactly zero at the edges, and so the curve may eventually pass through object boundaries [28]

11. Multiobjective Image Segmentation

Earlier image segmentation problem has been treated as mono objective. Mono-objective

images considers only one objective, because a single segmentation image. Such type of segmented images are of good quality but may not allow a higher level process (as image segmentation considered as low level process & pattern recognition, object tracking & scene analysis as high level process) to extract all information included within the image. So different segmentation results are calculated. Image segmentation is a multi objective optimization problem [29]. The consideration of multiple criteria (objectives) starts from the understanding of image pattern to its selected segmentation process involved (feature selection/extraction, similarity/ dissimilarity measure) and finally the assessment of its output (validity assessment). As there are possibilities of multiple sources of information for a segmentation problem, thus multiple representations have to be considered, for example, feature selection is the process of identifying similarity criteria used in segmentation process, now either only single criteria is used, that is intensity of pixels, or to make it a multi objective problem consider several similarity criteria to segment same image, which can be intensity, color, texture, shape, spatial information. For instance, in segmenting a medical image based on CT scan, multiple features like intensity, shape and spatial

Relationship could be considered. Similarly criteria for inter pattern similarity that is grouping can be multiple, spatial coherence vs. feature homogeneity, connectedness vs. compactness, diversity vs. accuracy. For image segmentation multiple methods can be used for getting appropriate output, and there may be a tendency for multiple optimizations and decision making processes where multiple validity assessment should be used.[28] There are two general approaches for Multi objective optimization problem, the first approach is to combine multiple objective functions into a single composite function, and the second is to determine a set of solutions that are non-dominated with respect to each objective.

III. CONCLUSION

Image segmentation is one of the most challenging and active research areas in the field of medical image processing. Mammogram Image segmentation is a challenging task and there is a need and huge scope for future research to improve the accuracy, precision and speed of segmentation methods. Thus there is no single method which can be considered good for neither all type of images, nor all methods equally good for a particular type of image. Due to all above factors, image segmentation remains a challenging problem in image processing and computer vision and is still a pending problem in the world. Further works may be conducted to develop efficient segmentation methods.

REFERENCES

[1]. The American college of radiology (ACR), http://www.acr.org//
[2]. Stems .e.e(1996) can j. sung. Vol 33-pp128-132
[3]. Highmam R and Brady M(1999) mammogaraphic image analysis,klworers academic publishers,isbn:0-7923-5620-9.
[4]. Sheng zhow Xu and hong Liu&Enmin song “marker-controlled watershed for lesion segmentation in mammograms”.J digital imaging 24:754-763,2011
[5]. M.Grgic et al.[eds];recc Advan.in mult.sig.processing and communication sci231,pp631-657,2009
[6]. chang PL .Teng wg(2007) exploting the self organiszing map for medical image segmentation,in,twentieth IEEE international sysmposium on computer based medical systems.pp281-288
[7]. Guido .M.te Brate and Nico Karssemrjes,single and multiscale detection of masses in digital mammograms,IEEE Transations on Medical imaging Vol.18,no 7,july1999,628-638.
[8]. Samir kumar bandyopathyay,pre-processing of mammogaram images,international journal of engineering science and technology,vol.2(11),2010,6753-6758.
[9]. D. narvain ponraj,m.evangelin jenifer,p.poongodi,j.samuvel manoharan.a survey on the pre-processing techniques of mammogram for the detection of breast cancer, journal of emerging trends in computing and information sciences.vol 2,no:12,December 2011.
[10]. Jwad nagi automated breast profile segmentation for ROI detection using digital mammogram IEEE EMBS confrerence on bio-medic al engineering and sciences(Iecbes2010),kuala lumpur.
[11]. Junn shan wen ju,yanhui, guoa, ling zhang, h.d.cheng. automated breast cancer detection and classification using ultrasound images-a survey. Pattern recognition 43,(2010) 299-317
[12]. an s.an d(1984) stochastic relaxation gibbs distribution and the Bayesian restoration of images,IEEE trans pattern and mach intel 721-741.
[13]. nowak rd (1999) wavelet based rician noise removal for MRI images,IEEE trans image processing.8(10);1408-1419.
[14]. Suzuki h.torkakij (1991) automatic segmentation of head MRI images by knowledge guided thresholding,computer medical imaging graphic15(4);233.

[15]. Dr.samir kumar bandhyopathyway,tuhin utsab paul,segmentation of brian MRI imges research in computer science and software engineering,volume 2,issue 3,march2012,issn;2277 128x.
[16]. Mona choubey,suyash agarwal, an implementation of randow walk algorithms to detect Brain cancer in 2d MRtionI , international journal of engineering research and applications. Vol 2,issue 1,jan-feb 2012,pp998-1001,
[17]. Vincent L and soiled P(1996) IEEE trans on machine intel vol 18,no 12,pp.1163-1173.
[18]. M.C. jobin Christ,Dr.R.M.Parvathi,an adaptive mean-shift algorithm for MRI BRAIN segmentation. International journal of engineering science and technologies.issn;0975-5462, vol 3,no 7, july 2011
[19]. G.bharatha sreeja, Dr.P.Rathika, Dr.D.Devaraj, "detection of tumors in digital mamoograms using wavelet based adaptive windowing method",international journal modern education and computer science,2012, 3,57-65.
[20]. T. Kanungo. D.M Mount ,N.Netanyahu,C.Piatko,R.Silverman and A.Y.wa(2002),an efficient k-means clustering algorithms,analysis and implementation proc.IEEE conference computer vision and pattern recognition pp.881-892.
[21]. Bhagwati charanpatel, Dr.G.R.sinha, an adaptive k-means cluster algorithms for breast image segmentation, international journal of computer applications(0975-8887),vol 10-n 4 ,nov-2010
[22]. Thangavel. K. mohideran,a. k ,dept.of comp.sci,periyar university,salem,india. " semi-supervised k means clustering for outlines detection in mammogram classification" appears in treandz in information science and computing(2010)
[23]. An edge detection method for microcalcification cluster in mammogram by yu guang zhang wen Lu Fu yun cheng LI song taishan med.univ.taian,china, in second international conference on bio-medical engineering and informatics 2009
[24] Donald Mcrobbie. Medical Image Segmentation [Online]. Available: http:// encyclopedia.jrank.org
[25] Dr. H. B. Kekre et. al, Detection of tumor in mri using vector quantization Segmentation, International Journal of Engineering Science and Technology, Vol. 2(8), 2010, 3753-3757
[26] Rafael C. Gonzalez and Richard E. Woods, *Digital image processing*, Prentice Hall, 2002.
[27]. X. Jiang, R. Zhang, S. Nie,"Image Segmentation Based on PDEs Model: a Survey", IEEE conference, pp. 1-4, 2009.
[28]. Rajeshwar Dass, Priyanka, Swapna Devi, Image Segmentation Techniques, International Journal of Electronics & Communication Technology(IJECT) Vol. 3, Issue 1, Jan. - March 2012 ISSN : 2230-7109 (Online) | ISSN : 2230-9543 (Print)
[29] B. C. Wei, R. Mandava,"Multiobjective optimization Approaches in Image Segmentation- the Direction and Challenges", ICSRS Publication, 2010.