© 2016 IJSRST | Volume 2 | Issue 2 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Contrast Enhancement of Medical Images

Shankar Singh, Pravesh Pal
Electronics & Telecommunication Engineering, Chouksey Engineering College Bilaspur, Chhattisgarh, Madhya Pradesh, India

ABSTRACT

Contrast enhancement is very useful in medical image analysis that helps the physicians for disease diagnosis. The quality of medical images affects the analysis if the contrast of the images is poor. This paper presents method to enhance the contrast with improved CNR (contrast to noise ratio).
Keywords: Digital Image, Contrast, Medical Image, Enhancement.

I. INTRODUCTION

Image Processing is among rapidly growing technologies today, with its applications in various aspects of a business. Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it [1-2]. Image enhancement is one of the most interesting and visually appealing areas of image processing. The basic idea behind image processing techniques is to make details more obvious or to simply highlight certain features of interest in an image. A large number of image enhancement techniques exist for reducing image noise, highlighting edges, or displaying digital images. It is difficult to judge the effectiveness of these techniques due to various reasons such as the outcome depends on the exact application. An enhancement technique performing well in enhancing biomedical images may not be identically efficient in enhancing satellite images [1-3].

Contrast enhancement deals with improving the contrast in an image in order to make various features more easily perceived. Many contrast enhancement algorithms have been developed over the years, driven by different considerations. This paper presents a survey of contrast enhancement techniques for medical images to give a comparative overview along with the visual results of methods used for contrast enhancement of images [4-6]. Image enhancement includes intensity and contrast manipulation, noise reduction, edges sharpening and filtering, etc. Contrast Enhancement is focused on the problem of improving the contrast in an image to make various features more easily perceived. Contrast of an image is determined by its dynamic range, which is defined as the difference between lowest and highest intensity level [4-8].

II. METHODS AND MATERIAL

Literature Survey:

Wu et al. (2015) proposed a reversible data hiding method with contrast enhancement for medical images by excluding the corresponding histogram bins from being expanded for data hiding, the contrast of region of interest (ROI) in medical images can be selectively enhanced. The original image can be exactly recovered from the corresponding enhanced image by hiding the side information within it. The experimental results on a set of medical images show that the visibility of ROI can be improved. The method can achieve more contrast enhancement effects and better visual quality for medical images. Kim et al. (2013) suggested Medical Image Enhancement Algorithm Using Edge-Based Denoising and Adaptive Histogram Stretching to increase qualities of processing results. Wavelet transforms have shown promising results for localization in both time and frequency, and hence have been used for image processing applications including noise removal. The proposed adaptive nonlinear histogram stretching method is applied to increase the contrast of resultant image. Experimental results show that the

proposed algorithm can enhance a low contrast medical image while preserving edges effectively without blurring the details.

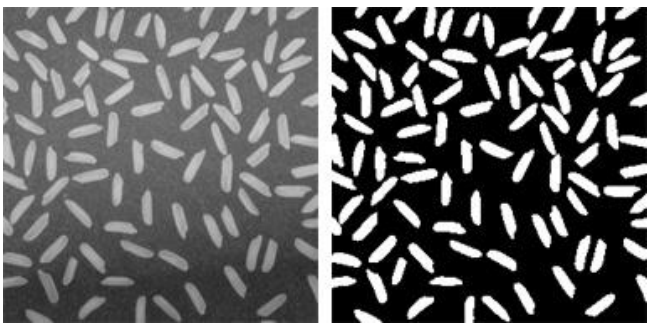
Chouhan et al. (2012) implemented Contrast Enhancement of Dark Images using Stochastic Resonance in Wavelet Domain In this paper, a dynamic stochastic resonance (DSR)-based technique in discrete wavelet transform (DWT) domain is presented for the enhancement of very dark grayscale and colored images. Jian Fan [10] established connections between dyadic wavelet enhancement algorithms and traditional un-sharp masking. This includes the systematic study of gain and threshold parameters for nonlinear enhancement. Flores [11] implemented Medical image noise reduction using partial differentiation method. An anisotropic scheme is used to iteratively reduce noise as well as to define image regions and enhance region contrast. The process is performed in three stages and the final values of the regions are automatically extracted from the image histogram, thus providing a fast method to obtain the most significant information in the image and a good approximation to region boundaries. This technique can be applied, not only to multiple region image segmentation, but also to certain processes of computer aided diagnosis which include several types of feature extraction. Majumder et al. [12-13] studied contrast sensitivity of the human eye shows that our contrast discrimination sensitivity follows the weber law for suprathreshold levels. The results generated by our method is superior to existing techniques showing none of the common artifacts of contrast enhancements like halos, hue shift, and intensity burn-outs.

Kamra (2015) implemented Contrast Enhancement of Masses in Mammograms Using Multiscale Morphology which is widely used technique for breast cancer screening. The proposed method is compared with other state of the art techniques. The experimental results show that the proposed method is better both qualitatively and quantitatively than the other standard contrast enhancement techniques. Godwin et al. (2014) presented a survey on Contrast Enhancement Techniques for Medical X-Ray Images to Highlight the Abnormalities. A detailed literature survey on the various techniques used in spatial, frequency and spectral domains for contrast enhancement is presented. Hanan (2011) showed improvement of Diagnostic Viewing of Medical Images using Enhancement Algorithms. The raw data obtained straight from devices of medical acquisition may afford a comparatively poor image quality representation and may destroy by several types of noises. Image Enhancement (IE) and denoising algorithms for executing the requirements of digital medical image enhancement is introduced.

Junhwan [17] suggested that medical imaging often involves the injection of contrast agents and the subsequent analysis of tissue enhancement patterns. Many important types of tissue have characteristic enhancement patterns; for example, in magnetic resonance (MR) mammography, malignancies exhibit a characteristic “wash out” temporal pattern, while in MR angiography, arteries, veins and parenchyma each have their own distinctive temporal signature. Ritika et al. (2013) opined that Image enhancement is one of the most interesting and visually appealing areas of image processing. It involves operations such as enhancing contrast, reducing noise for improving the quality of the image. This paper presents an analysis of the mathematical morphological approach with comparison to various other state-of-art techniques for addressing the problems of low contrast in images. Histogram equalization (HE) is one of the common methods used for improving contrast in digital images. This method is simple and effective for global contrast enhancement of images but it suffers from some drawbacks.

Contrast Enhancement:

Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further image analysis. An example of image enhancement is shown in Fig. 1.



(a) original image (b) enhanced image

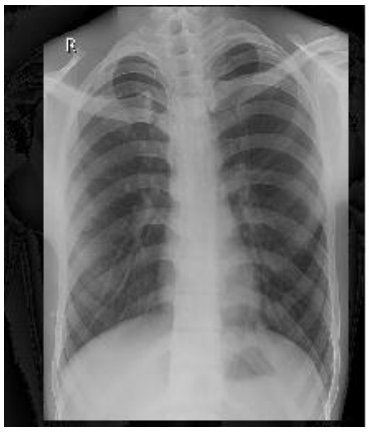
Figure 1. An example of image enhancement.

III. RESULT AND DISCUSSION

Contrast enhancement is achieved using following steps:

- Step 1: Load Images
- Step 2: Resize Images
- Step 3: Enhance Grayscale Images
- Step 4: Enhance Color Images
- Step 5: Assess the performance

A medical image x-ray was enhanced by using contrast enhancement and result is shown in Fig. 2.



(a) Original Image

(b) Enhanced Image

Figure 2. Result ofcontrast enhancement for an x-ray image (a) original (b) enhanced image.

CNR was evaluated for 10 images which can be seen in Table 1. The postive values indicate the improvement in contrast of the images.

Table 1 : CNR for the medical images.

Image	x-ray1	x-ray2	x-ray3	x-ray4	x-ray5	x-ray6	x-ray7	x-ray8	x-ray9	x-ray10
CNR	1.167	0.982	1.002	1.234	0.579	1.059	0.978	0.998	0.588	0.919

IV. CONCLUSION

The contrast of medical images could be improved by using standard intensity based transforms. It has been observed that the CNR was improved.

V. REFERENCES

[1] G R Sinha and Bhagwati Patel, Medical Image Processing: Concepts and Applications, ISBN: 978-81-203-4902-5, Prentice Hall of India, 2014.

[2] R C Gonzalez and R E Woods, Digital Image Processing, Prentice Hall of India, 2013.

[3] Rakesh Kumar Khare and G R Sinha, "CAD for Lung Cancer Detection: A Review", International Journal of Modern Trends in Engineering and Research (IJMTER), 02(07), pp. 333-338, 2015.

[4] Bhagwati Charan Patel and G R Sinha, "Histogram based Contrast Enhancement Method for Mammographic Breast Images", International Journal of Computer Applications, Applications of Computers and Electronics for the Welfare of Rural Masses (ACEWRM) 2015, pp. 25-38.

[5] Bhagwati Charan Patel and G R Sinha, "Energy and Region based Detection and Segmentation of Breast Cancer Mammographic Images", International Journal of Image, Graphics and Signal Processing, 6, pp. 44-51, 2012.

[6] Bhagwati Charan Patel, G. R. Sinha and Kavita Thakur, "Early detection of breast cancer using a modified topological derivative based method", International Journal of Pure and Applied Science and Technology, 7(1), pp. 75-80, 2011.

[7] Bhagwati Charan Patel and G.R.Sinha, "Early detection of breast cancer using self similar fractal method", International Journal of Computer Application, New York USA, Vol. 10, No. 4, pp. 39-43, November 2010.

[8] Hao-Tian Wua, Jiwu Huang and Yun-Qing Shi, "A reversible data hiding method with contrast enhancement for medical images", J. Vis. Commun. Image R. 31 (2015) 146–153.

[9] Rajlaxmi Chouhan, C. Pradeep Kumar, Rawnak Kumar and Rajib Kumar Jha, "Contrast Enhancement of Dark Images using Stochastic

Resonance in Wavelet Domain", International Journal of Machine Learning and Computing, Vol. 2, No. 5, pp. 711-715, October 2012.
[10] Jian Fan and Andrew Laine, "Contrast Enhancement by Multiscale and Nonlinear Operators", www.google.co.in.
[11] Miguel Alemán-Flores and Luis Álvarez-León, "Medical Image Noise Reduction and Region Contrast Enhancement Using Partial Differential Equations", www.google.co.in.
[12] Aditi Majumder and Sandy Irani, "Contrast Enhancement of Images using Human Contrast Sensitivity", www.google.co.in.
[13] Kartic Subr, Aditi Majumder and Sandy Irani, "Greedy Algorithm for Local Contrast Enhancement of Images", www.google.co.in.
[14] Amit Kamra, V. K. Jain and Pragya, "Contrast Enhancement of Masses in Mammograms Using Multiscale Morphology", International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering Vol:9, No:7, pp. 546-549, 2015.
[15] Godwin D., Edward Stephen Prasanth, Krishna Kumar S., Kishan Kumar K, Chitra P. and, Nandhitha N.M., " Survey on Contrast Enhancement Techniques for Medical X-Ray Images to Highlight The Abnormalities", Int. Journal of Engineering Research and Applications, Vol. 4, Issue 4(Version 6), April 2014, pp.19-24.
[16] Hanan Saleh S. Ahmed and Md Jan Nordin, "Improving Diagnostic Viewing of Medical Images using Enhancement Algorithms", Journal of Computer Science 7 (12): 1831-1838, 2011.
[17] Junhwan Kim and Ramin Zabih, "A Segmentation Algorithm for Contrast-Enhanced Images", www.google.co.in.
[18] Ritika and Sandeep Kaur, "Contrast Enhancement Techniques for Images–A Visual Analysis", International Journal of Computer Applications (0975 – 8887) Volume 64– No.17, pp. 20-25, February 2013.