



Survey of Breast Cancer Detection using Various Image Processing Technique Applied on Mammogram

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Abstract: Breast cancer is the most common cancer in women and the second most common cancer in worldwide. The cancer incidence(new cases) in men is estimated to be 679,421 in 2020 and 763,575 in 2025. Among women, it is estimated to be 712,758 in 2020 and 806,218 in 2025. To decrease this rate and to increase survival rate it is important to detect cancer as early as possible. There are various techniques has been used to detect the breast cancer. Mammography is one of the technique that examine the human breast for the diagnosis and screening. In this paper we have studied various technique presented by respected author in image processing and shown the comparative flow of the breast cancer detection technique.

Keywords: Breast Cancer, Mammogram, Pre-processing, Segmentation, Feature Extraction, Classification.

I. INTRODUCTION

Breast cancer is the cancer that begins in the breast. The breast cancer starts when cells begins to grow abnormally(out of control). Breast cancer cells usually forms a tumor that can often be seen in x-ray or called as a lump. Mostly breast cancer occur in women but men can affected too. The breast is made of specialized tissue that produce milk, among of fat determine the size of the breast. The milk producing part of the breast is organized into 15 to 20 section, called lobes. Within each lobe are smaller structures called lobules, where milk is produced. The milk travel through a network of tiny tubes called duct. The duct connect and comes together into larger ducts, which eventually exit the skin in the nipple called areola. The breast cancer starts in different part of breast:

- Most breast cancer begins in the duct that carry milk to the nipple(ductal cancer).
- Some start in the gland that make breast milk(lobular cancer).
- There are also other type of cancer that are less common like phyllodes tumor and angiosarcoma.
- A small number of cancer start in other tissue in the breast. These cancer are called sarcomas and lymphomas and not really through a breast cancer.

As the breast cancer is second most cancer in worldwide. It is reported that with four minutes, an Indian women is diagnose with breast cancer. A 2018 report of breast cancer statistics recorded 1,32,468 new registered cases and 87,090 reported deaths. Most of the women are diagnose with breast cancer when they have become under stage 3 to 4 stage. To increase the survival rate it is very much essential to detect disease as early as possible. It is on still challenge to fined best technique to detect and diagnose the breast cancer.

Mammography is one of the technique to detect tumor or lump from the breast. The mammography is having two types. Film screen mammography and digital mammography also called as full-field digital mammography or FFDM.

II. LITERATURE SURVEY

In this paper, the investigation has been done to classify whether the breast is cancerous or non-cancerous. Under consideration of image dataset, different authors are used different techniques to classify the breast is cancerous or non-cancerous. Such some techniques are studied and shown below.

Kavneet Kaur, Ms. Navneet Kaur, Mr. Rashwinder Singh are worked on mammographic images for the breast cancer detection using watershed and thresholding technique. This technique uses three main stage, detection region of interest, pre-processing and segmentation. Here, thresholding technique gives optimal result. While watershed transform is an efficient segmentation tool with marker based approach as it automatically detects the mass in the image. Also it draws ridge lines if more than one region is detected in an image. These proposed methods are successfully able to segment the image effectively and mass lesions. where the key factor is it draw ridge lines if more the one region is detected.

S. Punita, A. Amuthan, and K. Surash Joseph represented the benign and malignant breast cancer segmentation using optimized region growing technique. In the pre-processing step, the images are pre-processed using Gaussian filtering. An automated detection method of breast masses is proposed using an optimized region growing technique where the initial seed points and thresholds are optimally generated using a swarm optimization technique called Dragon Fly Optimization(DFO). The texture features are extracted using GLCM and GLRLM techniques from the segmented images and fed into a Feed Forward Neural Network(FFNN) classifier trained using back propagation algorithm which classifies the images as benign and malignant. The performance of the proposed detection technique is evaluated using the images obtained from DDSM database.

R. Guzman-Cabrera, J. R. Guzman-Sepulveda, M. Torres-Cisneros, D. A. May-Arrijoja, J. Ruiz-Pinales, O. G. Ibarra-Manzano, G. Avina-Cervantes and A. Gonzalez Parada suggest an approach to effectively analyze digital mammograms based on texture segmentation for the detection of early stage tumors. The proposed algorithm was tested over several images taken from the digital database for screening mammography for cancer research and diagnosis, and it was found to be absolutely suitable term distinguish masses and microcalcification from the background tissue using morphological operators and then extract them through machine learning techniques and a clustering algorithm for intensity-based segmentation.

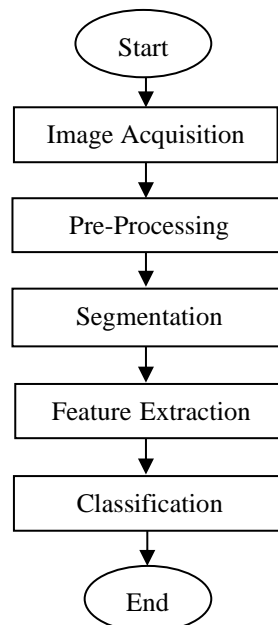
Tobias Christian Cahoon, Melanie A. Sutton and James C. Bezdek gave a new technique in image processing to breast cancer detection. They describe the use of segmentation with fuzzy modes and classification by the crisp k-nearest neighbor(k-nn) algorithm for assisting breast cancer detection in digital mammogram and shown that supervised and unsupervised method of segmentation, such as k-nn and fuzzy c-means(FCM).

Shalinia G and Dr. T.N.R Kumar provides a new method to detection of breast cancer. They are used adaptive median filtering for the pre-processing along with segmentation before classification. Neural network is aid for training purpose and prediction has been done appropriately.

Prannoy Giri and K. Saravanakumar used DDSM database for study of breast cancer. Initially they are converted mammographic image into specified resolution using image enchantment algorithm and then removed noise by noise removal algorithm. Thresholding approach is applied for segmentation. Machine learning algorithm, neural network is used to classify the image whether it is cancer affected or not.

III. METHODOLOGY

This section describe the different technique used by authors to identify the breast is cancerous or non-cancerous.



A. Image Acquisition

The first step is the image acquisition. The mammographic image dataset are available in web portal. Respected authors taken images from different databases and concluded the result respectively. Such some image database are try to show here.

- Mammographic Image Analysis Society(MIAS)

The Mammographic Image Analysis Society(MIAS) is an organization of UK research groups interested in understanding of mammograms and generate a database of digital mammograms. Films taken from the UK National Breast Screening Programme have been digitised to 50 micron pixel edge with a Joyce-Loebl scanning microdensitometer, a device linear in the optical density range 0-3.2 and representing each pixel with an 8-bit word. The database contains 322 digitised films and is available on 2.3GB 8mm(ExaByte) tape.

➤ Digital Database for Screening Mammography(DDSM)

The Digital Database for Screening Mammography(DDSM) is another resource for possible use by the mammographic image analysis research community. It is a collaborative effort between Massachusetts General Hospital, Sandia National Laboratories and the University of South Florida Computer Science and Engineering Department. The database contains approximately 2,500 studies. Each study includes two images of each breast, along with some associated patient information(age at time of study, ACR breast density rating, subtlety rating for abnormalities, ACR keyword description of abnormalities) and image information(scanner, spatial resolution, ...). Images containing suspicious areas have associated pixel-level "ground truth" information about the locations and types of suspicious regions. Also provided are software both for accessing the mammogram and truth images and for calculating performance figures for automated image analysis algorithms.

Sr. No.	Authors	Image Database used
I	Kavneet Kaur, Ms. Navneet Kaur, Mr. Rashwinder Singh	Mammographic Image Analysis Society(MIAS)
II	S. Punita, A. Amuthan, K. Surash Joseph	Digital Database for Screening Mammography(DDSM)
III	R. Guzman-Cabrera, J. R. Guzman-Sepulveda, M. Torres-Cisneros, D. A. May-Arrijoja, J. Ruiz-Pinales , O. G. Ibarra-Manzano, G. Avina-Cervantes, A. Gonzalez Parada	Digital Database for Screening Mammography(DDSM)
IV	Tobias Christian Cahoon, Melanie A. Sutton, James C. Bezdek	Digital Database for Screening Mammography(DDSM)
V	Shalinia G, Dr. T.N.R Kumar	Mammographic Image Analysis Society(MIAS)
VI	Prannoy Giri, K. Saravanakumar	Digital Database for Screening Mammography(DDSM)

Table 1. Types of database used by authors

B. Pre-Processing

The objective of the image pre-processing is to enhance the quality of image so that the analysis of the image will be done in better way. We may directly give the input to the program but those might give the poor result which will not accurate. So we are giving direction to the computer to achieve an accurate result by pre-processed image.

Here some image pre-processing technique used by respected authors shown in following table.

Sr. No.	Authors	Pre-processing method used
I	Kavneet Kaur, Ms. Navneet Kaur, Mr. Rashwinder Singh	Morphological operation – Dilation, Erosion
II	S. Punita, A. Amuthan, and K. Surash Joseph	Gaussian Filter
III	R. Guzman-Cabrera, J. R. Guzman-Sepulveda, M. Torres-Cisneros, D. A. May-Arrijoja, J. Ruiz-Pinales , O. G. Ibarra-Manzano, G. Avina-Cervantes, A. Gonzalez Parada	-
IV	Tobias Christian Cahoon, Melanie A. Sutton, James C. Bezdek	-
V	Shalinia G, Dr. T.N.R Kumar	Adaptive Median Filtering

VI	Prannoy Giri and K. Saravanakumar	Image enchantment algorithm, Noise removal algorithm
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Table 2. Types of Pre-processing Technique used by authors

C. Segmentation

Image segmentation is the process of partitioning the image into multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse. Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

Some image segmentation methods used by following authors shown in below table.

Sr. No.	Authors	Segmentation method used
I	Kavneet Kaur, Ms. Navneet Kaur, Mr. Rashwinder Singh	Watershed Segmentation
II	S. Punita, A. Amuthan, K. Surash Joseph	Optimized Region Growing Segmentation
III	R. Guzman-Cabrera, J. R. Guzman-Sepulveda, M. Torres-Cisneros, D. A. May-Arrijoja, J. Ruiz-Pinales, O. G. Ibarra-Manzano, G. Avina-Cervantes, A. González Parada	Clustering algorithm for intensity-based segmentation
IV	Tobias Christian Cahoon, Melanie A. Sutton, James C. Bezdek	Supervised and Unsupervised Segmentation
V	Shalinia G, Dr. T.N.R Kumar	-
VI	Prannoy Giri, K. Saravanakumar	Thresholding method

Table 3. Types of Segmentation Technique used by authors

D. Feature Extraction

Once the image is segmented it is clear to be extract features to classifying and recognition of image. Feature extraction is the process to collect the meaningful information from image. Features like shaped, edges, or motion in a digital image or video to process them.

E. Classification

Classification involve the vital role in image processing. It is a final stage of detection of any kind of feature in image. It use to classify a features into different classes by different characteristics. Some image classification algorithms are:

- Artificial Neural Network
- Convolutional Neural Network
- K nearest neighbor
- Decision tree
- Support Vector Machines

IV. CONCLUSION

In this paper, we have studied the various technique used in image processing to detection of breast cancer using mammographic images taken from different databases. We have researched pre-processing technique, segmentation technique. The various segmentation technique gives the approximate result but the 100 percent accuracy of the tumor is still in research. There may be better technique will be concluded ahead.

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