A Survey on Breast Cancer Detection

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Abstract: Breast cancer is the most common cancer among American women. The average risk of a women developing a breast cancer some time in her life is about 12% in the united states. Breast cancer stars when cells in the breast begin to grow out of control. These cells usually form as a tumor. Tumor is malignant if the cells grows and spread to the surrounding tissues that is, to other areas of the body. Breast screening exam allow early detection of the cancerous lesion that may be a more effective treatment of disease. Nearly all 25% of breast cancer deaths occur in women diagnosed between 40 to 49 years. Early detection of breast cancer still remains as open problem in the research community. This paper presents a survey of different techniques for early detection of breast cancer.

Keywords: Breast Cancer, Digital Breast Tomosynthesis, Microwave Imaging, Mammography; Ultrasound.

1.INTRODUCTION

Breast cancer is a most common cancer that is found in women. In 2017,around 252,710 new diagnoses of the breast cancer is expected in women, and also around 40,610 are likely to die from the breast cancer. The studies on causes for the breast cancer shows that the breast cancer can occur due to inherited genes or it may be due to the consumption of alcholol in high quantity. According to the American Cancer Society, over 2,50,000 new cases of invasive breast cancer will be diagnosed each year in women and in men over 2,400. Studies shows that the early detection of breast cancer and appropriate treatment for that will significantly increases the chances of survival.

The symptoms of breast cancer will include lump or mass in the breast that a individual can feel, swelling of all or the part of breast, breast pain,nipple pain or nipple turning inward , redness, or thickening of nipple or breast skin, lump in underarms
According to study breast calcifications are small calcium deposits in women's breast tissue. They are very common and usually benign. Microcalcification is a small deposit of calcium that looks a like a white specks. Microcalicfication cannot be felt but can only be seen using one of the screening methods. It is usually caused by aging, an old injury or inflamed tissues. Macrocalcification looks like a large white dots on the breast in x-ray which dispersed randomly within the breast. Mass in breast cancer is a symptom that is painless, hard and has a irregular edges is found to be breast cancer but breast cancer can be painful, soft and rounded. Therfore it is important to be checked by the healthcare if any abnormalities or mass is found in the breast.

1.1. IMAGING TECHNIQUES
Various medical modalities are used in detection of cancer to improve accuracy of reading scans. There are several imaging techniques for examination of the breast, including mammography, Microwave imaging Breast Ultrasound imaging, and Tomosynthesis.

Mammography
A mammography is an X-ray image of the breast. Mammography usually takes two x-ray of each breast from different angles that is from top to bottom and from side to side. In mammography it records the picture on computer and it is then read by the radiologist. But in mammography the compression of the breast that is required during the screening will uncomfortable for the patient and also it leads to the overlapping of the breast tissue while examining. Due to the overlapping of the tissue it will not give more information about the cancer and cancerous tissue may not be visible in the mammography.

Microwave Imaging
A microwave imaging is also one of the method for early detection of breast cancer.This is based on contrast of electric parameters between tumor and normal breast tissues within the microwave spectrum.

Detecting the breast cancer using only microwave imaging had a poor success because the breast is often highly heterogenous fibroglandular tissue randomly interpret in the adipose tissue.

Breast Ultrasound (or sonogram)

Ultrasound is a detection of breast cancer technique in which the sound waves of high frequency is passed through the breast and converts them into images on viewing screen. The ultrasound places sound emitting probe on the breast to conduct the test. But it cannot determine whether solid lump is cancerous nor it can detect calcification.

Digital Breast tomosynthesis

It is a three-dimensional mammography and it is andvanced form of breast imaging or mammography. It takes a multiple x-ray picture of each breast from many angles and x-ray tube moves in an arc shape around the breast by taking n images during the examination.

1.2. LITERATURE SURVEY

Early Stage Detection of Breast Cancer Using Novel Image Processing Techniques, Matlab and Labview Implementation[2013]:The early detection of breast cancer is carried out by using mammographic images. It is difficult to detect signs such as micro calcifications and masses due to their low contrast nature of the images.The purpose of this paper is that using image processing technique the algorithm is developed for detection of breast cancer. Novel algorithms are implemented for 1) Mass region extraction to get exact shape of the mass 2) Superposition of boundary of mass on mammogram helps doctors to view the boundary easily as mass region overlaps with breast parenchyma 3) Extraction of texture features like mean, standard deviation, entropy.[1]

A Novel Approach for Breast Cancer Detection and Segmentation in Mammogram[2015]:The Mammographic images that are considered are usually of low contrast and noisy. In breast mammography, bright regions will represent cancer. In some mammographic images, malignant tissues and normal dense tissues both may be present.The purpose is to develop the new algorithm for detection of breast cancer using enhancement technique to identify microcalcification and masses.The enhancement is done by histogram equalization technique to get the better result enhanced using adaptive histogram equalization techniques and then it is subjected to segmentation.[2]

A Novel automatic tumor detection for breast cancer using ultrasound images [2011]:Tumor detection is usually done by the ultrasound images but due to their low quality and specular nature of the ultrasound image it is very difficult to find the tumor and in many of the existing methods the region of intrest is selected manually.In this paper it uses the fuzzy logic.The fuzzy logic will going to transfer the ultrasound image to the fuzzy domain.By using this logic it can automatically select the region of intrest. [3]

Computer aided breast cancer detection using mammogram [2013]: This paper shows that the sensitivity and expertise of the radiologist.The mammogram are difficult to interpret ,especially in the scrrening because it of its image quality and also mammogram will not provide a good contrast between normal glandular and malignant tissue.The detection is done by the image processing steps.[4]

Detection of breast cancer with Hybrid image segmentation and Ostu's thresholding[2015]:In this paper it shows that the artifacts and the personal detail information is eliminated in the image pre-processing and segmentation stage .And also the tumor's edge details are computed by the segmentation and it is diagnoised by the experts.[5]

Modified Image Segmentation Method based on Region Growing and Region Merging[2014]:In this paper it shows the segmentation is done in three phases that is in first phase generation of threshold is done using dynamic modified region growing phase,in next phase the texture features are extracted and in third phase region merging is done[6]

Breast Cancer Detection in Digital Mammogram[2015]:In this paper the abnormalities in the mammogram is automatically detected.Prior to this abnormality detection the segmentation needs to be done by applying the image processing techniques to find the suspicious region of intrest.[7]

Novel Image Processing Technique for Early Detection of Breast Cancer Matlab And Lab View Implimentaion [2013] In this paper a novel approach to identify the masses and calcification the image enhancement technique is used for the early detection of breast cancer.For enhancement it uses wavelet and adaptive histogram equalization technique and segmentation by region growing techniwue and extraction of mass by canny edge detection.[8]

An Adaptive Clustering Algorithm For Image Segmentation[1992]:In this paper the generalization of the the kmeans is used for the segmentation which includes spatial constraints and local intensity values[9].

Improved Region Growing Based Breast cancer image Segmentation [2016]:In this paper the segmentation is done by region growing technique but in region growing it considers only one constrain but here the orientation constrain is also considered which improves the result in the segmentation[10]

Calcification In The Breast And Digital Breast Tomosynthesis: In this paper the comparision is done between the conventional mammography and the digital breast tomosynthesis based on the clarity of these two results that are obtained.The clarity here refers to the sharpness, contrast and the diagnostic qualities.[11]

Estimating Breast Tomosynthesis Performance In Detection Task With Variable-Background Phantoms[2009]:In this paper it develops a computational approach to improve the performance in DBT.The system developed must incorporate multi-angle co-relation into the mathematical model.It also include variable-background phantom.[12]

Stationary Digital Breast Tomosynthesis With A Multi-beam Field Emmission X-ray Source Array[2008]:In this paper it shows that the aim is to reduce the imaging time,to simplify system design and to improve the quality of the image when compared to the conventional mammography[13]

Digital Breast Tomosynthesis Using An Amorphous Selenium Flat Panel Detector[2005]:In this paper the system developed which has the detector is an amorphous selenium and the system can read the sequence that can be used to investigate the different tomosynthetic data aquistion modes .The reconstruction of these images is also done[14]:

LIMITATIONS OF CURRENT IMAGING TECHNIQUES

Three imaging tools are commonly utilized for early detection of breast cancer:Microwave imaging or digital mammography, breast ultrasound and breast MRI. These 3 imaging technologies have limitations that may beaddressed by DBT. The main limitation of conventional isthat it gives less information and also due to overlapping of breast tissue it has poor result. In addition, conventional screening mammography has a poor specificity with recall rates up to 10% for negative or benign findings.

Breast ultrasoundit cannot determine whether solid lump is cancerous nor it can detect calcification.Many calcifications seen on the mammogram is not visible in ultrasound. However, the specificity of breast ultrasound is even lower than mammography.

By using the Microwave Imaging Technique it doesnot result in the sucsess because the breast tissues are randomly interpret in the breast which are heterogeneous and are fibroglandular tissues

DBT's advantage is that it can overcome the limitations of other screening techniques when compared to conventional mammography DBT captures multiple images of each breast so that more information will be provided.But in mammography 2 projection of the each breast is captured which will produce less information for further processing.

2. IMAGE PROCESSING METHODS

Image processing is a technique that is performed on an image,which will going to perform some operations so that some information is obtained.May be in order to get an enhanced image or to extract some useful information from it. It is a processing technique,in which the input to that process can be an image or the features associated with that image. Nowadays, image processing is among rapidly growing technologies. Image processing basically includes the following three steps:

- Image Acquisition tools are used to import the input
- Analysing and manipulating the image;
- Output in which result are obtained and that can be modified based on image analysis.

Pre-processing
The main goal of the pre-processing is to improve the image quality to make it ready to further processing by removing the noise that are present in the input image.

Hence pre-Processing is essential to improve the quality. It will prepare the input for the next two-process segmentation and feature extraction. The noise and high frequency components removed by filters.
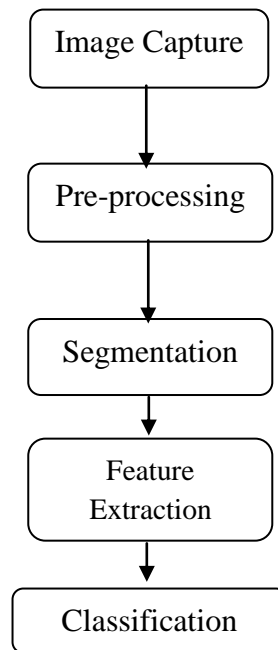
Fig 1:Image processing steps

Segmentation

Image segmentation is the process of partitioning the given input image into multiple segments.The main aim of the segmentation process is that the representation of the image is made simpler and more meaningful and analysing that image should be made easier. Image Segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images.In an image segmentation process each pixelis assigned with the label for the image so that the pixels with the same characteristics will share the same label.

Feature Extraction

Feature extraction involves reducing the amount of resources required to describe a large set of data. When analysing the complex data one of the problem involved in that is presence of the number of the variables that are involved. Analysis with a large number of variables generally requires a large amount of memory and computation poweror a classificationalgorithm which overfits the training sample and generalizes poorly to new samples. Feature extraction is the process of constructing the combinations of variables.

3. CONCLUSIONS

As per survey early detection of breast cancer is still a challenge. There is scope for improvement. Each modalities have their own limitations, thus fusion of information retrieved from different modalities may be helpful to improve the accuracy of early detection of breast cancer

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