



PECTORAL MUSCLE EXTRACTION USING GRAY THRESHOLD METHOD IN A MAMMOGRAM

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Abstract: Noise reduction and pectoral muscles are the two essential pre-processing steps for breast cancer diagnosis. This work introduced an updated CLAHE algorithm for noise detection and elimination. This method eliminates Gaussian and pulsing noise with great effectiveness without any loss of necessary data. This paper uses gray thresholding to recognize pectoral muscles for segmentation and removal of pectoral muscles, applies morphological operations to identify the edge of the entire breast and connected part labelling to identify and remove the connected pixels outside the breast region with the help of MATLAB tool.

Keywords: Noise removal; CLAHE algorithm; Gray Thresholding; MATLAB; Pectoral muscle Extraction;

I. INTRODUCTION

Breast cancer is one of the major causes of death, because it is very difficult to identify in middle-aged women. Since its origin remains unknown it cannot completely prevent it. Yet early diagnosis of breast cancer helps to lower the mortality rate and better treatment options available to patients. The breast cancer survival rate can be improved if it is diagnosed early in stage 1. Mammography will achieve the earlier stage detection. Mammograms can't prevent breast cancer but they can save a patient's life by detecting breast cancer as soon as possible. Mammography helps spot intangible tumours and thereby increasing the rate of survival. [1]Radiologists analyse these mammographic images to detect anomalies and to assess whether they are benign or malignant, but the radiologist often fails to distinguish between false positive and false negative. A human radiologist is therefore sometimes unable to identify anomalies correctly. However, the development of MATLAB software allows researchers to diagnose breast cancer at its earlier stage with great accuracy and diagnostic stability. In order to automatically identify suspected lesions from digitized mammograms, certain pre-processing steps must be taken to enhance the image quality and prepare it for further processing. The accuracy can be enhanced by eliminating the undesired regions in the mammogram image context. Noise reduction and pectoral muscles are the two essential pre-treatment steps for breast cancer diagnosis.

In contrast to noise, pectoral muscle is another significant artefact present in mammogram picture that appears similar to mammographic parenchyma that disturbs proper breast cancer detection. Thus pectoral muscle detachment from mammogram picture plays a significant role in successfully detecting lesion.

And pre-processing is an essential part of the identification of micro calcification. Pectoral muscles comprise bright pixels that exist as a rectangular region in one side of the mammograms of the mediolateral oblique view (MLO), as shown in Fig.1.

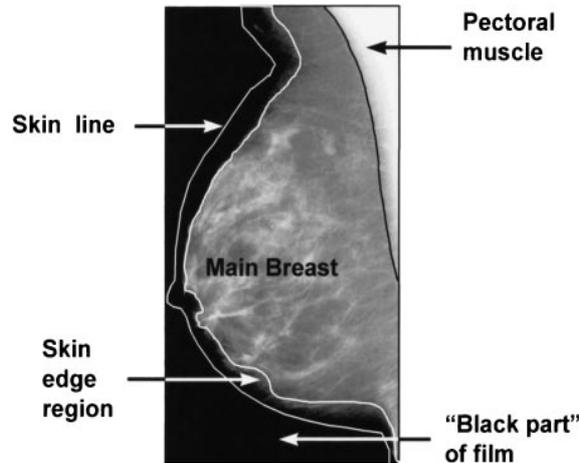


Fig. 1. Anatomy of women Breast

The purpose of this study is to propose a method for removing two objects in a mammogram image. First goal is to implement a better way to remove noise in the image. Regardless of the noise level in each pixel, a modified CLAHE algorithm is applied uniformly throughout the image for noise removal. This paper introduces a new technique for calculating the noise level in each pixel and extracting it from the mammogram without interrupting the uncorrupted parts, In addition to noise reduction, Extracting Pectoral Muscle is also an effective procedure for detecting breast cancer. Hence the second objective of mammograms is to locate and extract pectoral muscle. The pectoral muscles in the mammogram appear slightly darker than the rest of the breast tissues. This work helps to achieve an efficient method for eliminating noise and distinguishing the pectoral muscle, which appears as a rectangular area on one side of the mammograms of the mediolateral oblique view.

II. RELATED WORK

One of the few features in the breast is pectoral muscle in mid-lateral oblique (MLO) mammogram images. Yet it can bias and influence any method of analysing mammogram data. In this work it is often necessary to avoid these consequences, to treat pectoral muscle identification and segmentation as a classification issue. The mammogram image is decomposed into a set of basic functions using the Independent Component Analysis (ICA) method of use and each small image subsection of interest is categorized as pectoral muscle or breast tissue via a previously trained classifier (Support Vector Machine, SVM) based on other examples of such basic functions. The picture subsections labelled as pectoral muscle provide the details used to extract the pectoral muscle from the breast [2].

[3]Proposes a new algorithm for automated detection of breast border in mammograms, with pectoral muscle suppression. The proposed algorithm segments the pectoral muscle automatically using an iterative thresholding strategy, and detects irregular axillary lymph nodes and breast boundary detection.[4]Removal of the PM region can be seen on mammographic images as a precondition for early detection of breast cancer. The key component of the PM boundary layer is created using the orientation and eccentricity function of Canny edge sensed coarse mammographic image constituents that were derived from a multiscale decomposition approach using Laplacian pyramid (LP). Using the nearest neighbour method, the principal portion of the PM boundary is applied to top and left boundaries.

[5]The technology uses adaptive local thresholding to construct an initial binary mask for an image. This is accompanied by the use of morphological operations to eliminate background artefacts. Then an adaptive algorithm is implemented to detect and eliminate the pectoral muscle dynamically depending on the gray-level intensity factors.[6]A hybrid approach is proposed for Pectoral Muscle Detection. For easier edge detection this method uses reduction of image bit depth to obtain more contrast in the image. Approximation images of the 4th stage dyadic wavelet decomposition are used for the process of edge detection. After edge detection using the Sobel filter a smooth curve is drawn to segment the area of the pectoral muscle. In this way, segmented pectoral muscle can be easily removed, or its coordinates can be used to capture images. [7]Propose a new approach for pectoral muscle recognition in MLO mammograms using Gabor wavelets focused on a multi resolution technique.

This new technique needs to overcome the constraint of straight line representation considered with the Hough transform in our initial investigation. The approach starts by transforming a group of Gabor filters, designed specifically to improve the edge of the pectoral muscle, with the area of interest comprising the pectoral muscle.

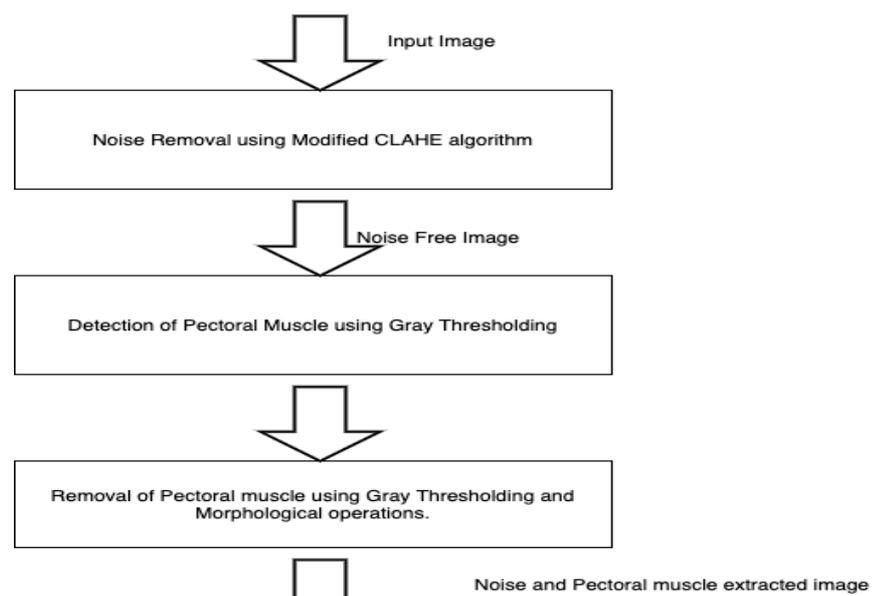
The magnitude value within each pixel is dispersed in the direction of the phase while computing the magnitude and phase artefacts using a vector summation system. The resulting image is then used for detecting the respective edges. Eventually, it requires a post-processing stage to find the true edge of the pectoral muscle. The procedure has been adapted to a Mini-MIAS database of 84 MLO mammograms (Mammographic Data Analysis Society, London, UK).

[8]The recommended algorithm applies the morphological pre-processing and rising seed region (SRG) algorithm to: (1) eliminate digitizing noise, (2) remove radiopaque anomalies, (3) distinguish background area from the breast image region, and (4) extract pectoral muscle to accentuate the breast profile area.[9]A new adaptive algorithm is suggested to remove the pectoral muscle dynamically on digitized mammograms; it utilizes knowledge of the location and shape of the pectoral muscle on the mediolateral oblique angles. First, the pectoral edge is determined by a straight line which is checked for position and orientation correctness. This approximation is then refined using iterative "cliff detection" to more accurately delineate the pectoral margin. Finally, an enclosed region, which represents the pectoral muscle, is created as a segmentation mask. The algorithm was applied to the set of 322 images of the entire Mammographic Image Analysis Society (MIAS).[10]Proposed a new approach for pectoral muscle recognition in MLO mammograms focused on a nonlinear diffusion algorithm which is a smoother preservative bottom. The approach proposed is applied to a sample of 90 mammograms from the Mammography Image Analysis Society (MIAS).[11]A breast boundary detection mechanism is given in mammograms. The approach began with adjustment of the contrast to the original image. A binary methodology was then adapted to the image, and the active contour algorithm in MATLAB often had to find an approximate contour of the breast. Ultimately, the identification of the real breast boundary was performed using the calculated contour as the input to a specifically tailored active contour model algorithm to this end.

III. PROPOSED METHOD

The method proposed is represented using the block diagram shown in Fig.2. Pre-processing must be performed to remove noise and pectoral muscles to classify the ROI in mammogram. The first module in the block diagram represents normalization and the normalized image provided as input to the second module, which uses modified CLAHE algorithm to perform noise removal. Third section reflects an overview of the pectoral muscles. The mammogram picture uses grey thresholding to classify the pectoral muscles. After the pectoral muscles have been established, it is extracted by combining grey level thresholding processes with morphological approach in MATLAB.

Image Pre-processing: separate the breast profile from the background & remove the digitization noises.



Proposed algorithm for noise removal using Modified CLAHE algorithm by computing Area.

- Step1: start.
- Step2: Use a median filter to filter out the noise.
- Step3: Apply CLAHE to an image and specify additional name-value pairs.
- Step4: Compute the area of each component in an image.
- Step5: remove the small area of objects in an image (noise Removal).
- Step6: select a region of interest in an image

Pectoral Muscle Extraction:

Extracting Pectoral Muscle is also an effective procedure for detecting breast cancer. Hence the second objective of mammograms is to locate and extract pectoral muscle. The pectoral muscles in the mammogram appear slightly darker than the rest of the breast tissues.

Proposed Algorithm for Pectoral muscle extraction by thresholding

- Step 1: Calculate a threshold using gray thresh. The threshold is normalized to the range [0, 1].
- Step 2: Convert image to binary image, based on threshold
- Step 3: detect the pectoral muscle and display it.
- Step 4: modifying extra components to be present in image
 - 1. Create a disk-shaped structuring element with a radius of 1.
 - 2. Subtract the images using in subtract function
 - 3. Applies a specific morphological operation to the resultant image
 - 4. Fill image regions and holes using in fill function
- Step 5: convert the binary image to original image
- Step 6: Display cropped image.

IV. RESULT AND DISCUSSION

The current approach uses mammogram images taken from the Mammographic Image Analysis Society (MIAS), which would be a public mammogram database, for testing, 100 images are randomly chosen from the normal and abnormal list of images¹⁹ and the proposed method is tested on these images. The database is composed of 322 images from 161 patients. All mammograms are 8-bit gray images, digitized at an edge of 200 microns and 1024 pixels.

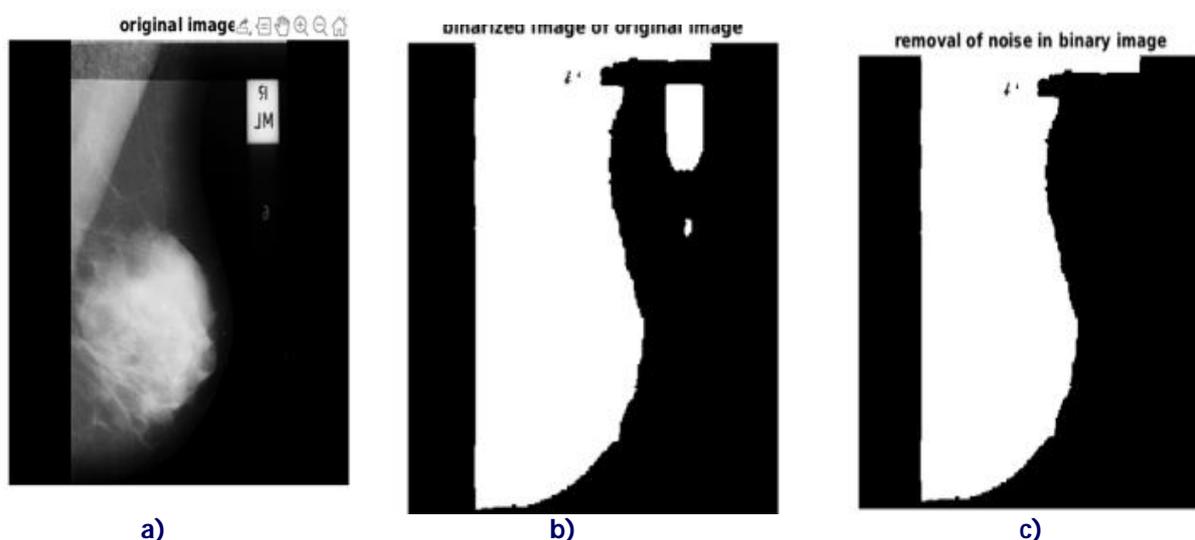


Fig. 3. Result of proposed method.

(a) Original mammogram image with noise (b) binary image of original image (c) noise reduced binary image

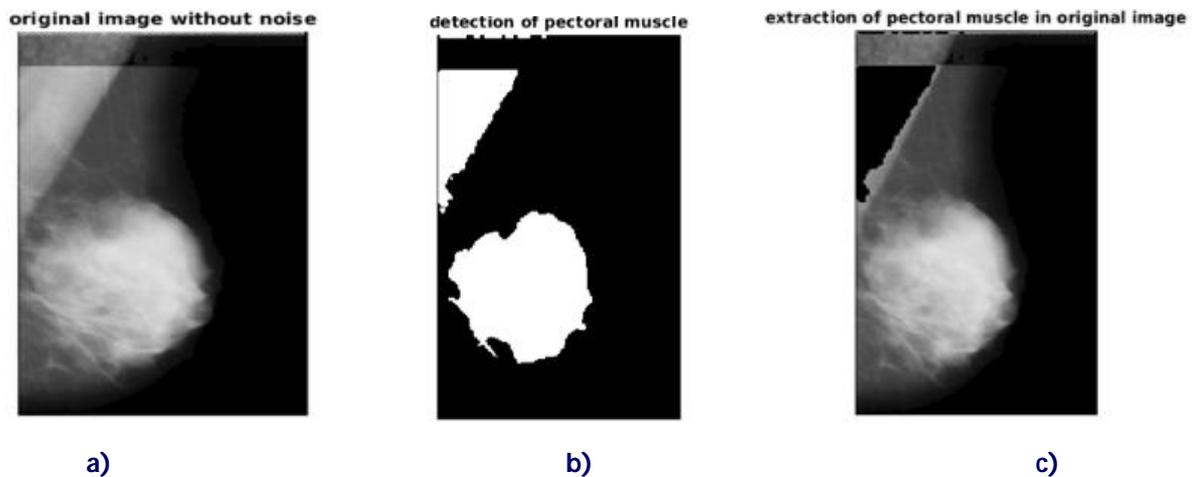


Fig. 3. Result of proposed method.

(a) Original mammogram image without noise (b) binary image of original image (c) pectoral muscle extraction in a original image.

V. CONCLUSION

In this paper we used certain image processing approaches for pre-processing and pectoral muscle segmentation to further process of mammogram images. Modified CLAHE (Contrast Limited Adaptive Histogram Equalization) algorithm is used for pre-processing to eliminate both Gaussian and impulse noise and then use gray thresholding and morphological operations to remove pectoral muscles.

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