DESIGN AND ANALYSIS OF ACTIVE CONTOUR MODEL IN BREAST CANCER DETECTION USING CONVENTIONAL ULTRASOUND AND COLOR DOPPLER

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ABSTRACT

In current day we can see most number of women's is suffering with breast cancer problem that is due to lack of prior examination. Regular examination of breasts may prevent and help to cure because breast cancer is treatable when it is detected early. In order to examine the breast cancer there is a primitive and cost effective method like ultrasonic imaging modality (US) is used for identifying the presence or traces of any cancer. As we all know that there may be some false results while examining with US method, we try to increase the performance of detection by using Color Doppler method to decreasing the rate of false-positive in breast cancer diagnosis. Hence the combination of both these imaging methods in breast cancer identification will give some best results for the diseased patients, but still has some sort of limitations in identifying the disease in the early stages.Hence we try to integrate an effective method for feature segmentation like active contour model to detect the disease in the early stage with a very low-false positive rate. In this proposed paper we try to design a novel method for automatic detection of active contour model designed with an association of US-based imaging modalities. This proposed novel method initially tries to estimate the initial contour by utilizing the features of conventionalultra sound andcolor doppler. In this proposed thesis we try to extend the detection of breast cancer ability by integrating a novel method like contrast-enhanced ultrasonography (CEUS) in the diagnosis of vascular pathologies for increasing the detection of breast cancer due to the broader availability of modern ultrasound systems with CEUS capabilities. By conducting various experiments on our proposed method, our comparative results clearly demonstrate the advantages of the proposed method in finding the breast cancer early detection accurately compared with all primitive modes and this novel method will show high accuracy compared with other modes of detection.

Key Words:

Ultrasonic Imaging Modality,Color Doppler,Segmentation,Breast Cancer,Contrast-Enhanced Ultrasonography (CEUS).

1. INTRODUCTION

Breast cancer is cancer that develops from breast tissue, this is also known as carcinoma. The following are the signs of carcinoma to identify the breast cancer like a lump within the breast, breast shape will be changed, skindimpling, fluid coming from the nipple, a newly-inverted nipple, or a red or scaly patch of skin [1].In those with distant spread of the disease, there could also be bone pain, swollen lymph nodes, shortness of breath, or yellow skin [2].A lot of risk factors are present for developing carcinoma which includes being female, excess obesity, excessive workout, alcoholic, body radiation, an early age initially menstruation, having children late in life or not in the least, older age, having a previous history of carcinoma, and a case history of carcinoma [3].

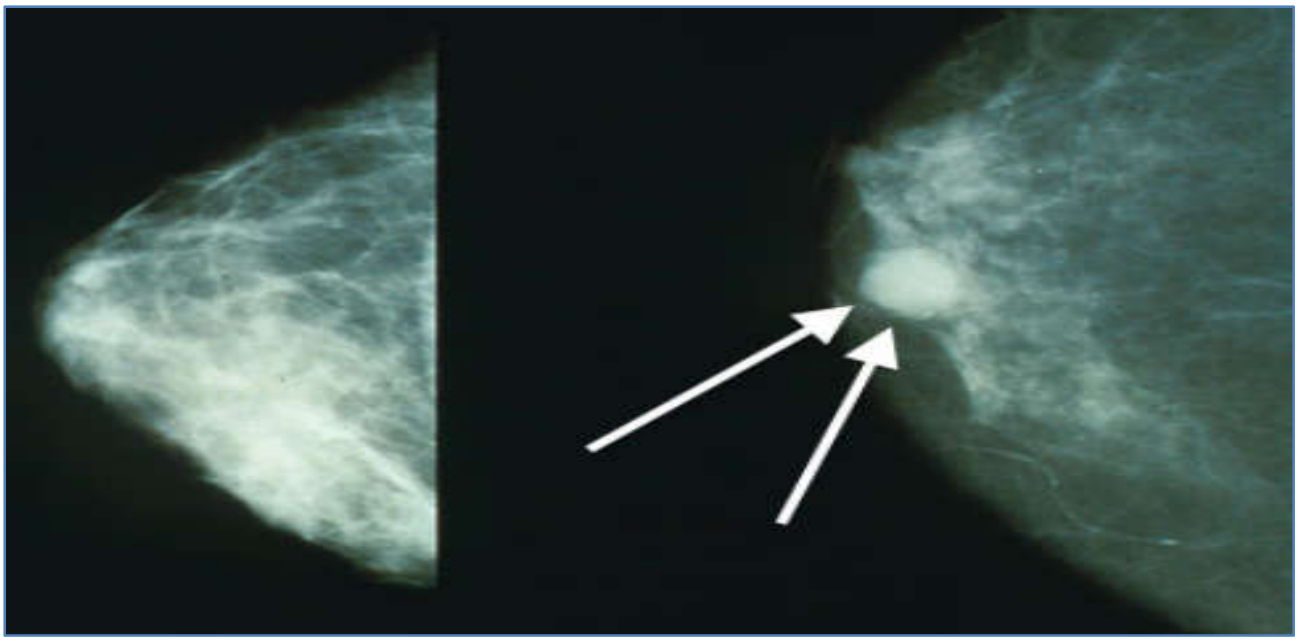


Figure 1.Represents the Mammo Breast Cancer Imagewith arrows pointing to Breast Cancer

About 5–10% of cases are the results of a genetic predisposition inherited from an individual's parents, including BRCA1 and BRCA2 among others [4] carcinoma most ordinarily develops in cells from the liner of milk ducts and therefore the lobules that provide these ducts with milk[5]. Cancers developing from the ducts are referred to as ductal carcinomas, while those developing from lobules are referred to as lobular carcinomas.[1] There are quite 18 other sub-types of carcinoma[6] .Some, like ductal carcinoma in place, develop from pre-invasive lesions. The diagnosis of carcinoma is confirmed by taking a biopsy of the concerning tissue. Once the diagnosis is formed, further tests are done to work out if the cancer has spread beyond the breast and which treatments are presumably to be effective.

From the above figure 1, we can clearly identify the breast cancer image having some abnormalities on the both breasts. These are shown by pointed with two arrows which clearly seen the different factors which impact for occurring the breast cancer. The effective breast screening modality, ultrasonic imaging and its adjunct modalities have been used for breast cancer diagnosis for many years.

2. LITERATUREWORK

In this section we mainly discuss about the background work that was carried out in finding the work that is related to cancer detection.

MOTIVATION

In general most of the breasts cancers are easily identified by diagnoseusing microscopic analysis of a sample - or biopsy - of the affected area of the breast. But for some types of breast cancer it requires some external lab exams to predict the disease. There are two commonly used screening methods for identifying the cancer like one is physical examination of the breasts by a doctor which is having experience on that subject and other one is to identify by using a mammography, which is used to find any lump is present inside the breast. If any lump is present abnormally on either of the breast like a simple cyst ,we can detect the problem as cancer.In some cases the results may not be conclusive for detecting the disease, then we need to remove a sample of the fluid in that lump region and try to send for a microscopic analysis (a procedure known as fine needle aspiration, or fine needle aspiration and cytology, FNAC) to help establish the diagnosis. This method is performed under a medical supervisor under a healthcare provider's clinic[7\.

For doing the FNAC procedure, the person is given a small amount of anaesthesia by a local anaesthetic on the breast tissue to prevent pain during the procedure, but may not be necessary if the lump isn't beneath the skin. A finding of clear fluid makes the lump highly unlikely to be cancerous, but bloody fluid may be sent off for inspection under a microscope for cancerous cells. Together, physical examination of the breasts, mammography, and FNAC can be used to diagnose breast cancer with a good degree of accuracy[8]. Other options for biopsy include a core biopsy or vacuum-assisted breast biopsy,[92] which are procedures in which a section of the breast lump is removed; or an excisional biopsy, in which the entire lump is removed. Very often the results of physical examination by a healthcare provider, mammography, and additional tests that may be performed in special circumstances (such as imaging by ultrasound or MRI) are sufficient to warrant excisional biopsy as the definitive diagnostic and primary treatment method[9].

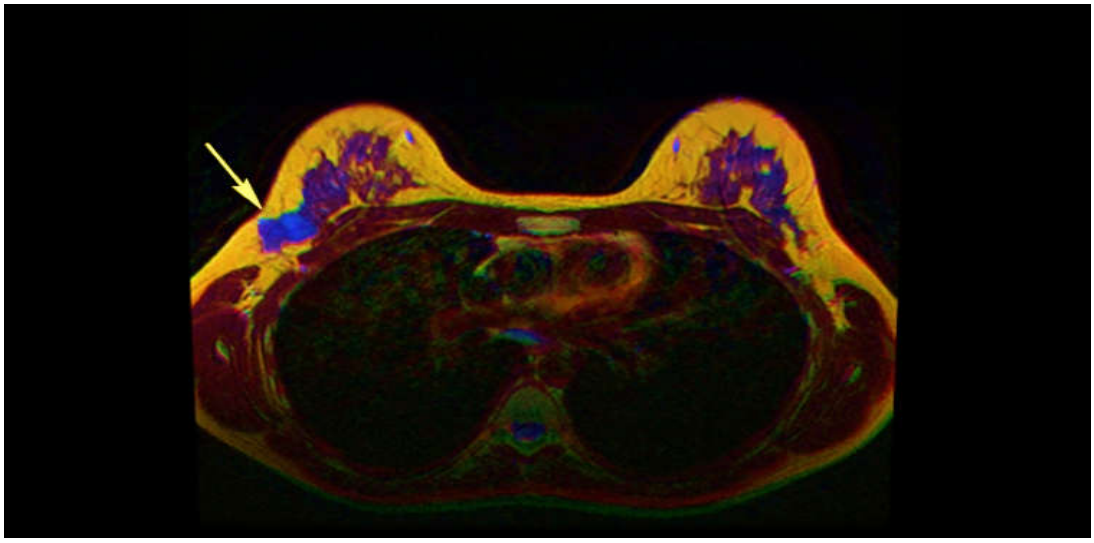


Figure 2.Represents the MRI Scan Report for Breast Cancer Detection

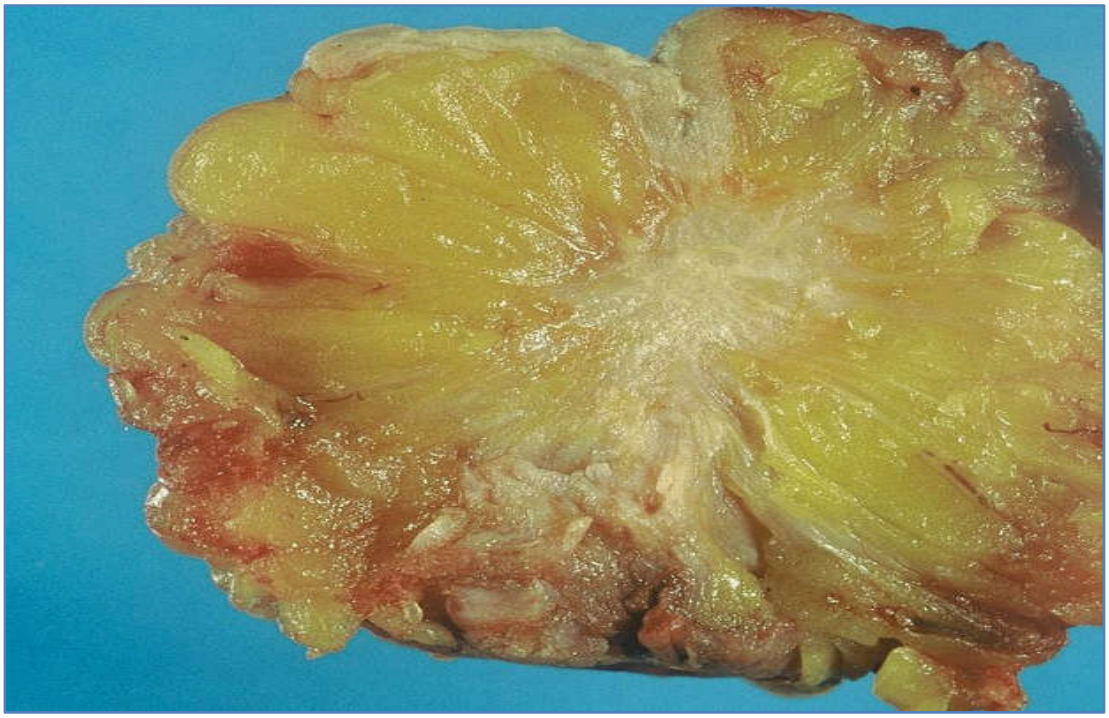


Figure 3.Represents the Excised human breast tissue, showing an irregular, dense, white stellate area of cancer 2 cm in diameter, within yellow fatty tissue.

From the above figure 2 and 3 we can able to identify some of the methods to identify the breast cancer. One form of method is using MRI scan to detect the abnormalities on either of the two breasts. And another form of identification is collecting tissue from that lump area which is ir-regular dense and having more diameter than the required one. This tissue will be mostly present on yellow color and fatty in structure[10].

3. THE PROPOSED SYSTEM ARCHITECTURE

In this section we try to represent the proposed architecture for identifying the breast cancer in early stage.

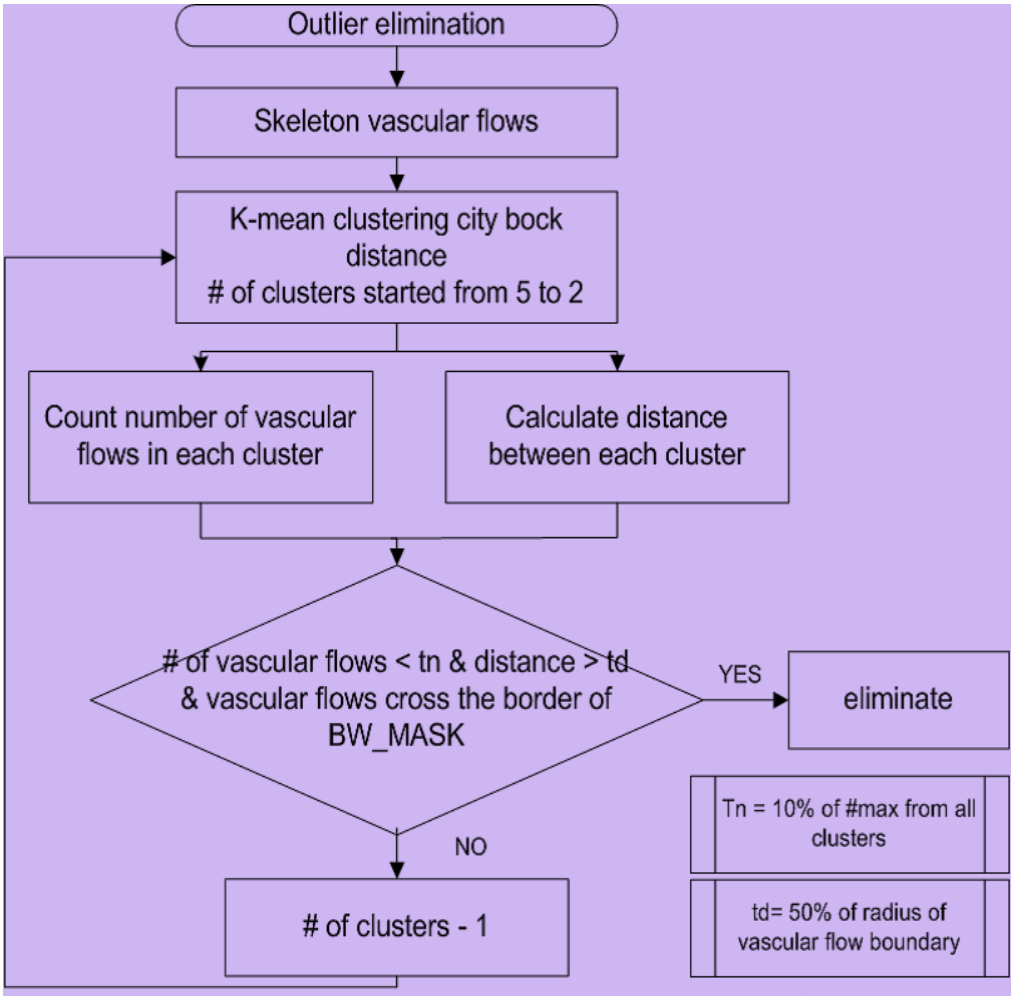


Figure 4.Represents the Contrast-Enhanced Ultrasonography (CEUS) in the diagnosis of vascular pathologies for increasing the detection of Breast Cancer

From the above figure 4, we can clearly identify the disease identification based on CEUS method, in which the image will be processed for outlier detection and then the skeleton vascular flows will be identified. Once they are identified now we try to calculate the clusters based on k-means clustering algorithm. Here try to count the vascular flow of each and every individual cluster and then see the flows are less than tn.And if we try to see any values are not within the disease limit they are eliminated[11].

Contrast-enhanced ultrasound (CEUS) is the application of ultrasound contrast medium to traditional medical sonography. Ultrasound contrast agents rely on the different ways in which sound waves are reflected from interfaces between substances. This may be the surface of a small air bubble or a more complex structure. Commercially available contrast media are gas-filled micro bubbles that are administered intravenously to the systemic circulation. Micro bubbles have a high degree of echogenicity (the ability of an object to reflect ultrasound waves). There is a great difference in echogenicity between the gas in the micro bubbles and the soft tissue surroundings of the body. Thus, ultrasonic imaging using micro bubble contrast agents enhances the ultrasound backscatter, (reflection) of the ultrasound waves, to produce a sonogram with increased contrast due to the high echogenicity difference. Contrast-enhanced ultrasound can be used to image blood perfusion in organs, measure blood flow rate in the heart and other organs, and for other applications

4. IMPLEMENTATION STAGE

Implementation is a stage where the theoretical design is automatically converted into programmatically manner. This is mainly divided into number of modules. They are as follows:

1) Edge Map Module
2) Dark Gray Region Mask Module
3) Segmentation of vascular flows
4) Filter the common area of conventional US and Color Doppler
5) Eliminating outliers of vascular flows
6) Estimating an initial contour for ACM
7) Contrast-Enhanced Ultrasonography (CEUS) in the diagnosis of vascular pathologies

Now let us discuss about each and every individual module in detail:

1) Edge Map Module

In this module we try to segment the breast cancer mass by applying the ACM method in the primitive ultrasound (US) thus the binary edge detection of the image is required as a part of making external forces for ACM. Due to the sparkle noise and intensity in homogeneities of the breast cancer mass, normal edge detection method may not work well.

2) Dark Gray Region Mask Module

Under the assumption that the dark gray region (acoustic strengthening and calcification content) would likely to be the breast cancer mass area. First the conventional US is applied by Gaussian blur to smooth noise, and then thresholding technique is used.

3) Segmentation of Vascular Flows Module

The interesting feature in Color Doppler is vascular flows that present as color areas. Basically, in gray-scale regions, the intensity values of R, G, and B channels are almost same. It contrasts with the color objects which have different intensity values in the three channels with big variance

4) Filter the common area of conventional US and Color Doppler Module

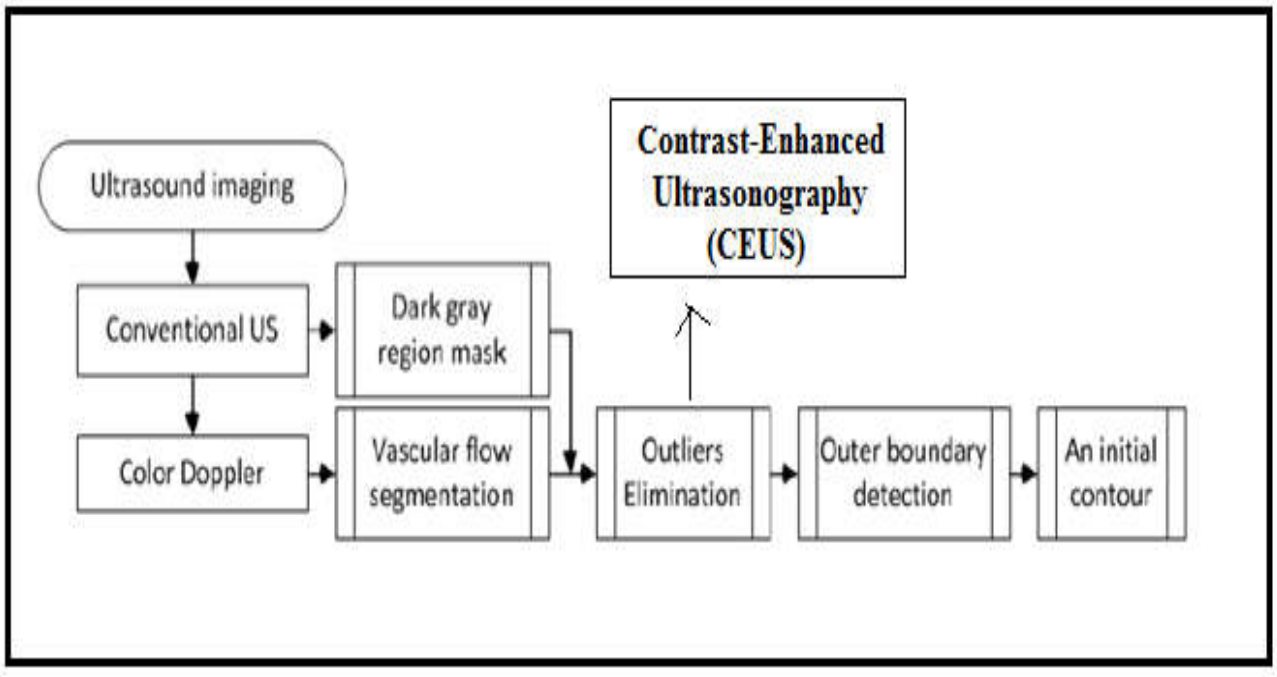
Finally, the output binary image showed obtained by applying dark gray mask to find roughly common area.

5) Eliminating outliers of vascular flows Module

Sometimes, results after applying the dark gray mask may not be satisfied because of outliers. Normally, the outliers are quite far from the main region. The method to eliminate outliers. The boundary of vascular flows is obtained from convex hulls algorithm [12]. The main method to find possible outliers is K-mean clustering. The maximum number of clusters is defined based on the observation from all datasets.

6) Estimating an initial contour for ACM Module

An initial contour is estimated based on the boundary of the vascular flows after filtering out the non-cancerous regions and suppressing outliers. It is the set of points obtaining from convex hulls algorithm.

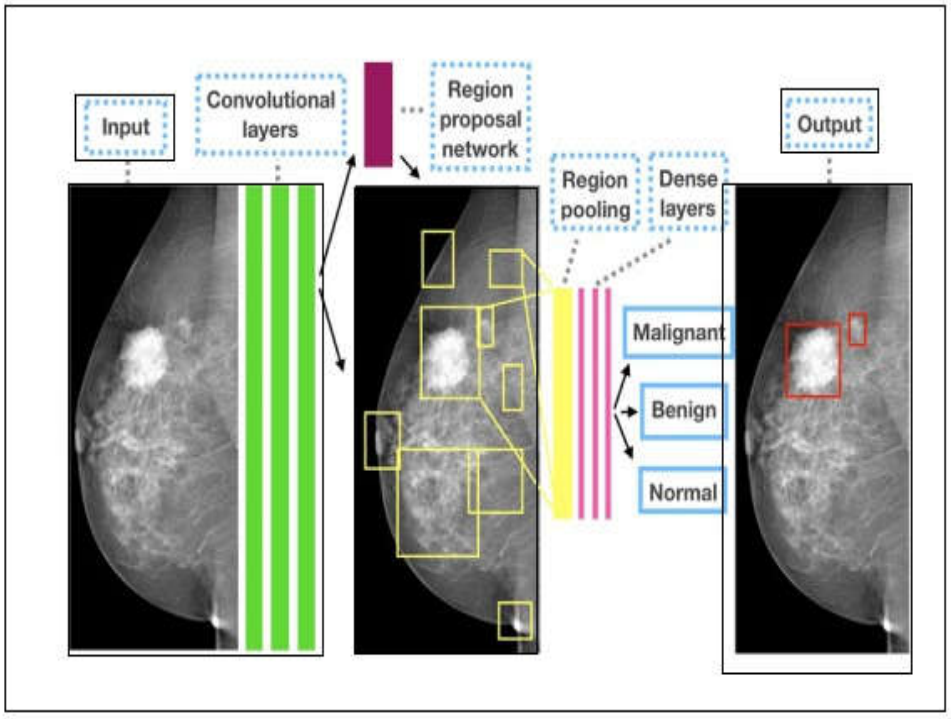


7) Contrast-Enhanced Ultrasonography (CEUS) in the diagnosis of vascular pathologies

In this stage Contrast-Enhanced Ultrasonography (CEUS) is used in the diagnosis of vascular pathologies, where this is included at outlier's elimination stage and this will be extracted at the outer boundary detection. In that stage the input is clearly scanned and after this phase this is obtained as an initial contour. This will be finally send for the process of detecting the abnormality in the process of cancer detection.

5.EXPERIMENTAL EVALUATION

We have conducted experiment on some sample breasts collected from different hospitals and we try to verifythe resultant output in terms of identifying the breast cancer patient with his abnormality type. Initially we try to collect some sample input images which contain some sort of abnormality in those two breasts. This will be initially scanned and converted into gray scale to identify the convolutional layers present inside the breast. After the layers are formed and identified then we try to identify the image as region proposal network and they are identified based on two types of layers like region pooling and dense layers. Here from those layers we are going to identify the type of defect or abnormality present in the breast. The abnormality can be identified as following ways: Either Malignant, benign or normal. The resultant output will be traced based on the type of cause and those will be sending for the treatment based on the current stage.



6. CONCLUSION

A novel automatic initialization for ACM in breast cancer segmentation applied to conventional US, has been proposed. The combination of conventional US and Color Doppler is utilized. Various methods have been applied to extract useful features from these images but none of them can give accurate results in identifying the early detection of breast cancer. In this proposed paper we try to design a novel method for automatic detection of active contour model designed with an association of US-based imaging modalities. This proposed novel method initially tries to estimate the initial contour by utilizing the features of conventional ultra sound and color doppler. In this proposed thesis we try to extend the detection of breast cancer ability by integrating a novel method like contrast-enhanced ultrasonography (CEUS) in the diagnosis of vascular pathologies for increasing the detection of breast cancer due to the broader availability of modern ultrasound systems with CEUS capabilities. By conducting various experiments on our proposed method, our comparative results clearly demonstrate the advantages of the proposed method in finding the breast cancer early detection accurately compared with all primitive modes and this novel method will show high accuracy compared with other modes of detection.

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