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A Method for Separating Region of Interest In Digital Mammograms

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Abstract- Tumors in mammography images are appeared as a mass (pile, stack) with high brightness, so darker region and lower gray levels will not need processing. So, first it is better to separate doubtful parts with tumors occurrence probability and limit processing to these parts, but the matter is not in the same easiness since the tumor's background are different. In some cases tumors hide themselves in the denser regions. Sometimes tumors create like a spherical piece in fatty tissues. In some models there is also multiple calcium exist in the tumor, so exact tumor's separation in mammography images is not an easy action. Some people, in normal case, have tumorous breast tissue and these tissues may make mistake with tumors. Since tumorous tissues have high luminosity, when tumors appear in or near these tissues the tumor's margin are less clear and diagnosis is become more difficult. In any case we search for regions with high tumor occurrence and we prefer to separate these parts from mammograms, this work decrease the volume (dimension, size) of mammograms. In this paper we present a method for extract (separate) doubtful region name ROI from mammography images. Our method in this article is in this form that we separate doubtful regions by the usage of image's energy logarithm, binary image according to the threshold limit's gray level and performing a series of morphology operations. Our method accuracy has been reported to 88% .

Key words: Mammography, Cancer Breast Tumor, Region Of Interest, Image Processing, Binary Image, Morphology operation

I. INTRODUCTION

Breast cancer is the most frequent type of cancer in women in the world. The expected rate is increasing in many countries especially in the United States, where it is estimated that cancer affects three out of four families. Breast cancer is the major cause of death amongst women in the 35 to 55 age group (15000 deaths a year in the UK, with 26000 new cases being diagnosed every year [1]. [2] examines several factors that affect the chances of developing breast cancer. In particular, the relationship between ageing and probability of developing breast cancer have been investigated by [3] using a sample of 1500 women. A mass can be benign or malignant. These masses can form as a result of different internal processes that affect the breast in different ways. Examples of benign breast masses include fibrodenomas, fibrocystic disease, atypical hyperplasia of the breast, phyllodes tumour, periductal mastisis and papillomas [2]. Malignant breast masses can either be confined to the ducts where they are formed or they can be invasive spreading through the channels to lymph nodes and other distant sites. For cancers localised to ducts, the most common examples include lobular carcinoma insitu and intraductal carcinoma. Invasive breast cancers can be ductal, lobular, medullary, comedocarcinoma, papillary, scirrhous or tubular. Mammographically, benign masses are well circumscribed compared to malignant masses however it is difficult to generalise. In general, all masses detected need further analysis unless they are classical representation of well-known types.

There are several ways for detecting and diagnosing breast abnormalities such as selfexamination and clinical breast exams, mammography, and open surgery (biopsy). Clinicians recommend mammography because it is considered to be safe, less harmful compared to biopsy, and more accurate than self-examination where the tumour can be detected before it can be felt. Mammography is considered as the best method for early detection of breast cancer, and the percentage of patients that can be cured at early stages is usually high [4,5]. A detailed description of breast screening programme facts and figures in England appears in the bulletin of the National Health Service. For the period 1997-1998, the results show that mammography successfully diagnosed 6,914 cases as having cancer at a rate of 5.9 per 1000 women screened. It has been observed that this figure per 1000 has increased over the years as mammography improves and more cases are being detected now at an earlier stage. Some of these recent developments in breast imaging are discussed by [6]. The value of mammography is that it can identify breast abnormalities that may be cancer at an early stage before physical symptoms develop. Numerous studies have shown that early detection increases survival and treatment options. The American Cancer Society's guidelines for early breast cancer detection stress mammography and physical examinations. Obviously there are many other methods and techniques that are used for breast screening and each method achieves a different level of clarity in presenting breast images.

However, mammography is the only technique that has been proven to be effective for breast cancer screening. One of the main advantages of using mammography is its cheap cost of implementation for a large population of subjects. Since on average radiologists screen more than hundreds of films each day, maintaining consistency and accuracy in diagnosis is not easy. This means that computer assisted diagnostic techniques have the greatest hope for improving breast cancer detection and reducing morbidity from the disease.

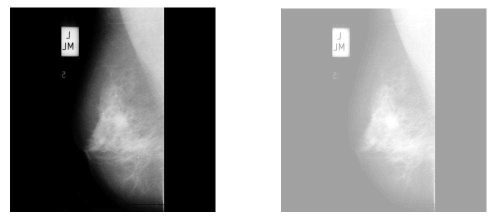
X-ray images are acquired by compressing breasts within a plate. Most hospitals take two views of left and right breasts called Medio-Lateral Oblique (MLO) view and Cranio-Caudal (CC) view. The x-rays are scanned by a digital scanner whose optical characteristics are directly related to the quality of digital image produced. Unfortunately, it is not currently possible to acquire digital images directly which would eliminate some of the problems that we have with analogue to digital conversion. Enhancement can be performed in either the spatial or spectral domain. A variety of image enhancement algorithms are presented by [7]. If the quality of compression is poor or the scanning mechanism has low resolution, the signal to noise ratio is poor in resultant images. Noise can be filtered from such images by taking their Fourier transforms and removing high frequency components before taking an inverse to provide enhanced images. It is expected that the resultant images are of good quality for the detection of abnormalities using digital image processing. The next step is to find regions of interest that need further investigation to determine if they represent some form of abnormality. There are two common methods of isolating regions of interest (ROI). These include bi-lateral subtraction and single image decomposition into ROI methods. Bi-lateral subtraction techniques align left and right breasts taken with the same view using landmark information (for example the position of the nipple), and find differences between the two breasts by subtracting one image from another. Asymmetries are widely thought to represent possible areas of abnormality and represent good starting points for analysis. The weakness of this approach lies in the fact that there are not accurate landmarks for aligning images and the two breasts can be differently imaged giving grey level differences. Single image decomposition approach assumes that uniform regions within an image require detailed investigation. Most masses when imaged show as regions with uniform gray level intensity. These regions of uniform intensities can be detected by pixel clustering. Using both methods, the aim is to have a set of regions which must ideally contain the abnormality if it exists. Region detection methods in themselves are not capable of judging the label of a region (normal or abnormal). Further shape or texture techniques must be applied to find this. However, regions of interest must be first detected to compute features from them- it would be highly uneconomical to do feature extraction for all parts of the image. [8], performed according to the fuzzy algorithm copy of increase region. [9], use the method of breaking and combing images. [10],Obtain ROI regions by the usage of two maximum and minimum threshold. [11], use fuzzy classification and edge diagnosis for finding doubtful regions.

The paper is organized as follows.

In section II, our suggested method for separating ROI regions In section III, Results & Discussion
Section IV, Conclusion

II. OUR METHOD

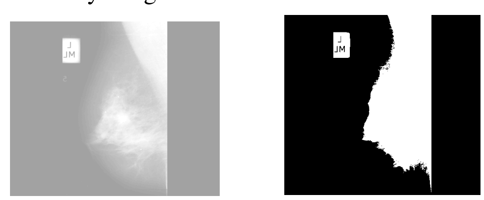
In this paper for finding doubtful region with tumors (ROI) first we obtain the energy of the image which is equal with the second set decimal files. obtaining the image's energy we change image to double. With this work we take image to the domain of [0-1] and finally we bring it to power 2. After obtaining the image's energy we add it with distinct threshold limit and catch the normal logarithm from it then equal the image and transfer it to the unsigned range of uint 8.
You can see one sample of image uniformity equal image in fig 1.



a b

Figure 1. a) Primitive image b) a sample of equalizing the image of logarithm's energy

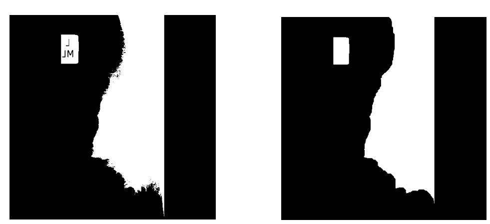
According to the gray level of threshold limit's image, we make the binary image



a b

Figure 2. a) equalizing the image of logarithm's energy b) a sample of binary image after equalizing the image

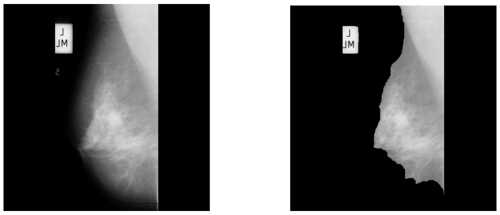
Then we separate doubtful regions from binary image by a serious of morphology operations like "closing" and "erodation". A sample of this separating is observable in fig 3.



a b

Figure 3.a) binary image after the image uniformity b) a sample of separating doubtful regions from binary image

Then we multiple binary image by the original image. With this method doubtful region from each image is in the form of continuous region, it means we have one doubtful region in lieu of each image. In fig 4 there is a sample of doubtful region from a mammography image which extract by suggested method.

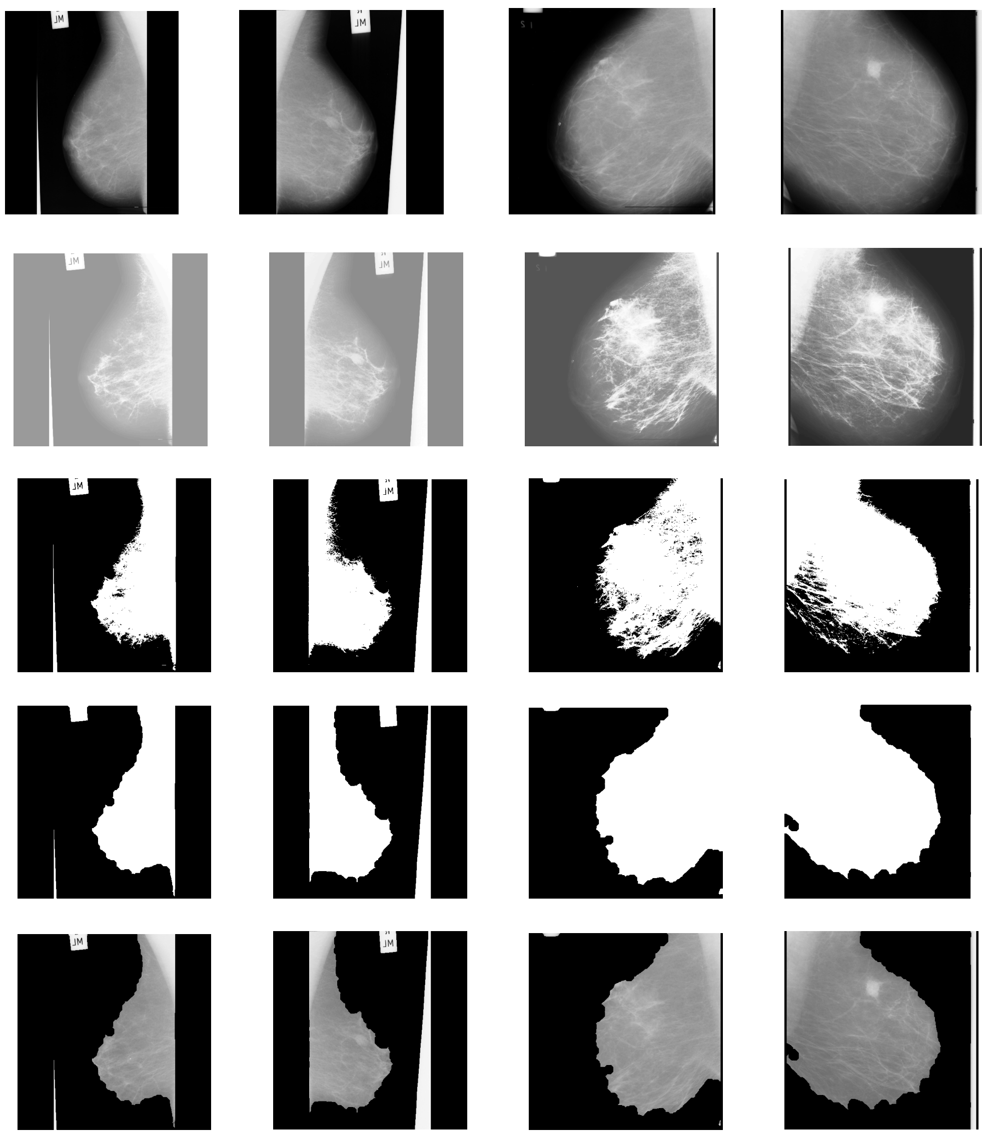


a b

Figure 4. a) Primitive image b) doubtful region's separation

III. RESULTS & DISCUSSION

Doubtful regions named as ROI are parts of image which may have tumor. In the other way properties (characteristics) of these parts are mostly similar with tumors. For finding these regions first we calculate the logarithm of image's energy and we separate these parts by binary images according to the gray level of threshold limit and by performing a series of morphology operations. Obtained doubtful regions are a continuous region in such a manner that we have one doubtful region in lieu of each mammogram. Used image in this paper is from Mini MIAS database site [12]. At first ROI regions are marked by radiologist and then these regions are extracted from images by our method, the accuracy of this method has been reported to 80%. Samples of mammograms by mentioned method which are processed in this paper are shown in fig5.



(a) (b) (c) (d)

Figure 5. A sample of doubtful regions which is extracted in our method by mammograms

IV. CONCLUSION

In this paper we present a method for separating Region of Interest in digital mammograms. In this method we can distinct ROI regions by using the logarithm of image's energy, binary images according to the gray level of threshold limit and by performing a series of morphology operations. We try to progress this method to decrease these regions and by considering the mammogram's doubtful parts, decrease them as far as possible.

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