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Performance Evaluation of PLT Algorithm for Denoising and Segmentation for Separation of Masses

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Abstract: In this paper, the problem of identification of masses or tumors in the Mammogram Images are discussed. Here a novel method of Power Law Transformation is introduced on the mammogram images. The gamma value for the mammogram Image is fixed as 2.5 and thresholding is done. Thus the resulting binary image clearly separates any kind of tumors or masses present in the mammogram images and makes the identification process easier. Here the performance of the PLT algorithm for the segmentation of the Mammogram image is done and it is compared with the existing algorithms in the literature. The experimentations is done with the some of the medical images obtained from various clinics, with different intensities of the masses. It is reported that the masses in the mammogram images is identified correctly in majority of cases and the efficiency of the proposed algorithm is 76%. The PSNR of the Proposed Algorithm is 34.56dB.

Key words: Kidney stone · Binarization · Segmentation · Non linear enhancement · Color plane · Power law transform

INTRODUCTION

The Medical Imaging, especially the identification of masses in the mammogram images is one of the most prominent research area. Today there are reported numbers of increasing breast cancers and there increases the need for the proposal of optimum algorithm for the clear indication of masses in the scanned images. Since in most of the cases the scanned images are of low contrast and low quality, the doctor finds it difficult to analyse the image and feels it difficult to locate the exact point at which the masses are located. Also it is necessary to find out the sizes and intensity of the masses, so as the declare the nature of the cancer.

From literature there are many algorithms available. Most of them tend to fail in many cases and hence there is need to propose an algorithm that behaves well for the input image.Methods have already been published for the computer assisted detection of mass lesions in digital mammograms. These methods can be classified as either pixel or region based. Pixel based methods extract statistical features from each individual pixel in the mammogram image. These methods use a classification scheme to identify and record pixels of interest. In some cases, a further examination could indicate if a mass represented by these pixels is benign or malignant. The other method is region based and it searches whole areas of the mammogram image for masses. Researcher presents a hybrid method for computer assisted screening of mammograms for masses. The hybrid method is a combination of pixel and region based analysis. We employ a step, which narrows the focus of analysis from every pixel in the image to groups of pixels, which are areas in the image. These image areas are screened to determine if they have possible masses. Those with possible masses are then extracted and processed.

Imaging techniques play an important role in helping perform mammogram, especially of abnormal areas that cannot be felt but can be seen on a conventional mammogram or with ultrasound [1]. In the paper a proposed technique, we have developed a supporting tool to easy identification of abnormal masses in mammography images, which will reduce false positive (FP), false negative (FN) detection.

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Hence a novel algorithm of Power Law Transform has been proposed for the segmenting the mammogram images, so as to clearly indicate the masses in the mammogram images. The Power Law Transform commonly called as PLT is one of the most efficient and best performing algorithm. The results produced by this particular algorithm is more efficient and hence help in clear identification of breast cancers at the earlier stages.

Here the major objective of the paper is to evaluate the performance of the proposed PLT algorithm with those of the other algorithms.

Existing Algorithm: Cancer is a group of diseases that cause cells in the body to change and grow out of control. Most types of cancer cells eventually form a lump or masses called a tumor and are named after the part of the body where the tumor originates. Breast cancer begins in breast tissue, which is made up of glands for milk production, called lobules and the ducts that connect lobules to the nipple. The remainder of the breast is made up of fatty, connective and lymphatic tissue [2].

Breast cancer is a leading cause of cancer deaths among women. For women in US and other developed countries, it is the most frequently diagnosed cancer. About 2100 new cases of breast cancer and 800 deaths are registered each year in Norway. In India, a death rate of one in eight women has been reported due to breast cancer [3]. Efficient detection is the most effective way to reduce mortality and currently a screening programme based on mammography is considered one the best and popular method for detection of breast cancer. Mammography is a low-dose x-ray procedure that allows visualization of the internal structure of the breast.

Recent studies showed that the interpretation of the mammogram by the radiologists give high rates of false positive cases indeed the images provided by different patients have different dynamics of intensity and present a weak contrast. Moreover the size of the significant details can be very small. Several research works have tried to develop computer aided diagnosis tools. They could help the radiologists in the interpretation of the mammograms and could be useful for an accurate diagnosis [4-6].

Thresholding: The advantage of these Multimodal Brain images is the minimum variation in the illumination. Hence the common thresholding technique of Global Thresholding (i.e) Otsu's method can be applied after the

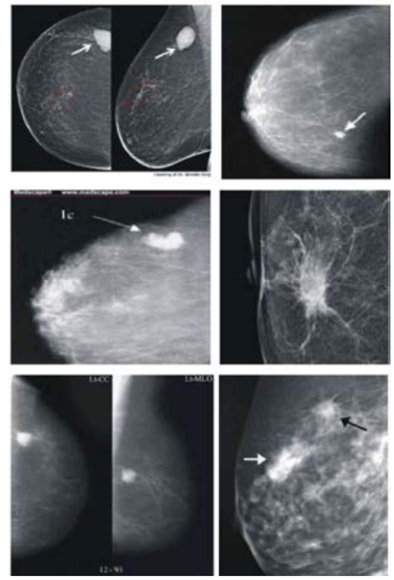

Fig. 1: Some of the mammogram image dataset with masses

ower Law Transformation. Yet another problem is arriving the optimum threshold value. The threshold value k splits the histogram into two parts. Hence the optimum threshold value is arrived by maximizing the following objective function.

$$\sigma^2(k^*) = \max_k \frac{[\mu_T\omega(\mathrm{k})\text{-}\mu(\mathrm{k})]^2}{\omega(k)[1-\omega(k)}$$

where,

$$\omega(k) = \sum_{i=1}^{k} p_i$$

$$\mu(k) = \sum_{i=1}^{k} ip_i$$

$$\mu_T = \sum_{i=1}^{k} ip_i$$

Here, ‘L’ is the total number of gray levels and ‘pi’ is the normalized probability distribution obtained from the histogram of the image.

Power-Law Transform: One of the most important advantage of the Power Law Transform, is that, it increases the contrast of the image and helps in better segmentation.

s=c r $^{\delta}$

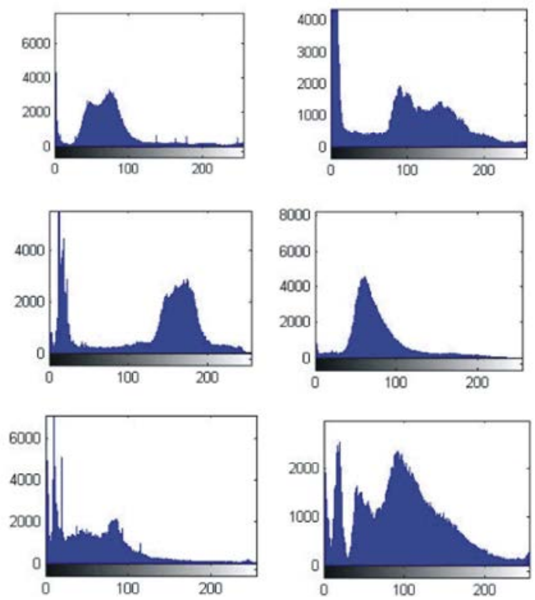

Fig. 2: Histogram of certain sample images from dataset

Here the exponential component is Power-Law is referred to as Gamma. In experimentation the Gamma value is predefined as 2.5. The dynamic range of pixel value will be affected by scaling if c=1.

Proposed Algorithm: Here at first the mammogram image with masses is taken into consideration. The image is converted into gray scale image and Power Law Transform is to be applied. Before performing the transformation, every pixel intensities in the input image has to be scaled from 0 to 255 scale to 0 to 1 scale. Then the power law transform is applied, which transforms the gray scale image into the segmented image. This particular final segmented image clearly indicated the masses in the mammogram images and hence helps the doctors to locate the masses easily. It also helps to identify the intensity and nature of the masses in the mammogram images, which in turn helps to identify the stage of breast cancer.

RESULTS

The following shows the response of the proposed PLT algorithm for the input brain Images.

Performance Evaluation: Here the proposed PLT algorithm is compared with those of other existing algorithms and their accuracy of detection is computed. The PSNR value of the proposed algorithm is 34.56dB.

Fig. 3: Segmented Image representing the masses in mammogram images using PLT

Table 1: Performance evaluation of Algorithms

S.No	Algorithm	Accuracy of Stone Identification in Kidney
1.	PLT Algorithm	76.00%
2.	Low-dose x-ray	62.58%
3.	Ultrasound Technique	65.23%
4.	Statistical Feature Extraction Method	45.83%
5.	Semi Automatic Segmentation approach	52.25%

CONCLUSION

We have proposed a novel algorithm using the power law transform for the clear indication of the masses in the mammogram images, so as to determine the breast cancers and evaluates the performance of the PLT algorithm with those of the other algorithms in the literature. This particular algorithm is simple and efficient one, with very less computational works and hence it holds an added advantage. This helps the doctor to identify and locate the masses in the mammogram images and hence help them to declare the stages of breast cancer. It also helps to analyse the nature and intensity of the masses.

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