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An Efficient Contrast Enhancement of Medical X-Ray Images -Adaptive Region Growing Approach

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Abstract:

In digital image processing Medical Imaging is one of the most significant application areas. For visualizing and extracting more details from the given image processing of medical images is much more supportive. Several techniques are existing nowadays for enhancing the quality of medical image. Contrast Enhancement is one of the most functional methods for the enhancement of medical images. Various contrast enhancement techniques are in practice, some are as follows: Linear Stretch, Histogram Equalization, Convolution mask enhancement, Region based enhancement, Adaptive enhancement is already available. Based on characteristics of image choices can be done. On comparing my approach with the existing popular approaches of adaptive enhancement and linear stretching, it has been concluded that the proposed technique is giving much better results than the existing ones. Further, the technique is seed dependent so selection of seed is very important in this algorithm. A seed chosen in darker regions will give better results than the seed chosen in brighter region, because it is assumed that user will require enhancing the darker portions of the image. Furthermore, zooming window and edge growing method is used to visualize the edges more precisely which gives an added advantage is to doctors for better perception of X-ray.

Keywords: Histogram Equalization, Adaptive, Convolution, Mask, X-Ray, Zooming, Edge Growing.

I. Introduction

Image enhancement is among the simplest and most appealing areas of digital image processing. Image Enhancement techniques usually are Problem Oriented Processing Techniques in which a specific algorithm is used to design for a particular type of application [1]. Image Contrast Enhancement is important in medical applications. This is due to the fact that visual examination of medical images is essential in the diagnosis of many diseases.

X-Ray images are being used from a long time to image the internal structure of human body. It is one of the most widely used diagnostic tools in the field of medicine.

X-Ray is used to capture the internal body structure images which help a lot to the radiologists in recognizing the internal problems. This is the most useful imaging modality to check for the bone fractures and other related anomalies. Though there are numerous advantages of X-Ray technology, but it generates low contrast images. One of the reasons for low contrast of

X-ray images is presence of bulk amount of liquid in human body. One can increase the power of X-Rays for capturing images but it may harm human body / bones.

To make the images more visual and explanatory contrast may be increased on software and hardware level. With advancement of technology some X-Ray machines have also been introduced which can increase the contrast at their own with the help of software and hardware. As the X-Ray images are being used for diagnostic purposes, some software may also be designed to perform auto diagnosis.

Zooming an image is an important task used in many applications, including the World Wide Web, digital video, DVDs, and scientific imaging.

Image enhancement is also a significant part for automated X-Ray inspection systems. For making the X-Ray images more visual and explanatory some contrast enhancement techniques may be implemented in manual or auto-diagnose system.

Ii. Related Works

Years of research in Image Enhancement have demonstrated that significant improvements on the contrast of medical X-Ray images results may be achieved by using a lot of techniques such as:

A. Linear Stretch:

This is the simplest technique which enhances the contrast of an image. In this technique the intensity is increased uniformly for all the pixel values.

B. Histogram-Equalized:

Histogram equalization is a technique by which the dynamic range of the histogram of an image is increased. It flattens and stretches the dynamic range of the image's histogram and resulting in overall contrast improvement [2].

Histogram equalization assigns the intensity values of pixels in the input image such that the output image contains a uniform distribution of intensities. It improves contrast by obtaining a uniform histogram. This technique can be used on a whole image or just on a part of an image.

C. Convolution Mask enhancement:

This is a very common technique for contrast enhancement of digital images. Unsharp masking is commonly used for implementation of this contrast enhancement technique. Polesel [3] presented a new method for unsharp masking for contrast enhancement of images. The approach employs an adaptive filter that control the contribution of the sharpening path in such a way that contrast enhancement occurs in high detail areas and little or no image sharpening occurs in smooth areas.

D. Enhancement by Background Removal:

A direct method of reducing the slowly varying portions of the image, to allow increased gray level variation in image details, is background subtraction. It is implemented by using low pass filters.

E. Adaptive Histogram Equalization:

In this method, the contrast of the image is enhanced by transforming the values in the intensity image. Adaptive Histogram Equalization attempts to overcome the limitations of global linear min-max windowing and global histogram equalization by providing most of the desired information in a single image which can be produced without manual intervention [4]. This approach makes the method more effective and thus popular for contrast enhancement of the greyscale and colour images.

Iii. Proposed Algorithm

Classical image enhancement techniques cannot adapt to the varying

characteristics of images. The application of a global transform or a fixed operator to an entire image often yields poor results in at least some parts of the given image [5]. Morrow [6] has proposed a region based technique for improvement of results. Keeping in view, the shortcomings of the pre-build techniques, a modified algorithm is proposed based upon the adaptive region growing technique. This region growing technique involves the implementation of 8-connected approach and concept of seed selection.

The whole algorithm is split into five major steps. 1) A seed point is selected on the image to be enhanced. 2) Based upon the selected seed point, whole image get split into foreground and background region. 3) Foreground region is then enhanced by equalizing histogram adaptively and then background region is added to the enhanced foreground. 4) Next the enhanced image is obtained by adding gradient of original image to the image obtained in step 3.5) Finally two approaches such as Zooming and Edge growing are used to enhance the contrast of x-ray image much more better than any other existing methods.

Zooming an image is an important task used in many applications, including the World Wide Web, digital video, DVDs, and scientific imaging. When zooming, pixels are inserted into the image in order to expand the size of the image, and the major task is the interpolation of the new pixels forms the surrounding original pixels. Weighted medians have been applied to similar problems requiring interpolation, such as interlace to progressive video conversion for television systems. The advantage of using the weighted median in interpolation over traditional linear methods is better edge preservation and less of a "blocky" look to edges.

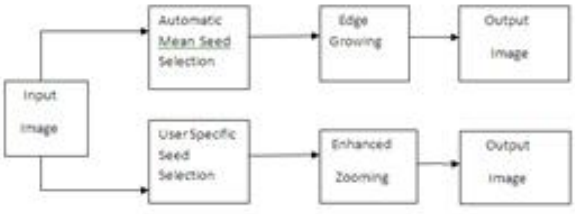

Figure 3.1 System Overview

Overall System Design is described in the above Figure 4.1.The input image is given to the Automatic Mean Seed Selection Method or User Specific Seed Selection Method. Then the outputs of the above methods can be given to either Edge Growing or Zooming Method.

Edge detection is a fundamental tool in image processing and computer vision, particularly in the areas of feature detection and feature extraction, which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities.

The execution of algorithm will depend heavily upon the seed point. For splitting the image in different parts all the pixels of the image will be checked against some threshold defined in accordance to seed point gray value.

IV.EXPERIMENTAL RESULTS

A. Test Images

The first image i.e. Figure 1 is low contrast X-Ray of bone-xray-ankl representing the bone structure of leg and specially the joints of toes. The second image Figure 2 is another low contrast X-Ray capture of human chest to resolve the related medical issues..

Figure 1: bone-xray-ankl

Figure 2: X-Ray image of Chest

B. Results

The test images have been enhanced using proposed algorithm, Adaptive approach & Linear Stretching. These mentioned enhancement techniques produced following results for the above images:

Figure 4a represents the Original Image of bone-xray-ankl the next figure 4b represents the Image Enhanced using User Specific Seed Selection Method and the next figure 4c represents the Enhanced through Automatic Adaptive method.

Figure 4(clockwise): 4a. Original Image 4b. Image Enhanced using User Specific Seed Selection Method 4c. Enhanced through Automatic Adaptive method

Figure 5 represents the Image Enhanced Using Various Edge Growing Methods. The First Figure 5a represents the result of Mean Based Edge Method. The second Figure 5b represents the result of Thin Edge Image Method. The third Figure 5c represents the result of Thick edge Image Method. And the fourth figure 5d represents the result of Histogram applied Image.

Figure 5(clockwise): Image Enhanced Using Various Edge Growing Methods 5a. Mean Based Edge 5b. Thin Edge Image 5c. Thick edge Image 5d.Histogram applied Image

Figure 6 Zooming in Image Enhanced using User Specific Seed Selection Method

The derived results are again giving better values to Proposed Enhancement method followed by Zooming and Edge Growing. Linear Stretch method is also producing images having quality values, but less good than Adaptive Enhancement.

V.CONCLUSION

In this project, a seed dependent Adaptive region Growing approach for contrast enhancement has been proposed for X-Ray images. On comparing this approach with the existing popular approaches of adaptive enhancement and linear stretching, it has been

concluded that the proposed technique is giving much better results than the existing ones. Further, the technique is seed dependent so selection of seed is very important in this algorithm. A seed chosen in darker regions will give better results than the seed chosen in brighter region, because it is assumed that user will require enhancing the darker portions of the image. Furthermore, zooming window and edge growing method is used to visualize the edges more precisely which gives an added advantage is to doctors for better perception of X-ray.

Vi. Future Scope

Future work in this domain may include implementation of multiple seed points. The approach may be adopted for other type of medical images. Some denoising technique may also be included in the algorithm to improve the high noise images. Further some segmentation techniques may also be developed using the proposed technique as the preprocessing.

REFERENCES

1. Hassan, N. Y. and Aakamatsu, N., ―Contrast Enhancement technique of dark blurred Image‖, International Journal of Computer Science and Network Security (IJCSNS), Vol. 6, No. 2, 2006, pp. 223-226.

2. Chen, Soong-Der and Ramli, Abd. Rahman, ―Minimum Mean Brightness Error Bi-Histogram Eualization in Contrast Enhancement‖, IEEE Transactions on Consumer Electronics, Vol. 49, No. 4, 2003, pp. 1310-1319.

3. Polesel, A. Ramponi, G. Mathews, V.J. Tele Media Int. Ltd., Frankfurt, ―Image Enhancement via adaptive unsharp masking‖, IEEE Transactions on Image Processing, Vol. 9, Issue. 3, 2002, pp. 505-510