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Improved Fusion based Breast Ultrasound Image Segmentation technique

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Abstract
Image segmentation plays vital role in the biomedical imaging .Image segmentation is the process of dividing image into segmentation to extract the information. Breast Cancer is most common form of cancer found in women. The main cause of the disease is still known, only way to cure the disease is the detection of this disease in early stages. Image segmentation is considered as the one of the efficient method of detection of the disease. Traditionally various image segmentation techniques have been proposed for the cancer detection.
The existing system has some problems faced that as in the final stage the optimization based approach is used to get segmented image there will be some chances to get degraded results because of some disadvantages that are noticed in case of optimization algorithm .
In this approach a new method is proposed for the detection of cancer. In this frequency as well as spatial domain segmentation is applied on shows the proposed method is more accurate and efficient than the traditional method. the image. As by applying the image segmentation is used for dividing the image, to obtain the image again the image fusion is applied. For fusing the image PCA technique of image fusion is used. So by applying this technique the quality of the image is not degraded. From the results obtained it is concluded that this proposed algorithm is better than the traditional used algorithm. A comparison is performed that shows the proposed method is more accurate and efficient than the traditional method.
Keywords--- *image segmentation; biomedical imaging; image fusion; PCA.*

Introduction

Cancer is the most horrendous disease that is the leading cause of illness among the humans worldwide. According to the survey conducted it was found that is one of major cause of the death among the humans and is growing at fast pace. Since the roots of the cancer are still unknown the numbers of deaths due to the cancer are increasing every year. As it is not possible to completely prevent or take caution of the disease. [2] The early detection of the disease can increase the rate of survival. Breast cancer is the common type of cancer that is found in the women. This is result of the abnormal and unconstrained growth of the breast cells that are divided and give rise to tumor. [3] Benign and the Malignant are two types in which the tumor is defined. Benign is not harmful as it grows but does not spread to other part so this is not cancerous. Malignant tumor grows and spread to other body parts so it is cancerous. They can be treated if they are early detected. Due to the advancement in the biomedical imaging now it's possible to detect the disease so that it can be diagnosed. Various image processing techniques like preprocessing, segmentation, feature extraction etc are used for the detection of the disease.[4]

In case of medical image the processing done before the diagnosis needs special attention as the detection of the disease is important step for diagnosis. Segmentation is one of the basis processes of image

processing that is used for detecting the cancer.[15] Image segmentation is the process of separating the image into segment. It is used for locating the boundaries of the image like lines, curve etc. In biomedical the segmentation and the extraction of features are main steps for the image analysis. [5] Segmentation is used for number of application like detecting, diagnosis, planning of treatment etc. Most of the biomedical images are altered by noise that causes difficulty when the further processing is done.

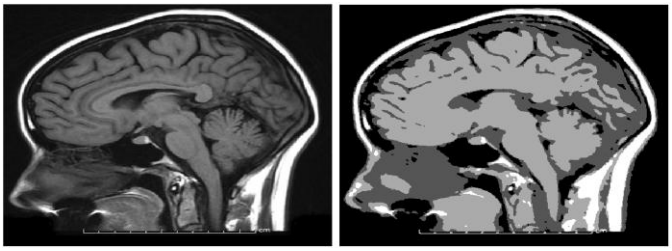

Fig 1 a) Original image b) Segmented image [3]

The mammography is medical imaging that is done for detecting and diagnosing the breast cancer. [6] X-rays are done for examine the disease, these image are further observed by the radiologist to find an abnormality.

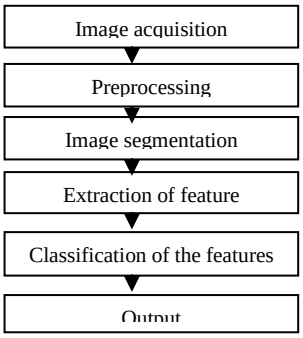

Fig 2. Cancer detection process using image segmentation [6]

The description of the detection process is given below:-

- Image acquistaion: In this process the image is selected from the given set of the data for further processing.
- Preprocessing: In this step the the image is preprocessesd.The image is filtered in this process the noise is removed. various preprocessing methods are proposed so that the segemnation image is more informative.
- Image segmentation: In this process the image that is preprocessed is segmented to divide the image into various segments so that it can eaily datect the information present in the image.
- Extracion of feature: In this the feature are extracted from the sehments of the image. This feature are than futher used for the detection diasease.
- Classification: In this step the features that are extracted are classified. This process will detect the changes that occurs in the results.
- Output: finally the resultant image is obtained after following this process

Related work

Traditionally various image segmentation techniques have been proposed for the cancer detection. This section represents the literature survey on various detection segmentation techniques proposed till date. Some of the paper based has been discussed below:

Rafika Harrabi explained that the main focus is on the new technique that is used to increase the information quality, and to obtain more reliable and accurate results. This technique is based on the multi level thresholding and data fusion techniques. In this technique, the main focus is on the combining different data sources that are associated to the same color image. The proposed system is different and explores a new strategy as this technique is using combination of same images rather than only one image for each application. Segmentation is considered in two steps. First step involves identification of most significant peaks of histogram. In this step, multi-level thresholding technique is used which is based on the two –stage Otsu Optimization approach. Whereas second step involves the evidence theory in which several images are merged and represented in different color spaces. Thus this also provides reliable and accurate result. This paper presents Dempster-Shafer (DS) evidence theory, which is linked to Gaussian distribution. It helps to obtain final segmentation and expressed the input image in

different color spaces. Experiments have been performed with the help of segmentation of medical color images. Results proof that the proposed system is more effective as well as superior from existing one [6].

Alzate, C studied that in the existing graph based segmentation data driven matrix is used in which similarities between every pair of pixels are defined. The eigenvectors of this matrix consist of relevant information about the clusters present on the image. In this paper, a proposed technique is using spectral clustering for image segmentation with the extension out-of-sample. This approach is based on the PCA framework. This approach is used because of the various advantages. It helps to train and validate the clustering model on the sub sampled parts of the image to be segmented. Then, the remaining pixel of cluster indicatorscan be inferred using out-of-sample extension. With the help of sub sampling scheme, computation time of the segmentation can be reduced. Experiments have been performed and their results with grayscale and color images show the improvements in terms of computation time [5].

Hakeem Aejaz et al explained that a proposed technique is used for image segmentation known as Pillar K-means algorithm. In this method high resolution images elements are grouped by means of new mechanism which helps to improve the accuracy as well as reduce the computation time. Thus, in this paper, system uses K-means method for image segmentation. In the pillar algorithm, the position of the pillars should be located s far as from each other so that the pillars can handle the pressure distribution of a roof as well as the placement of the number of centroids be same between the data distribution. K-means method has provided the clustering for image segmentation that provides accuracy as well as reduction in computation time. In this algorithm all initial centroids are distributed with the help of maximum cumulative distance metric. This paper also concludes proposed approach used for image segmentation and provides compare it with the K-means clustering algorithm and Gaussian mixture model. It also presents the participation of RGB, HSV, HSL and CIELAB color spaces. Further, experiments have been performed to check the effectiveness of the proposed approach in terms of segmentation quality and time taken for the computation[1]

Varshali Jaiswal studied that image segmentation is defined. Segmentation means partitioning of digital image into set of pixels known as regions that follow some homogeneity criterion. There are various approaches that have been used for image segmentation. These approaches depend on the type of the image. Different approaches are used for different image for image segmentation. The output of these images cannot be measure or the quality of the image is difficult to measure as there may be much correct segmentation for a single image. In the image segmentation, input image or raw image is divided into homogenous regions that mean each region are of same size but the union of any two neighboring regions is heterogeneous. The final output i.e. segmented image considered as highest domain-independent abstraction of an input image. Image segmentation used in various applications like: - image, video and computer vision applications. This paper also concludes various approaches as well as algorithms used in image segmentation. It is difficult to ensure that which algorithm can produce more accurate results (segmentations) than other, whether for a particular image, set of images or for a whole class. In this paper, proposed methods of image segmentation using artificial intelligence are discussed [2].

Sapna Varshney described that image segmentation is used in various applications. Various algorithms and the techniques have been designed for perform the segmentation process. In this paper the author has present the comparison of various image segmentation techniques. the techniques like edge-based, k-means clustering, thresholding and region-based technique etc have been compared . The image enhancement is performed before the image segmentation is done. The original image is compared with the extracted object from the image and the mean weighted distance is calculated. For matching of the two objects the image segmentation

is used. To measure the similarity the between the two objects the correlation is used .Along with this the PCA is used that will match the object that have different orientation in different images regions. Thus, this paper focuses on the edge detection for image segmentation with the help of soft computing approach [25].

Amira et al explained that Study Principal Component Analysis (PCA) is a mathematical procedure which uses sophisticated mathematical principles to transform a number of correlated variables into a smaller number of variables called principal components. In PCA the information contained in a set of data is stored with reduced dimensions based on the integral projection of the data set onto a subspace generated by a system of orthogonal axes. The reduced dimension computational content is selected so that significant data characteristics are identified with little information loss. Such a reduction is advantage in several fields as for image compression, data representation, etc. Consequently, PCA has a wide range of applications in the field of Medical Image Processing. It can be used for Feature extraction, Image fusion, Image compression, Image segmentation, Image registration and de-noising of Images. Thus PCA is used for various applications in various fie lds of research, this work focus on the various applications of PCA in Medical Image processing. As well as, various medical image applications based PCA results are exhibited, which proves its efficiency with medical applications[10]

Problem Statement

Segmentation is a critical step in a Breast ultrasound computer aided diagnosis (BUS CAD) system. Manual segmentation methods are time-consuming and tedious, and suffer from great individual variability. Semi-automatic segmentation methods solved the problem partially. Nevertheless, some interactions are still required which prevented the widespread applications of BUS CAD systems. Therefore, driven by clinical needs and related applications, it is necessary and essential to develop automatic segmentation methods having the ability to reduce dependencies on operators and ultimately lead to a fully automated CAD system. Fully automatic BUS image segmentation approach for performing accurate and robust Region of interest (ROI) generation, and tumor segmentation. In the ROI generation step, the proposed adaptive reference point (RP) generation algorithm can produce the RPs automatically based on the breast anatomy; and the multipath search algorithm generates the seeds accurately and fast.

The existing system has some problems faced that as in the final stage the optimization based approach is used to get segmented image there will be some chances to get degraded results because of some disadvantages that are noticed in case of optimization algorithm.

Proposed Work

As a proposed technique the working will be done on replacing the optimization with the fusion of the feature for segmentation achieved by spatial and frequency domain finally Principle component Analysis(PCA) based fusion will be used to get the segmented image as PCA is much better technique to find the components in the image then by using it we will get the much better technique in the segmentation. This will resolve the problem that is faced in the present technique. Principal Component Analysis (PCA) is a mathematical procedure which uses sophisticated mathematical principles to transform a number of correlated variables into a smaller number of variables called principal components. In PCA the information contained in a set of data is stored with reduced dimensions based on the integral projection of the data set onto a subspace generated by a system of orthogonal axes. The reduced dimension computational content is selected so that significant data characteristics are identified with little information loss. Such a reduction is advantage in several fields as for image compression, data representation.

The main objectives of the proposed work are:-

1. To analyze the existing segmentation algorithm based on spatial and frequency

2. To study the various fusion methodologies for fusion approach to be add in proposed work
3. To update the system using fusion approach at getting finalized results.

Methodology

The methodology of the proposed work is described below:

1. Initially the image that is to be segmented is selected form the given set of images. This selected image is further used for the processing.
2. Next step after the selection of the image is to find the region of interest (ROI). In this process samples are selected from the given data set and are further identified. This is basically an image segmentation method.
3. After applying ROI, next step is to apply the pre-processing on the image. In this preprocessing step the image is filtered in this process the noise is removed.
4. In this step the segmentation of the image is done. The segmentation is applied in both the domain. The segmentation is done in the frequency domain and the spatial domain.
5. After applying segmentation two images are obtained. one image is obtained by applying frequency dolman segmentation and other is obtained by applying spatial domain segmentation. so to combine these two images PCA fusion technique is used in this process.
6. Finally the calculations of the results are done. These results obtained will depict the efficiency of the proposed method.

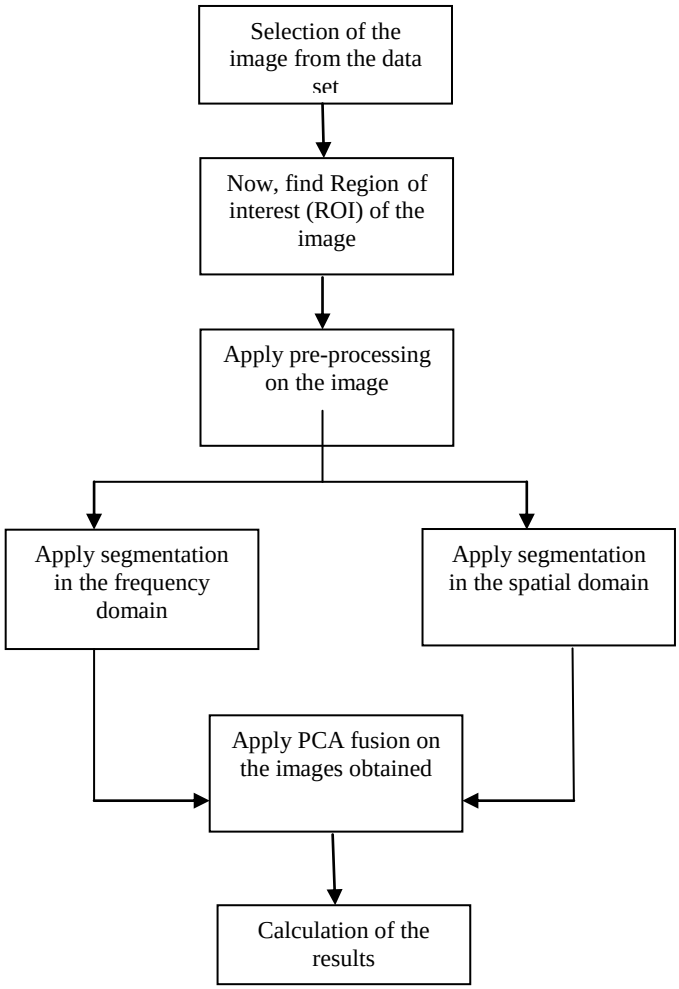

Fig 3 Block diagram of proposed work

Results and discussion

In this section of Results and discussion we have discussed about the results that were obtained by applying proposed method. This section gives description of the proposed algorithm that is represented with the help of GUI. In the propose work new method of detection of cancer is proposed. Segmentation is considered as the one of the efficient method of the cancer detection. In this proposed method the ROI technique of image segmentation is used of the segmentation of the image in both frequency and the spatial domain. After this the PCA is applied for fusing the images. The results show this method is better and efficient than traditional method.

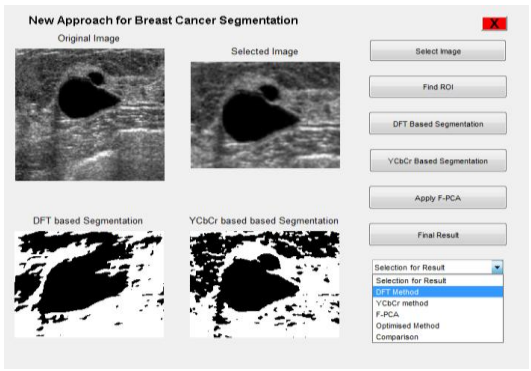

Fig 4 calculation of result using DFT method

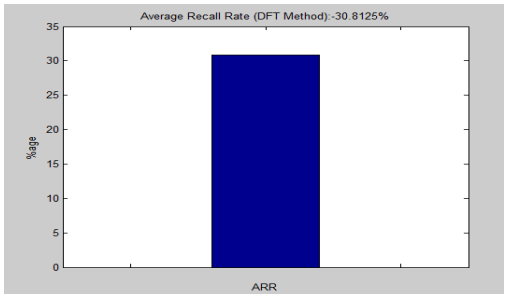

Fig 5 Average ratio rate using DFT method

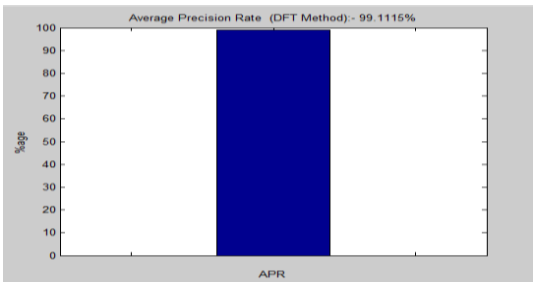

Fig 6 Average precision rate using DFT method

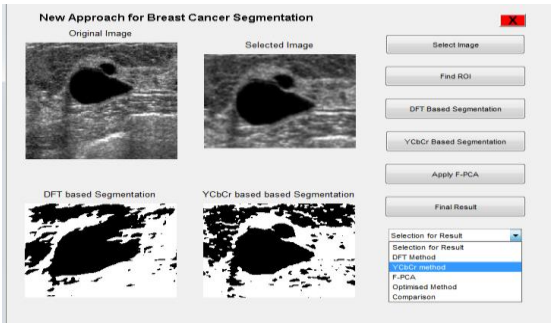

Fig 7 calculation of result using YCbCr method

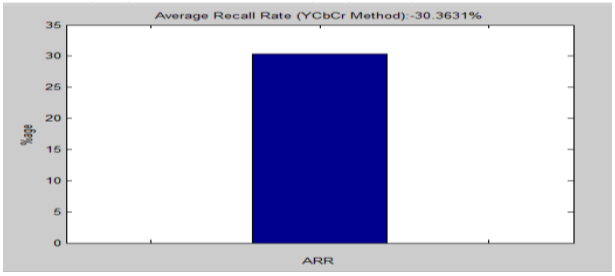

Fig 8 Average ratio rate using YCbCr method

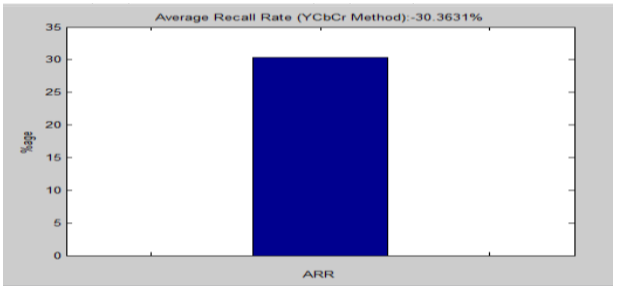

Fig 9 Average precision rate using YCbCr method

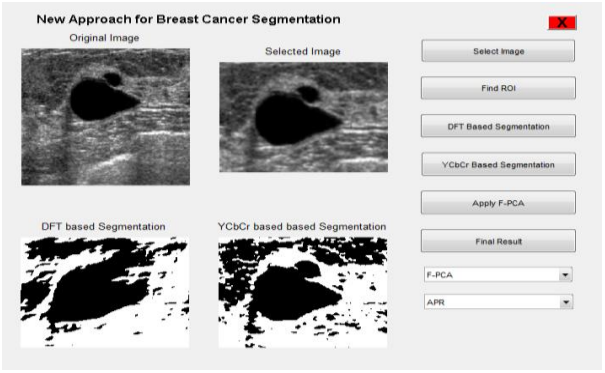

Fig10 calculation of F-PCA results

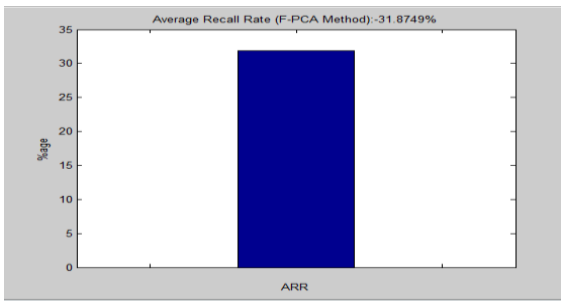

Fig 11 Average ratio rate using F-PCA

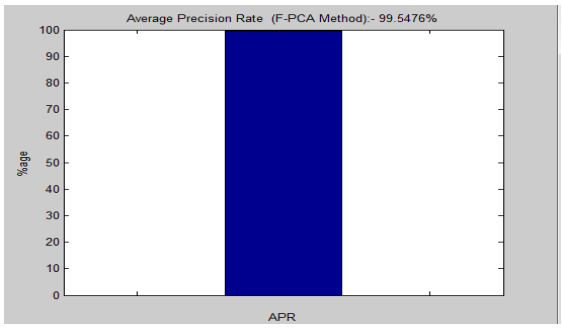

Fig 12 Average precision rate using F-PCA

A comparison between the traditional and the proposed method is made. From the comparison graph it is concluded that the proposed method is better and efficient than the traditional method.

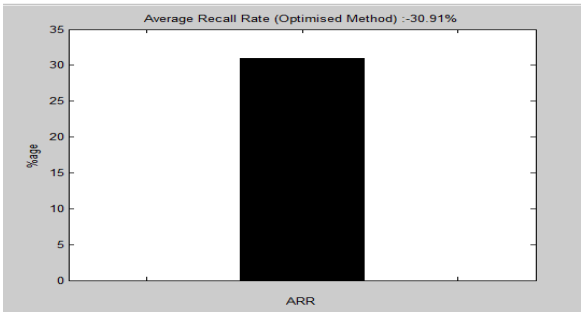

Fig 13 Average ratio rate using old method

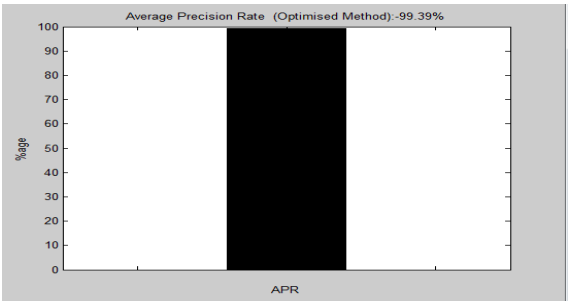

Fig 14 Average precision rate using old method

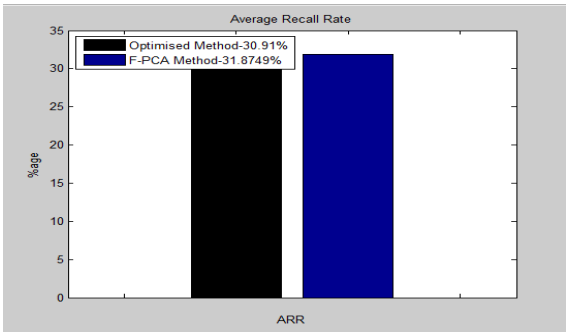

Fig 15 Comparison graph on the basis of the Average ratio rate between old and new approach.

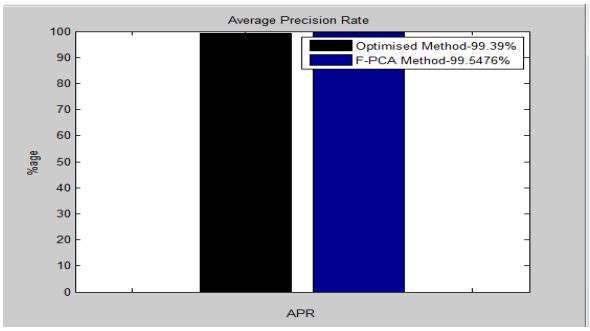

Fig 16 Comparison graph on the basis of the Average precision rate between old and new approach conclusion and future scope

Image segmentation plays important role in the biomedical images Cancer is the most deadly disease that is the leading cause of illness among the humans worldwide. The main cause of this disease is still not found. So detection of the disease in early stage is important in order to prevent it. Image segmentation is considered as the one of the most efficient method of disease detection .in this proposed work the image segmentation is done in both spatial and the frequency domain and after that the PCA technique of image fusion is applied on it . Before applying pre processing the Region of interest method is used for segmentation. From the results obtained it is concluded that this method is efficient and better than the traditional method.

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