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Detecting Cancer Using Image Enhancement Technique

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Abstract: In breast cancer diagnosis, the radiologists mainly use their eyes to discern cancer when they screen the mammograms. However, in many cases, cancer is not easily detected by the eyes because of the bad imaging conditions. In order to improve the diagnosis rate of cancer, image-enhancement technology is often used to enhance the image and aid the radiologists. In this paper, we are trying to de-noise the image initially. This is achieved by median filtering the noisy image that has salt and pepper noise. Enhancement of the image is done through sobel filtering where edges are highlighted. Threshold segmentation and morphological operations of the enhanced image is done to isolate the cancerous cells. This is used to estimate the percentage of cancerous cells with respect to the entire mammogram image. This data helps in identifying the stage of cancer necessary for further treatment.

Keywords: cancer, median filter, mammograms, salt and pepper noise, sobel filtering

I. Introduction

Cancer is potentially fatal disease caused by environmental factors which mutate genes encoding critical cell proteins. One of the most common types of cancer in women is breast cancer. In western countries, there is one out of eight women suffers from breast cancer and majority is in the age group of 40 to 50 years. Cancers are divided into two types: benign and malignant and breast cancer has no exception. If the cancer is malignant under the conditions of early diagnosis, increasing age and treatment hope for patients will be very high. Studying patients and identifying all the factors influencing the disease, there are hopes to take useful steps towards this. Breast Cancer is the second leading cause of death for both men and women in the United States and in the entire world and is expected to become the leading cause of death in the next several decades. Breast cancer is a disease in which normal cells in the breast begin to change, grow without control, and no longer die. Cancer that has not spread is called in situ, meaning "in place". Cancer that has spread is called invasive or infiltrating. Breast cancer makes up one third of all cancers in women. Lifetime risk of breast cancer is one in nine.

It has been shown that early detection and treatment of breast cancer are the most effective methods of reducing mortality. Early detection is done by means of screening on the basis of mammogram. Mammogram is a picture of breast taken with a safe, low dose X-ray machine. It is a recommended exam for women in early detection of breast cancer. Mammograms are not that efficient when it comes to denser tissues. Other imaging methods include MRI (magnetic resonance imaging), Ultrasound, and CT (computed tomography) scan.

One big issue, when the radiologists screen mammograms, is that the contrast of the images obtained with a low-dose X-ray machine is low. In the low-contrast images, the minor difference between the normal tissue and the malignant disease is not discernable and makes the interpolation very difficult. Thus, enhancing the contrast of the image becomes very important when the mammograms are screened.

Enhancement can be done by removing noise. The common noise present in mammogram is impulse noise which is also called as 'salt and pepper' noise. Salt and pepper noise contains random occurrences of black and white pixels. This noise can be removed by using different types of filters like mean filter, Gaussian filter, median filter etc...

The current methods which are employed for cancer detection are:

- Cancer screening
- Medical imaging techniques:
 - Computed tomography (CT) scan
 - Magnetic resonance imaging (MRI)
 - Positron emission tomography (PET) scans
- Mammography
- Biopsy

II. Literature Survey

Numerous promising approaches are being proposed by various authors. Few of these recent works have been extensively studied by us and discussed in this paper.

Maitra *et al.* [1] basically concentrated to develop a technique to identify the abnormal growth of masses in breast using very simple algorithms. The tool will only identify the masses with some distinguishing features to ease further investigation. In this new process they have selected the digital mammogram, which has become the most effective technique for early breast cancer detection. The mammogram images used in this experiment are taken from the mini mammography database of MIAS (Mammographic Image Analysis Society). The original MIAS Database (digitized at 50 micron pixel edge) has been reduced to 200-micron pixel edge and clipped/padded so that every image is 1024 pixels x 1024 pixels. All images are held as 8-bit gray level scale images with 256 different gray levels (0-255) and physically in portable gray map (.pgm) format. The list is arranged in pairs of mammograms, where each pair represents the left and right breast of a single patient. In their experiment they have considered all three types of breast tissues i.e. Fatty, Fatty-glandular, Dense-glandular. Different types of abnormalities like calcification, well-defined or circumscribed masses, speculated masses and other ill-defined masses have also been considered by our study. They have considered more than hundred samples as a test case. The identification technique is divided into two parts. They follow after preprocessing of digital mammogram. Qing-Hang, He *et al.*[2] proposed a combined method of image enhancement techniques to the degraded medical digital images, which increase the image's quality greatly.

Paper [3] proposes pre-processing technique for the removal of noise which is very important in breast cancer analysis because it reduces the number of false positives. It proposes various filtering techniques to solve the noise removal problem and separate the background region from the breast profile region using an automatic thresholding technique and connected component labeling.

Muneer Ahmad *et al* [6] discussed on an integrated approach using wavelet transforms and image filtering. methodology includes transformation of RGB image to a gray scale image, filtration of image using low pass and high pass band discrete filters of third order, application of soft threshold factor over decomposed wavelet coefficients, synthesis of noise reduced decomposed signal and application of prewitt filtering method for further suppression of noise and enhancement in features of image.

A new type of nonlinear filter called the alpha weighted quadratic filter is introduced in [10]. This filter has been shown to effectively enhance the overall contrast of mammograms and also improve the local fine details and dark regions in mammograms. Two classes of non-linear filtering techniques are discussed in [11], which have the characteristics of linear filters at expense of median filters. Edge detection filters are classified in [12].

III. Limitations of Current Methods

1. Screening can lead to substantial false positive result and subsequent invasive procedures. It is not indicated unless life expectancy is greater than five years and the benefit is uncertain over the age of 70.
2. Several deaths have been reported in patients with pacemakers who have undergone MRI scanning without appropriate precautions.
3. The very high strength magnetic field can also cause "missile-effect" accidents, where ferromagnetic objects are attracted to the center of the magnet, and there have been incidents of injury and death.
4. The ionizing radiation in the form of x-rays used in CT scans is energetic enough to directly or indirectly damage DNA. This and other types of DNA damage are occasionally not corrected properly by cellular repair mechanisms. Such damage to the DNA occasionally leads to cancer.
5. Mammography may also produce false negatives. Estimates of the numbers of cancers missed by mammography are usually around 10% - 30%. This means that of the 350 per 100,000 women who have breast cancer, about 35-105 will not be detected by mammography.

IV. Motivation and Scope

The alarming rise in the death rate of women due to breast cancer made us think how effectively we can use our technical knowledge to help people in an economical way. In such a scenario, early detection of cancer plays a crucial role. Image processing applications have gained great popularity in recent times. This motivated us to develop a method which will help in the reduction of mortality rate due to faulty and late detection of cancer cells. We believe that this will be our small contribution to the society.

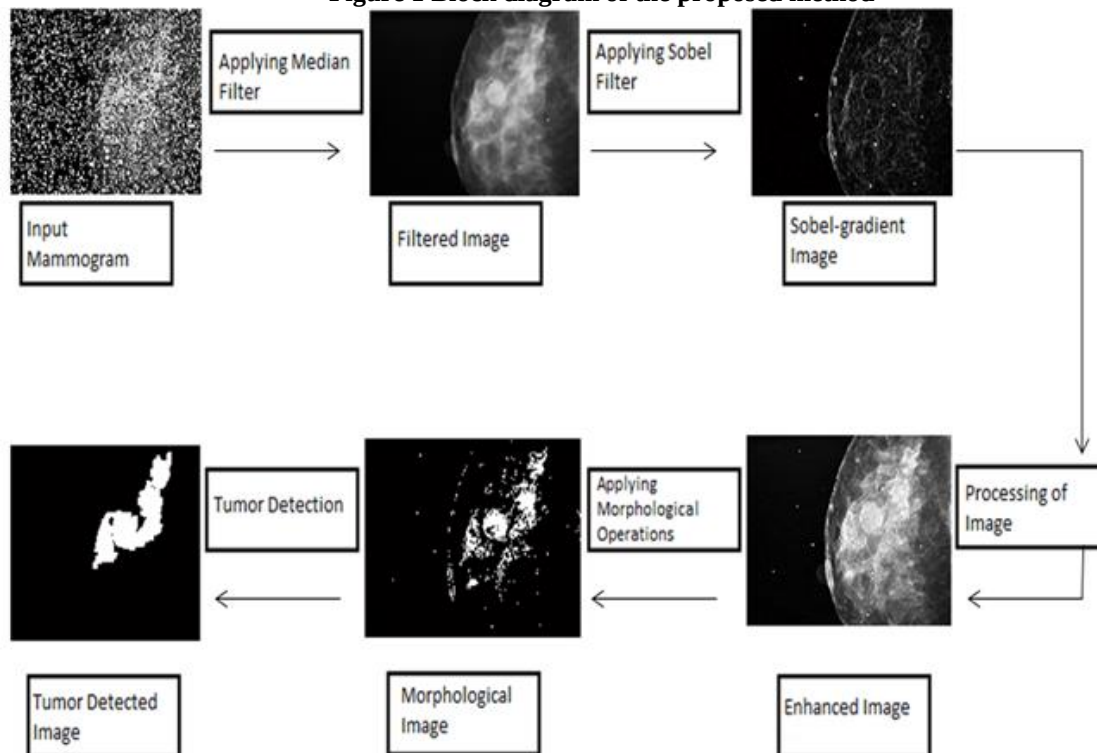
The existing methods have limited functionality in terms of accuracy and stage of detection. This project has a wider scope when compared to other methods for breast cancer detection and the same method can also be used to detect brain tumor.

V. Methodology

The system consists of three stages to detect the breast cancer. In the first stage, mammogram image is acquired and pre-processing is done to remove the noise and to sharpen the image. In the second stage, global threshold segmentation is done on the sharpened image to segment the cancerous cells. In the third stage, the segmented

image is post processed by morphological operations and tumor masking in order to remove the false segmented pixels. Results and experiments show that our proposed technique accurately identifies and segments the cancerous cells in mammogram images.

Figure 1 Block diagram of the proposed method



VI Results and Discussion

Results Observed Case 1:

Figure 2 Noisy original image

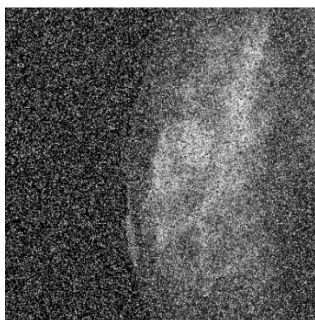


Figure 3 Filtered Image

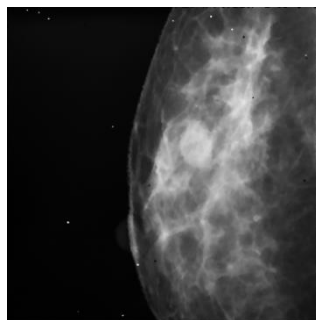


Figure 4 Sobel Filtered Image

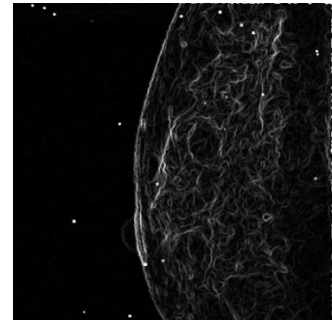


Figure 5 Enhanced Image

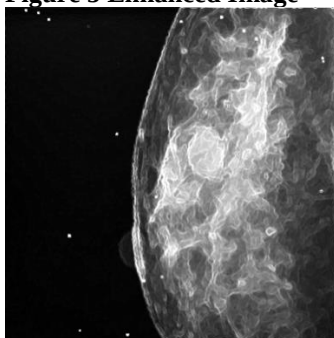


Figure 6 Segmented Image

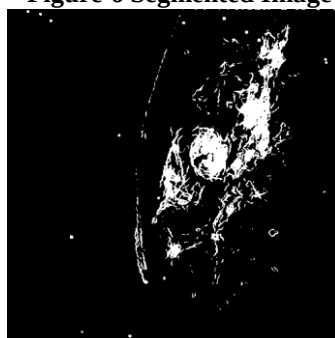
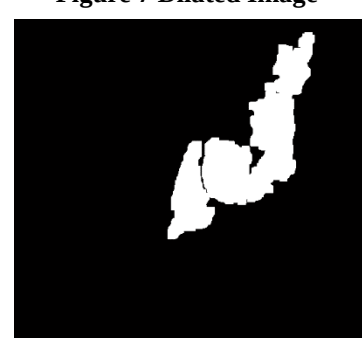


Figure 7 Dilated Image



Results Observed Case 2:

Figure 8 Original Noisy Image

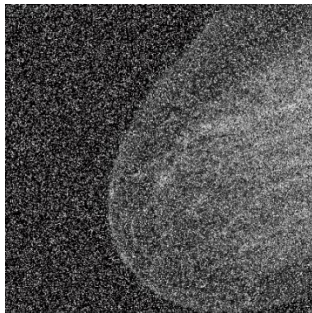


Figure 9 Filtered Image

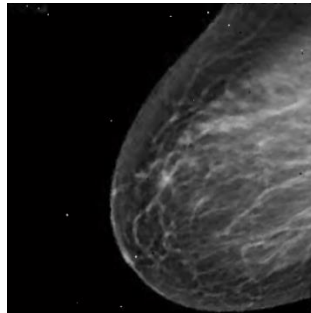


Figure 10 Sobel Filtered Image

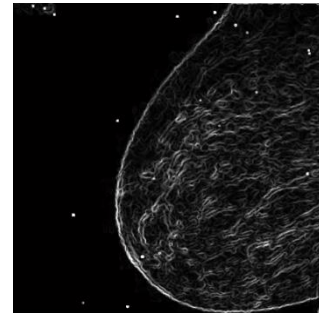


Figure 11 Enhanced Image

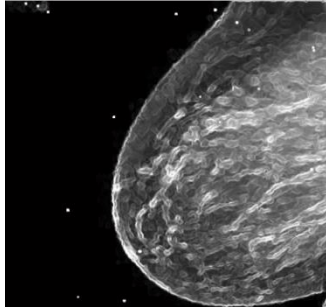
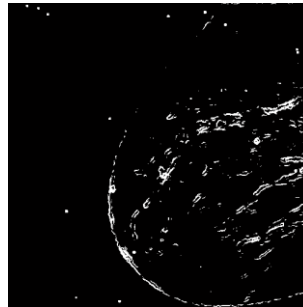


Figure 12 Segmented Image



VII. Conclusion and Future Scope

In this paper, segmentation and detection of cancerous cells in the mammogram image is done. Enhancement of the mammogram image and segmentation of the cancerous cells using global thresholding is carried out. False segmented pixels are removed using morphological operations. The proposed method is invariant in terms of size, shape and intensity of mammogram image. Experimental results show that our method performs well in enhancing, segmenting and extracting the cancerous cells from mammogram images.

Further improvements to the code can be done so as to better identify the minute details in a mammogram image. Hardware implementation of the code can be done to identify the computation and analysis time.

VIII References

- [1]. Maitra, Indra Kanta, Sanjay Nag, and Samir Kumar Bandyopadhyay. "Identification of Abnormal Masses in Digital Mammography Images." *International Journal of Computer Graphics*, Vol 2, No. 1, pp 17-30. 2011.
- [2]. Qing-Hang, He, et al. "The Processing of the Degraded Medical Digital Image's Image Enhancement." *Conference proceedings: Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Conference*. Vol. 4. 2004.
- [3]. Pragathi. J and H T Patil. Segmentation Method for ROI Detection in Mammographic Images using Wiener Filter and Kittler's Method. *IJCA Proceedings on International Conference on Recent Trends in Engineering and Technology 2013ICRTET*(4):27-33, May 2013.
- [4]. Muneer Ahmad et al. "An Integrated Approach for Medical Image Enhancement using Wavelet Transforms and Image Filtering." *Life Science Journal* 11.6 (2014).
- [5]. Pengpan, T., et al. "A motion-compensated cone-beam CT using electrical impedance tomography imaging." *Physiological measurement* 32.1 (2011): 19.
- [6]. Hadadnia, Javad, and Khosro Rezaee. "Extraction and 3D Segmentation of Tumors-Based Unsupervised Clustering Techniques in Medical Images." *Iranian Journal of Medical Physics* 10.2 (2013): 95-108.
- [7]. Zhou, Yicong, Karen Panetta, and Sos Agaian. "Mammogram enhancement using alpha weighted quadratic filter." *Engineering in Medicine and Biology Society, 2009. EMBC 2009. Annual International Conference of the IEEE. IEEE, 2009*.
- [8]. Yong Hoon Lee, Saleem A. Kassam. "Generalized Median Filtering and Related Nonlinear Filtering Techniques". *IEEE Transactions on Acoustics, Speech and Signal Processing*, Vol.33, No. 3, pp. 672- 683, 1985.
- [9]. Mohsen Sharifi, Mahmoud Fathy, Maryam Tayefeh Mahmoudi, "A Classified and Comparative Study of Edge Detection Algorithms", *Proceedings of the International Conference on Information Technology: Coding and Computing (ITCC'02)*, pp. 1-4, 2002.
- [10]. Wang, Jun, and Ying Tan. "Morphological image enhancement procedure design by using genetic programming." *Proceedings of the 13th annual conference on Genetic and evolutionary computation*. ACM, 2011.
- [11]. Yusoff, Intan Aidha, Nor Ashidi Mat Isa, and Khairunnisa Hasikin. "Automated two-dimensional K-means clustering algorithm for unsupervised image segmentation." *Computers & Electrical Engineering* 39.3 (2013): 907-917.
- [12]. Tsai, Chun-Ming. "Adaptive Local Power-Law Transformation for Color Image Enhancement." *Applied Mathematics & Information Sciences* 7 (2013): 2019-2026.