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Hybrid Segmentation with Canny Edge and K Means Clustering To Extract the Mammogram Tumor

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ABSTRACT
To assist the manual examination to the physicians. We need to find a tumor with a help of machine as well as radiologist instead of the main aim of this research is to improve the accuracy of tumor detection and extraction from the mammogram screening. In this research, two segmentation techniques are combined together and processed as a mammogram images to get the accurate result. The combination of edge base canny method and k means clustering method called edge based clustering (EBC) in a single flow of process. Used hybrid feature helps to improve the detection extraction the tumor accurately. And also the implementation of these approaches has been calculated in performance measures, it helps to seen the quality of the mammogram tumor image. The result proves the efficacy of the proposed method in classifying task.
Keywords :— Image segmentation, Hybrid segmentation, Edge based segmentation, Clustering segmentation, Performance Measures.

I. INTRODUCTION

A great variety of segmentation methods has been proposed in the past decades, and some categorization is necessary to present the methods called hybrid segmentations. Which is help us to segment the tumor image in clearly and good quality visualization. Segmentation can be defined as the process of partitioning a digital image into multiple segments, where multiple segments are Group of pixels. Main objective of segmentation is to change or simplify the representation of a digital image into something that is much more significant and easier to analyse. The aim of the segmentation step in mammographic image analysis is to extract regions of interest (ROIs) containing all breast abnormalities from the normal breast tissue So this proposed Hybrid Segmentation system mainly focused on medical Mammogram images to extract the tumor images. It has high-resolution and accurate positioning of soft and hard distortion tissues [1and 2]. So this type of imaging is more suitable to identify the brain lesions or tumor. The Mammogram images which contains tumor that are shown below.

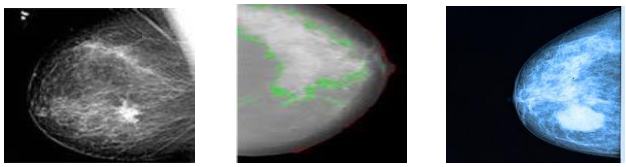


Figure 1: Sample Mammogram tumor images

Commonly, tumors are looking like solid white tissues with black background in the Mammogram image. Figure 1, seems the various tumor variation images. The proposed method should help to identify the tumor without loss of pixels and handing easier. The clustering algorithm is used to extract or grouping the damaged cells of the tumor portion is extracted separately to the given mammogram images. There are various images have the various levels of tumor portion the pixel of points having different tumor levels as well as pixels.

II. RELATED WORKS

In [3], Rangayyan presented the different operators for edge detection like sobel operator, Log (Laplacian of Gaussian) operator, prewitt operator and Roberts's operator. In [9], author Fauci et al. proposed the method of edge based segmentation which is based on iterative process called ROI hunter method for extracting the ROIs. ROI Hunter technique is uses the concept of searching of intensity maximum within

square windows those constructing the image of mammographic. In [4], author Pappas used the basic k-means clustering technique for image segmentation. K-means clustering extracts the pixels into the different clusters as segmented masses. In [5], author Sahiner et al. introduced the modified k-means clustering technique in which selection of object is done in order to detect the initial mass area in ROI after k-means clustering. The methods of edge detection are based on image discontinuities of gray level. Derivatives or Gradients are used to measure rate of change of gray level in [6], author uses the DWCE (Density contrast enhancement) method with Laplacian method in Gaussian filtering. Aim of DWCE technique is enhancing mammographic image structures for detecting the objects boundaries using edge detection method. Bovis and Singh [7] analysed two different classification methods, which are four-class categories according to the BIRADS system and two-class categories, differentiating between dense and fatty breast types. Sets of classifier outputs are combined using six different classifier combination rules proposed by Kittler et al. [8] and the results were compared. The results showed that the classification based on BIRADS system for the four-class categories

III. PROPOSED WORK

The Mammogram image explicitly contains tumor portion is taken as an input image. This work
Contains three phases.

Phase 1: The pre-processing steps (i.e. Gray scale conversion, Image Histogram)

Phase 2: The results of edge based segmentation and clustering segmentation and applying proposed hybrid method and getting results.

Phase 3: Performance of the proposed system can be measured by the various quality metrics.

In Edge based segmentation technique, edges in an image are assumed to represent object boundaries, and used to identify these objects. In this edge based segmentation, there is no need for the detected edges to be closed. We are used Canny Edge Detection concept. The Edges are continuities in the sense of intensity, which gives a layout of an object. All objects in the image are traced when the intensities are calculated accurately Canny Edge Detector is used to get the high spatial gradient. Segmentation can also be done through edges. There will be some gap between the edges as it is not closed. So, the gap is filled by edge linking. The broken edges are extended in the direction of the slope for the link to get the connectivity for segmentation. And the Segmentation is also done through Clustering. The Clustering methods attempt to group together patterns that are similar in some sense. The goal is very similar to what we are attempting to do when we segment an image, and indeed some clustering techniques can readily be applied for image segmentation. They grouping the distortion tissues and viewed clearly, The proposed method is experimental and performance of this hybrid segmentation is measured which will perform well and gives expected output that is considered as a good segmentation to extract tumor as it is in the Mammogram images. Extracting the tumors with edges is very difficult but by applying this hybrid edge based clustering is clearly viewed the tumor positions with edges.

IV. METHODOLOGY

The proposed methods gives the better result to finding the tumor easily .The overall process flow of the proposed system is shown below:

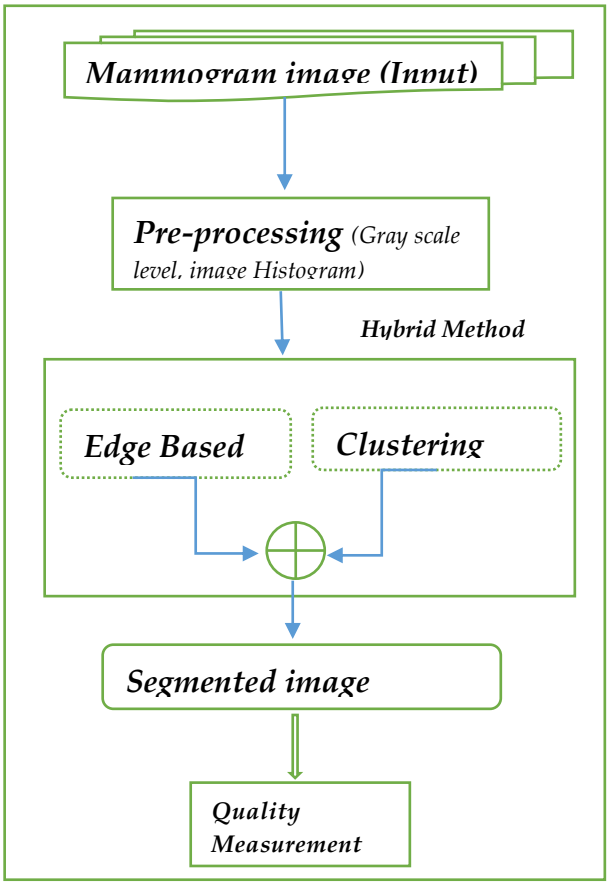


Figure 2: Flow Diagram of overall process.

4.1 Pre-Processing

The input of Mammogram images are pre-processed by means of two processes such as, (i) Gray scale level, and (ii) Histogram Equalization. The collection of mammogram images from various resources has different from one image to another image and pixel may differ in the tumor.

- The Gray level has been applied to improve the contrast of the image. This process can be achieved by adjusting the grey level and dynamic range of the image, which is the deviation between minimum and maximum pixel value.

- Histogram equalization is used for contrast adjustment using the image histogram When ROI is represented by close contrast values, this histogram equalization enhances the image by increasing the global contrast.

4.2. Proposed Hybrid Segmentation

Hybrid segmentation method is the coordination of 2 methods which will effectively give preferred results over the single segmentation technique. The, proposed work pre-dominantly centered around restorative imaging to concentrate tumor and particularly in mammogram images. It has high-determination and precise situating of delicate soft and hard tissues, and it is particularly appropriate for the conclusion of breast tumors.
The proposed hybrid technique are having the below steps.

- According to the abnormal images are smoothing with Gaussian function and find the gray tones of the tumor.
- Analyzing the Histogram to find the tumor pixel value.
- Cluster point chosen randomly and assume like k.
- Separate the groups in soft and hard tissue.
- Find and segment the tumor until all tumors are separated in one group.

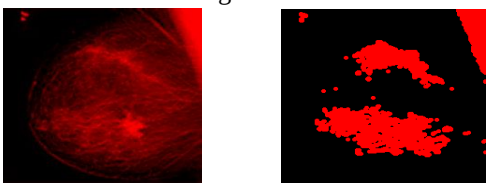
4.2.1 Edge based segmentation technique

Edge detection is the basic function of image segmentation, but it has the major feature for image analysis. It may use by some edge detecting techniques but we used canny method to detect the tumor easily.

Steps for Canny algorithm

Canny edge detection is a technique to extract tumor portion from the mammogram abnormal image. Canny has found that the requirements for the pixels of edge detection. Thus, an edge detection solution to address these requirements can be implemented in a wide range of situations. The general criteria for edge detection include:

1. Detection of edge with low error rate, which means that the detection should accurately catch as many edges shown in the image as possible
2. The edge point detected from the operator should accurately localize on the center of the edge.
3. A given edge in the image should only be marked once, and where possible, image noise should not create false edges.



(a) (b)

Figure 3 :(a) Original image (b) Edge Deducted image

4.2.2 Clustering Segmentation Technique

The main purpose of clustering is to divide a set of abnormal pixels into significant Groups. The clustering of pixels is based on measuring of correspondence between the pair of pixels using distance function. Thus, result of clustering is a set of clusters, where pixels within one cluster is further similar to each other, than to pickle in another cluster. The Cluster analysis has been broadly used in numerous applications, including segmentation of medical images, pattern recognition, data analysis, and image processing. Clustering is also called data segmentation in some applications because clustering partitions huge data sets into groups according to their resemblance. In this proposed Clustering K-Means algorithm are under the group of squared error based clustering. The k means algorithms are an iterative technique which is used to split an image into k clusters. In statistics and machine learning, k means clustering is a method of cluster analysis which can to portions n observations into k cluster, in which each observation be in the right place to the cluster with the adjacent mean,

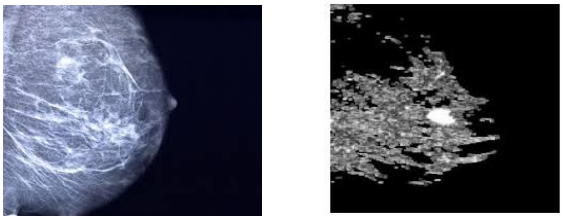
The basic k means clustering algorithms as follows:

i) pick k cluster center either randomly or based on some heuristic,

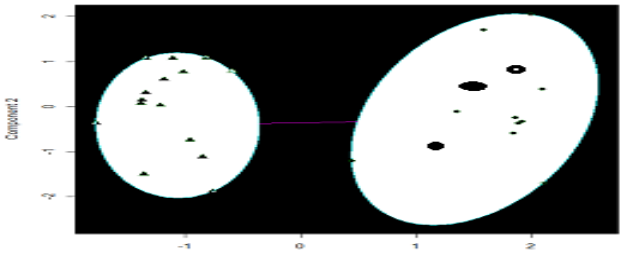
ii) Assign each pixel in image to the come together that minimum the distance between the pixels cluster center.

iii) Re-compute the cluster center's by averaging all of the pixels in the cluster. Repeat last two steps until convergences are attained.

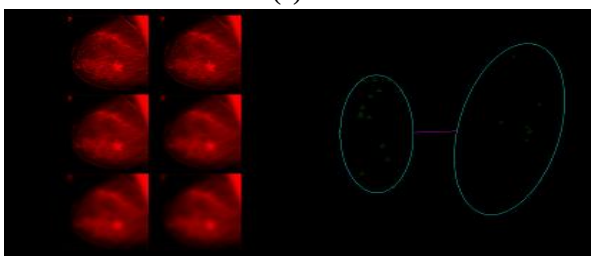
K-means clustering key endeavour to partitions the n observation into k sets (k<n) s= {s1, s2, s3….sk} so as to minimize the with in cluster sum of squares. And it can be obtaining the significant result when it's combined with edge detection segmentation. The result of the method is to very clear segmentation is processed.



(a) (b)



(c)



(d)

Figure 4 :(a) original image (b) after clustering segmentation (c) process of grouping the cluster in k (d) further steps of clustering segmentation technique.

4.2.3. Performance measures for analysis

Every image processing techniques are finally tested with any of the quality measures of an image, So we are calculate the performance measure for the proposed resulting images, as we test for the performance measures of Sensitivity, Specificity, Accuracy of an image should be calculated.

Accuracy: To estimate the accuracy of a test, we should calculate the proportion of true positive and true negative in all evaluated images, and it can be defined as:

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

Sensitivity: The sensitivity of a test is its ability to determine the tumor correctly. To estimate it, we should calculate the proportion of true positive in tumor, and it can be defined as:

Sensitivity=TP / TP+FN

Specificity: The specificity of a test is its ability to determine the healthy cases correctly. To estimate it, we should calculate the proportion of true negative in healthy, and it can be defined as:

Specificity=TN / TN+FP

True Positive (TP): The test result is positive in the presence of the objective abnormality.

True Negative (TN): The test result is negative in the absence of the clinical abnormality.

False Positive (FP): The test result is positive in the absence of the clinical abnormality.

False Negative (FN): The test result is undesirable in the presence of the clinical abnormality

FP= False Positive value pixel count /tumor size

FN= False Negative value pixel count /tumor size Correct rate= FP+FN

The proposed models of edge based, clustering and Hybrid approaches are tested with this performance measures in a mammogram images.

Table 1: Number of pixels and area of the tumor region

Finding the tumor pixels in Percentage wise for the proposed methods			
original image	**Edge based segmentation**	**Clustering segmentation**	**Hybrid Segmentation**
Image 1	59.68	65.57	92.36
Image 2	-3.69	-4.08	-63.02
Image 3	50.7	56.57	75.99
Image 4	-19.65	-24.94	-42.99
Image 5	6.6	9.25	29.74
Image 6	-25.08	-30.29	46.37
Image 7	-27	-33.3	-35.33
Image 8	54	56.32	-80.25
Image 9	7.29	8.03	25.38
Image10	1.5	5.58	15.23

Table 1 represent the tumors in various segmentation methods as well as the proposed method, the result should be very cleared in the hybrid methods. Tumor find in clearly.

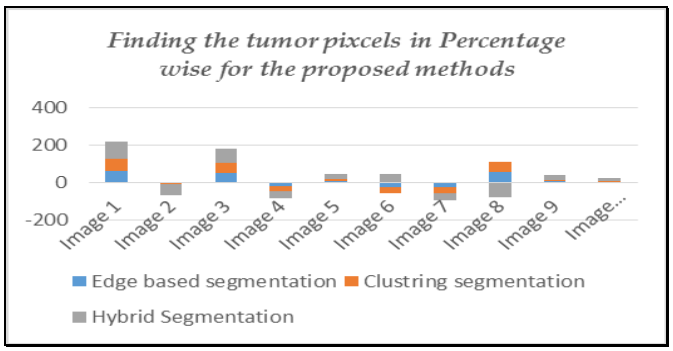


Figure 5. Comparison of proposed method based on performance measures.

V. RESULTS AND DISCUSSION

The hybrid approach of performance based classification of different image datasets of different resources of online images. Open Dataset are analysed using the performance measures of Sensitivity, specificity, accuracy are calculated and find the tumors in mammogram images and the result may analyzed by the quality measures.

Table 2: Results for segmentation using existing **method and Extracted Tumor region**

Original Image ***Exiting method*** ***Hybrid method***

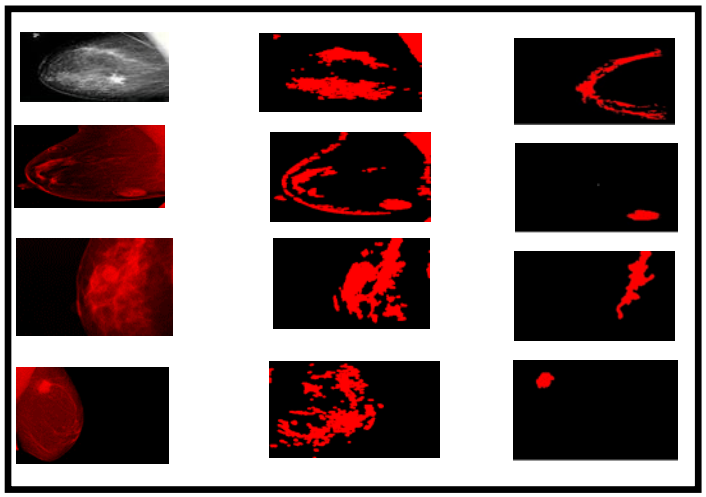


Table 2: Comparison of different feature extraction techniques

Performance measures and analysis for proposed methods in Mammogram image			
Hybrid Approached image	**Specificity**	**Sensitivity**	**Accuracy**
Image 1	87.23%	91.12%	93.00%
Image 2	67.00%	75.00%	89.00%
Image 3	86.00%	75.00%	92.40%
Image 4	67.25%	85.78%	92.35%
Image 5	62.45%	87.23%	91.32%
Image 6	89.23%	91.23%	97.85%
Image 7	76.54%	67.45%	92.58%
Image 8	45.59%	67.25%	85.45%
Image 9	58.65%	72.53%	82.34%
Image 10	75.54%	85.14%	97.45%

From these comparisons of hybrid approach segmentation techniques are calculated the feature extraction has highest percentage of accuracy 97.85% in the given Mammogram images.

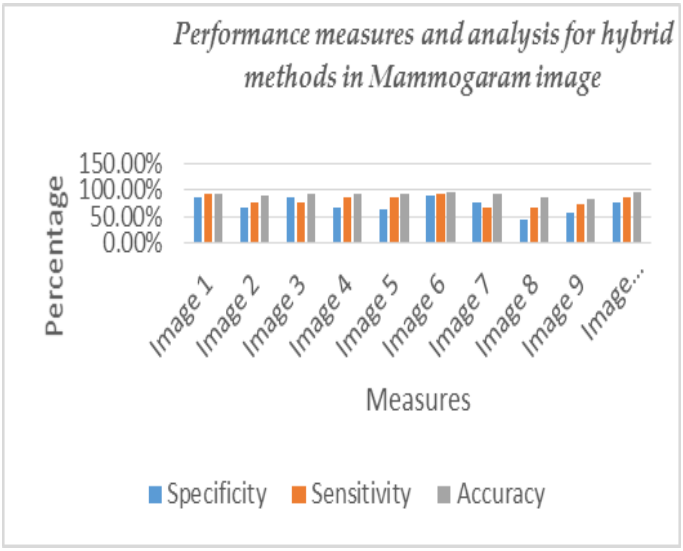


Figure 6. Comparison Chart hybrid method based on performance measures

VI. CONCLUSION

In this paper a hybrid approach of Segmentation is proposed and Compared in performance analysis. It help to get the better segmentation of the tumor portion is detected the tumor and extracted easily, also here calculated the total number of affected tumor cells. Performance measures witch help us to getting the image accuracy, sensitivity and specificity of given image. Thus the proposed hybrid method had a better quality segmenting the tumor. In future this work executed to improve

the quality of Classification rate, and accuracy rate with effective feature extraction technique.

REFERENCES

[1] D. Anithadevi, K. Perumal, (2014) "Brain tumor extraction based on segmentation",International journal on Recent and Innovation Trends in Computing and Communications, Vol.
2, No. 9, pp: 2682-2689.

[2] D. Anithadevi, K. Perumal, (2015) "Novel approach for noise removal of brain tumor MRI images", Journal of biomedical Engineering and Medical imaging (JBEMI), ISSN: 2055-1266, Vol. 2, No. 3, pp: 1-14.

[3] Rangayyan, R.M.: Biomedical Image Analysis. CRC Press LLC, Boca Raton (2005)

[4] Fauci, F., Bagnasco, S., Bellotti, R., Cascio, D., Cheran, S.C., De Carlo, F., De Nunzio, G., Fantacci, M.E., Forni, G., Lauria, A., Torres, E.L., Magro, R., Masala, G.L., Oliva, P., Quarta, M. , Raso, G., Retico, A., Tangaro, S.: Mammogram Segmentation by Contour Searching and Massive Lesion Classification with Neural Network. In: 2004 IEEE Nuclear Science Symposium Conference Record, Rome, Italy, October 16–22, vol. 5, pp. 2695–2699 (2004)

[5] Sahiner, B., Hadjiiski, L.M., Chan, H.P., Paramagul, C., Nees, A., Helvie, M., Shi, J.: Concordance of ComputerExtracted Image Features with BI-RADS Descriptors for Mammographic Mass Margin. In: Giger, M.L., Karssemeijer, N. (eds.) Proc. of SPIE Medical Imaging 2008: Computer-Aided Diagnosis, vol. 6915 (2008)

[6] Petrick, N., Chan, H.P., Sahiner, B., Wei, D.: An Adaptive Density Weighted Contrast Enhancement Filter for Mammographic Breast Mass Detection. IEEE Transactions on Medical Imaging 15(1), 59–67 (1996)

[7] K. Bovis and S. Singh, "Classification of mammographic breast density using a combined classifier paradigm", in Proc. Med. Image Understanding Anal. Conf., 2002, pp. 177–180.

[8]Online.http://www.diagnosticimaging.com/mammography/image-iq/. [Online; accessed 10-April-20015]

[9] Varsha J. Gaikwad "Marker-Controlled Watershed Transform in Digital Mammogram Segmentation" (International Journal for Research in Applied Science & Engineering Technology Volume 3 Issue III, March 2015)

[10] R.Radha and P.Rajendrian "Using K-Means clustering technique to study of breast cancer", (2014 IEEE World Congress on computing and communication technologies, India.)

[11] Sujata Saini and Komal Arora "A Study Analysis on the Different Image Segmentation Techniques" (International Journal of Information & Computation Technology. ISSN 0974-2239 Volume 4, Number 14 (2014))

[12] Piyamas Suapang Authors Chadaporn Naruephai, Methinee Thongyoun & Sorawat Chivaprecha "Mammographic Masses Segmentation Based on Morphology" (The 2012 IEEE Biomedical Engineering International Conference (BMEiCON-2012)