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Breast Cancer Detection and Identification using Fuzzy C Means and Edge Detection Algorithm

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***Abstract*—**In recent day's image processing technique is very exigent and extensively used in medical area for image amplification, where the time facet is very crucial to discover the anomalous tissues, especially in various cancer such as Breast Cancer, ovarian cancer, vagina cancer, etc. The growth of cancer cells forwomen is a more aggressive and harder to treat. Breast cancer is the formation of cancer cell inbreasts.The PET/CT scan is most persistently used device for diagnosis. In this paper,awell organized algorithm is proposed for Breast cancer, the growth of cancer cells are detected based on edge detection algorithm and nuclei segmentation of breast from PET/CT scan image using Fuzzy c means clustering algorithm, the behavior of the cancers patterns of the algorithm are analyzed.The olive color map function consists of colors that are shades of green and yellow. The edge detection algorithm takes less computational time than edge detection algorithm and it has the greatest PSNR value than edge detection algorithm. Finally, edge detected image will be binary image; this image is converted into color image using olive color map function.

***Keywords*—** Image processing, PET/CT scan, Fuzzy c means, improvedsobel edge detection.

I. INTRODUCTION

Image processing is a technique for converting an image into digital form that performs some operation, in order to get an enhanced image or to fetch some information from it for analysis. In this method, input can be image, video frames, etc and output may be image or characteristic associated with that image. Segmentation means partitioning an image into distinct region contain each pixel with similar attributes. The segmented image to be meaningful and used for image analysis and interpretation, the region are strongly related to depicted object or features of interest. A cancerous (malignant) tumor is a lump or growth of tissue made up from cancer cell which continue to multiply Breastcanceris a very typical type of cancer in women. A breast cancer victim's chances for long-term survival are improved by early detection of the disease, and early detection is in turn enhanced by an accurate diagnosis. Real time diagnosis of cancer by using more reliable algorithms has been an active of the latest development in medical imaging and detection of ovarian cancer in PET and CT scan images.

Image segmentation method can be classified as thresholding, region based, supervised and unsupervised techniques. A CT/PET scan used to diagnose a cancer cell in whole body. The initial PET/CT scan the patient was sent for a CT guided biopsy, and during the procedure, the physician who could not see the lesion, sent for the fused images. The power of combined PET/CT imaging is in localizing disease before an abnormality is apparent on CT images. Physicians gain added confidence in their decision to treat a patient that has a negative CT scan, but has rising CA-125 levels and abnormal increased radiopharmaceutical uptake on the combined PET/CT scan.

Clustering algorithm is mainly divided into two techniques they are, hierarchical algorithm and partition algorithm. A hierarchical clustering algorithm divides the given data set into smaller subset. A partition clustering algorithm partition the data set into desired number of set in a single step.From the machine learning perspective, clustering can be viewed as unsupervised learning concept. Supervised machine learning means that the cluster depending on the predefined classes and training samples while classifying the data object. But in unsupervised machine learning, cluster does not depend the predefined classes and training samples.

Edge detection is an image processing technique for finding the boundary of object within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in area such as image processing, computer vision and machine vision. Edge detection refers to the process of identifying and locating shape discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of object in a scene. The most popular method is Fuzzy C-Means algorithm is a form of clustering in which each data point can belong to more than one cluster or partition, this algorithm refers to soft clustering. This

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algorithm is prominent to cluster massive data rapidly and efficiently so it can be used in image processing techniques especially in segmentation. This algorithm is used to detect the nuclei edge and highlight the cancer cell. And minute edges are detected by using improved sobel edge detection algorithm. The output image will be binary image, that image is converted into color by using olive color map function.

II. PROPOSED METHOD

In this paper, we have proposed segmentation of breast PET/CT scan images for detection of cancer using FCM clustering technique and edge are detected by using improved sobel edge detection algorithm. A clustering can be defined as grouping of similar pixels where all the pixels within the group defined by similar relationship. Clustering is unsupervised classification because the algorithm automatically classifies object based on user given criteria. Edge detection refers to the process of identifying and locating shape discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of object in a scene. In this paper, well organized algorithm is proposed for the detection of breast cancer, edge are detected based on improved sobel edge detection algorithm and nuclei segmentation of breast from PET/CT scan image using Fuzzy c means clustering algorithm. Finally, edge detected image will be binary image; this image is converted into color image using olive color map function. The olive color map function consists of colors that are shades of green and yellow.

A. ANTIQUE OF OVARIAN CANCER IMAGE

A 56-year-old woman with a history of breast cancer undergoes resection of the cancer followed by chemotherapy. The patient presented with rising CA-125 levels. A recent CT scan was negative. The physician referred the patient for a PET/CT scan·

The power of combined PET/CT imaging is in localizing disease before an abnormality is apparent on CT images. Physicians gain added confidence in their decision to treat a patient that has a negative CT scan, but has rising CA-125 levels and abnormal increased FDG uptake on the PET/CT scan.

B. SEGMENTATION USING FUZZY C MEANS CLUSTER

Fuzzy clustering is a form a form of clustering in which each data point can belong to more than one cluster or partition. Fuzzy C-Means clustering also referred to as soft clustering. This algorithm work by assigning membership to each data point corresponding to each cluster center on the basis of distance between the cluster and the data point. The data near to the cluster center more its membership towards the particular cluster center. Fig1 .shows the steps for the Fuzzy C-Means clustering algorithm.

Let us consider $X=\{x1,x2,.....x_n\}$ be the set of data points and $v=\{v1,v2,....,vz\}$ be the set of clusters.

Step 1: Randomly select 'c' cluster center.

Step2:Calculate the Fuzzy membership 'μ_{ij}' using:

$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)}$$

Step 3: Compute the Fuzzy centers 'v_j' using:

$$v_j = (\sum_{i=1}^{n} (\mu_{ij})^m x_i) / (\sum_{i=1}^{n} (\mu_{ij})^m), \forall j = 1,2,.....c$$

Step 4: Rrpeat step 2 and 3 until the minimum 'j' value is achieved or $\|U^{(k+2)}-U^{(k)}\| < \beta$

Where,

'k' is the iteration step.
'β' is the termination criterion between[0,1].
'$U=(\mu_{ij})_{n*c}$' is the fuzzy membership matrix.
'j' is the objective function.

Fig 1 Fuzzy c means clustering Algorithm.

Algorithm performs calculation as follows:

1. Initialization of U=[uij], U(0)
2. Calculation of centers of the vectors C(k)=[cj] and U(k)

C. IMPROVED SOBEL EDGE DETECTION

The sobel edge filter is used to detect edge based on applying a horizontal and vertical filter in sequence. The sobel operator performs a two dimensional spatial gradient measurement on an image and so emphasized region of high spatial frequency that correspond to edge. Typically it is used to find the approximate absolute gradient magnitude at edge point in an n input gray scale image. The sobel operator consist of 3*3 convolution masks as

-1	0	1
-2	0	2
-1	0	-1

Fig 2 .Horizontal filter

1	2	1
0	0	0
-1	-2	1

Fig 3. Vertical filter

The sobel operator is very similar to prewitt operator. Like prewitt operator, sobel operator is also used to detect two kind of edge in an image as vertical direction and horizontal direction. In this research improved sobel edge detection algorithm is proposed, this algorithm is same as that of sobel edge detection algorithm. But the minority differences is that, in sobel edge detection algorithm the dividend value is eight and in improved sobel edge detection algorithm the dividend value is two. The advantage of improved sobel edge detection algorithm takes less computational time than other edge detection algorithm.

D.OLIVE COLORMAP FUNCTION

MATLAB supports a number of build in colormap function such as jet, HSV, hot, cool, spring, etc. In this research, a novel color map function is introduced and it named as olive color map function. The olive color map function consists of color that is shades of green and yellow as

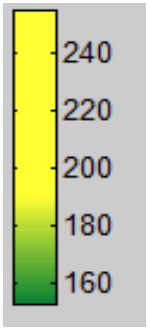
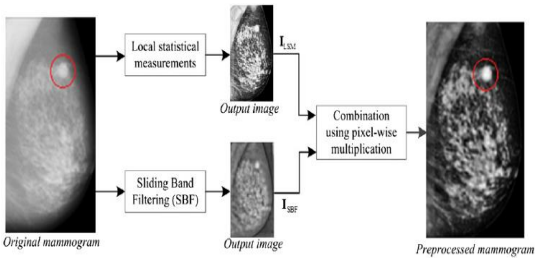


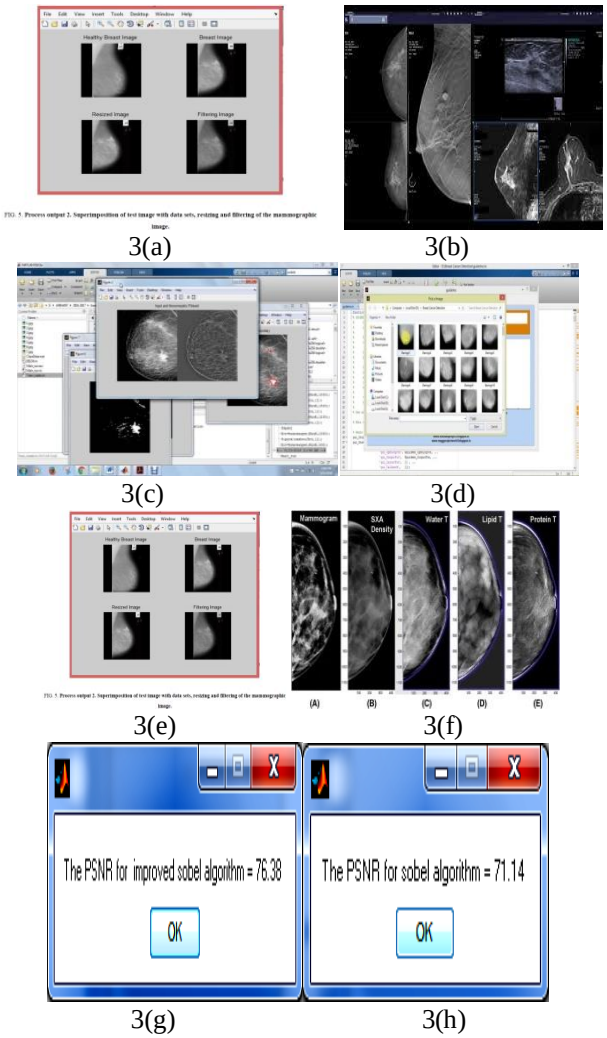
Fig 4 olive colormap

This function returns the colormap "olive". A colormap is a real [:,3] array where every row represent a color with the option argument "n-color' the number of rows of the returned array can be defined. The default value is "n-color = 64".

III. EXPERIMENTAL RESULT

The various experiment carried out in breast cancer image data set algorithm of k means and fuzzy c means in MATLAB 7.6(2008R). The complete process of image segmentation for breast cancer images and the standard are summarized in subsequent figure.



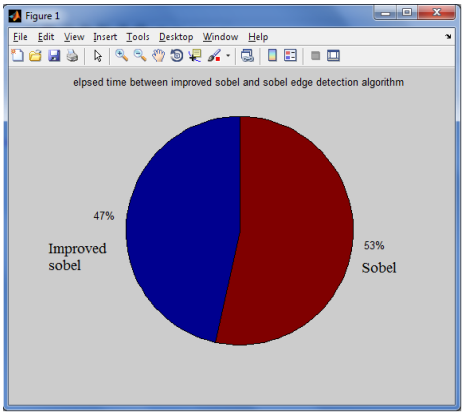


3(a) 3(b) 3(c) 3(d) 3(e) 3(f) 3(g) 3(h)

3(a). Original image, 3(b). Conversion of RGB into L*a*b color conversion, 3(c). Fifth clustered image using Fuzzy c means 3(d). Fifth nuclei image using FCM. 3(e). Minuteedges are detected by using improved sobel edge detection algorithm, 3(f). olivecolor map function, 3(g). The PSNR value for improved sobel edge detection algorithm, 3(h). The PSNR value for sobel edge detection algorithm.

IV. COMPARISON WITH IMPROVED SOBEL AND SOBEL EDGE DETECTION ALGORITHM

This experiment reveals the fact that improved sobel edge detection algorithm consumes less elapsed time i.e. 4.038698 seconds than sobel edge detection algorithm, which takes 4.636568 seconds. On the basic of the result drawn by this experiment it may be safely stated that improved sobel edge detection algorithm less time when compared to sobel edge detection algorithm.Fig3. Shows the comparative analysis for improved sobel edge detection and sobel edge detection algorithm.



V.CONCLUSION

Segmentation of breast cancer image is imperative in diagnosis and treatment in the field of medicine. Two segmentation methods are used to detect the breast cancer such as cluster technique and edge based method. In this research, well organized algorithm is proposed for breast cancer, edge are detected based on improved sobel edge detection algorithm and nuclei segmentation of ovarian from PET/CT scan image using Fuzzy c means clustering algorithm, the behavior patterns of the algorithm are analyzed. Finally, edge detected image will be binary image; this image is converted into color image using olive color map function. The olive color map function consists of colors that are shades of green and yellow. The improved sobel edge detection algorithm takes less computational time than edge detection algorithm and it has the greatest PSNR value than sobel edge detection algorithm

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