International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 04, 2020
ISSN: 1475-7192

HISTOGRAM EQUALIZATION BASED IMAGE ENHANCEMENT FOR MEDICAL IMAGE PROCESSING

[1]Lavanya M, [2]Sivasakthi T, [3]Palani U

ABSTRACT-- *In the medical field, resonance imaging (MRI) is one of the advanced techniques, which can be used to provide rich data regarding the human body. Tomography of the medical image may be a useful tool to help physicians to diagnose. Bar chart exploits are among the required steps within the image sweetening methods for Medical images. There are different ways of image sweetening, every one of them is required for a special sort of analysis. In this paper, Brightness preserving Dynamic Histogram Equalization (BPDHE) used for image enhancement. Contrast-enhanced is that the digital manipulating dispensed to increase excellence and reduces the noise in digital imaging.*

Keywords-- *BPDHE algorithm, MRI image, image enhancement*

I. INTRODUCTION

Medical image processing has experienced powerful growth, Associate in Nursing, and has been a knowledge domain analysis field, attracting competency from applying math, PC sciences, engineering, physics, biology, and medication. The computer-aided diagnostic process has already become the key to clinical routine. Image enhancement is one of the important and sophisticated techniques employed in the image process. The most focus of image sweetening is to urge the higher the visuality of the picture numerous sorts of images like satellite pictures, medical pictures, X-ray images, and real-life pictures, and these pictures are completely littered with different issues like low contrast and noise. It's very important to enlarge the contrast and take away the noise to extend the standard of a picture. Recently heaps of labor have been done by thoroughly different researchers and scientists within the field of image sweetening. The image sweetening method consists of a set of techniques that are won't raise the visuality of a picture. Image sweetening is one of the methods by that the visual quality and also the international appearances of a picture can be enhanced therefore, to derive the abstraction options of the image. The snapshots taken by mistreatment cellular phones and good phones are usually of poor distinction. So, this type of picture uses enhancement algorithms to lift its appearance. The important operation of image enhancement is to spice up inseparability or data of data contained inside the image for human viewers. It produces an output image

[1]B.E Student, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, lavanyam325@gmail.com

[2]Senior Assistant Professor, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, sakthi15ifet@gmail.com

[3] Professor Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, palani_uin@yahoo.com

Received: 15 Jan 2020 | Revised: 5 Feb 2020| Accepted: 30 Mar 2020

that relatively appears larger than the initial image by dynamically the pixel's power of the information picture. Picture enhancement that is one in all the necessary method in digital image processing, plays associate in a nursing necessary role in various fields, like to a clinical picture process, remote detecting, top quality television, hyperspectral picture process, modern X-beam picture process, infinitesimal imaging and bunches of selective picture/video process applications. The qualification upgrade procedure is utilized with a partner in nursing aspiration to get a supplanting expanded picture with a steady reference diagram. This may be achieved by mistreatment. The established accumulative bar graph because the grayscale mapping operates. The intermediate steps of the bar graph deed method are the bar graph and also the normalized accumulative bar graph. Mistreatment of the established accumulative bar graph as a color table of the initial image, we tend to acquire the bar graph equalized image. The bar graph of a picture represents the frequency of the incidence of gray levels inside a picture. It additionally represents the chance of such an event. With an exact distribution of gray levels, the distinction within the image is going to below, and also the dynamic varies restricted. Hence, a valuable grays level assignment theme would be to expand the intensity vary to fill the complete dynamic vary offered. In bar graph deed, the goal is to get a consistent bar graph distribution for the output image, so Associate in Nursing optimum overall distinction is perceived. After the important information is depicted by shut distinction values, it improves the native distinction of pictures.

II. PROPOSED METHOD

The essence of the projected algorithmic program is to utilize freelance bar chart equalization singly over 2 sub pictures obtained by rotten the initial image supported its mean with a constraint that the ensuing equal sub pictures square measure delimited from each other around the input means. It's going to be shown mathematically that the projected algorithmic program maintains the brightness of a given image considerably well compared to typical bar chart deed whereas, enhancing the distinction and, thus, provides a lot of natural sweetening which can be utilized in shopper e-product. It maintains the normal brightness of a given image considerably as well as compared to a typical bar chart deed whereas, enhancing the distinction. Enhancement is the process of arranging the image to manage the visuality of the watcher. Generally, enhancement can be used to arrange the initial digital values, highlight the bound characteristics, and point out the individual options of the picture. The final image is additionally (appropriate) than the primary image for a particular application.

A. BPDHE

The brightness preserving dynamic Histogram Equalization (BPDHE), is additional growth to Histogram equalization they will produce the final picture by the mean intensity that's nearly constant to the given mean intensity. It maintains the brightness of the image. The differentiation picture is helpful for more detailed analysis and identification. This differentiation is evaluated with totally various quality parameters. The distinction image is helpful for more detailed analysis and identification. This distinction is measured with completely different objective quality parameters. This technique partitions the bar chart supported the native maximums of the smoothened bar chart. Because the modification within the dynamic vary can produce the modification in average brightness, standardization of the final intensity is the major step of these techniques. So, the input and output

intensities of the given image should be the same. By this criterion, BPDHE can turn out higher increased pictures. In various cases, BPDHE with success improve the image while not secure aspect causes and constant time, it retains the mean initial brightness.

It comprises of five essential advances:

1) Smoothing the image with Gaussian Filter.

2) Detection of native maximums from the histograms/partitioning an image histogram called break point detection.

3) Mapping each partition of gray level allocation.

4) Equalize each partition.

5) Normalize the image brightness.

Parameters used for the analysis of Image improvement Techniques for the target activity of any formula for image improvement, there are varied parameters on the concept that the performance of the algorithms is evaluated.

III. IMAGE QUALITY/ PARAMETRIC MEASUREMENTS

The various parameters which are used to check the exhibition are as per the following.

[1] MEAN SQUARE ERROR (MSE)

The MSE value should be low, which suggests that the component intensity of the given and produce image got to be as shut as realizable.

$$\text{MSE}=\frac{1}{n_i n_j}\sum_{r=0}^{n_{i-1}}\sum_{t=0}^{n_{j-1}}[(r(i,j-t(i,j))]^2$$

Where n_i and n_j indicates the dimension of the grayscale image, r(i,j) signifies the value of input image, and t(i,j) represents the grey value of a test or output enhanced image.

[2] PEAK SIGNAL TO NOISE RATIO (PSNR)

Peak signal to noise magnitude to be as large as realizable that suggests that the content of the signal within the output is massive and hence the noise could be a smaller quantity. Since its peak signal to noise magnitude relation makes the range of the image is taken into consideration as most that of 255.

$$\text{PSNR}=10\log_{10}[\frac{\max(r(i,j))^2}{MSE}]$$

Where, $\max(r(i,j))^2$ indicates the maximum signal power.

[3] NORMALIZED CROSS CORRELATION

The value of each component in an exceedingly very correlation image may be alive off but well the target image matches the searched image at that point

$$\text{NCC (i,j)} =\frac{\sum_0^{n-1} i(n)*j(n)}{\sqrt{\sum_0^{n-1} i(n)\text{^}2}*\sqrt{\sum_0^{n-1} j(n)\text{^}2}}$$

[4] NORMALIZED ABSOLUTE ERROR

Normalized absolute error is printed as a result of the overall absolute error normalized by the error simply predicting every day of the actual values.

$$NAE=\frac{1}{n_i n_j}\sum_{r=0}^{n_i-1}\sum_{t=0}^{n_j-1}|(r(i,j)-(i,j))|$$

With this the magnitude of difference between the input and the processed image is evaluated.

[5] STRUCTURAL CONTENT

The structural content can be expressed as follows,

$$SC=\frac{\sum_{i=1}^{m}\sum_{j=1}^{n}(A_{ij})^2}{\sum_{i=1}^{m}\sum_{j=1}^{n}(B_{ij})^2}$$

If the SC value is high, so the image has poor quality.

[6] MAXIMUM DIFFERENCE

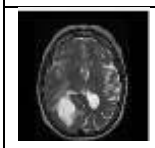
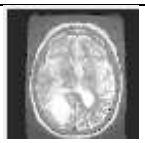
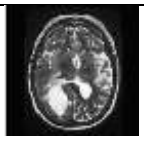
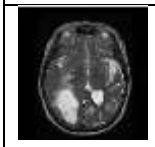
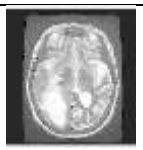
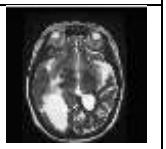
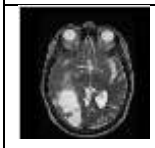
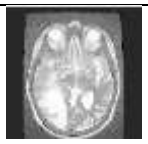
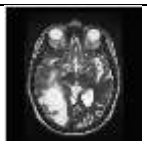
It provides the maximum of the error signal (difference between the processed image and input image)

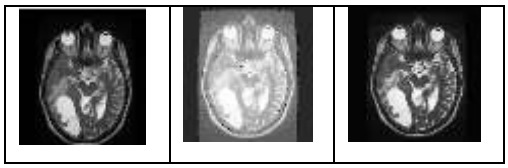
$$MD=\text{Max}\ (|A_{ij}-B_{ij}|)$$

Where, i=1, 2, … m J=1, 2, … n

The parametric quality metric evaluation helps to perform BPDHE better. This proposed evaluation saves the mean brightness value of an input image essentially all around contrasted with average histogram leveling. At the same time upgrading the difference, which gives a lot of regular improvement that can be used in medical applications. While upgrading the complexity, the mean contrast of an input image is saved altogether all around contrasted with common histogram adjustment.

TABLE 1. Different sample of MRI Images

Original image	BPDHE image	Enhanced image
		
		
		
		



IV. RESULTS

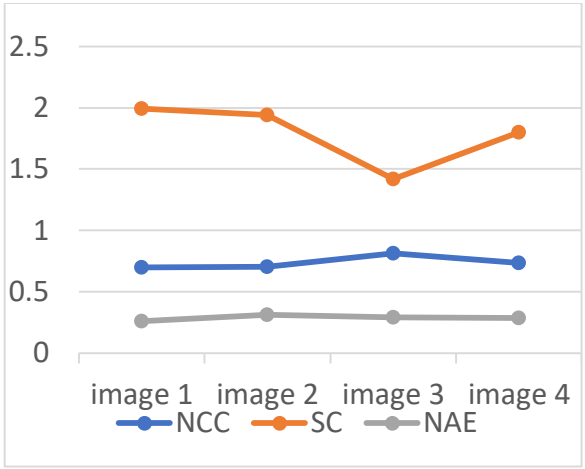
Here, the investigations are conveyed utilizing MATLAB coding. Also, arranged a GUI design with a rundown of menus. Tapping on every menu will play out a free capacity.

TABLE 2. Parametric Analysis of Different sample of MRI images

IMAGE	NCC	NAE	SC	AD	MSE	MD	PSNR
Image 1	0.699	0.261	1.99	14.5	786	111	19.176
Image 2	0.813	0.293	1.416	18.465	606.16	103	20.304
Image 3	0.706	0.313	1.939	17.671	789.43	113	19.157
Image 4	O.734	0.286	1.797	16.006	660.36	109	19.933
Image 5	0.763	0.264	1.674	14.779	530.5	94	20.884

From the above table, the low value of normalized absolute error indicates that the output image should be high quality. Then the value of structural content is low, it shows the image as high quality.

Also, the highest value of peak signal to noise ratio in dB scale signifies that the image quality is excellent. Also, the quality of an enhanced image compared to that of the input image is determined by obtained PSNR ranges from 19 to 24 dB.



Figuere 1. NCC, SC and NAE average value for the contrast-enhanced image.

V. CONCLUSION

There are various techniques for enhancing the image. After implementing some of the techniques, which all are based on the histogram equalization, it is concluded that the enhancement of any image is application dependent. By using the proposed methodology, the optic vision of the image is almost excellent when compared with all other technologies. In the future, there are multiple images that can be taken for enhancement purposes to analyses. Additionally, the diverse difference can likewise be contrasted with checking the consistency of the proposed algorithm. Also, new modification in the preferred method is also beneficial for enhancement purposes. Also, the optimization of proposed method can be done to reduce the complexity as much as possible. In future, the proposed algorithm can be analyzed with all other medical image modalities.

VI. REFERENCES

1. A. Laine, J. Fan, and W. Yang, "Wavelets for contrast enhancement of digital mammography," IEEE Eng. Med. Biol. Mag., vol. 14, no. 6, pp. 536–550, 1995.
2. W. Qian, L. P. Clarke, B. Zheng, M. Kallergi, and R. Clark, "Computer assisted diagnosis for digital mammography," IEEE Eng. Med. Biol. Mag., vol. 14, no. 6, pp. 561–568, 1995.
3. A. N. Netravali and B. G. Haskeli, Digital Pictures: Representation and Compression. New York: Plenum, 1988, ch. 4.
4. R. C. Gonzalez and R. E. Woods, Digital Image Processing. New York: Addison-Wesley, 1992. [5] M. A. Sid-Ahmed, Image Processing: Theory, Algorithms, and Architectures. New York: McGraw-Hill, 1995, ch. 4.
5. J. D. Fahnestock and R. A. Schowengerdt, "Spatially variant contrast enhancement using local range modification," Opt. Eng., vol. 22, no. 3, pp. 378–381, 1983.
6. I. Altas, J. Louis, and J. Belward, "A variational approach to the radiometric enhancement of digital imagery," IEEE Trans. Image Processing, vol. 4, pp. 845–849, June 1995.
7. V.Velusamy, Dr. M. Karnan, Dr. R. Sivakumar**,** Dr.N. Nandhagopal, "Enhancement Techniques and Methods for MRI A Review"**,** International Journal of Computer Science and Information Technologies, Vol. 5 (1), pp .397-403, 2014.
8. R. H. Sherrir and G. A. Johnson, "Regionally adaptive histogram equalization of the chest," IEEE Trans. Med. Imag., vol. MI-6, pp. 1–7, Jan. 1987.
9. S. M. Pizer, J. B. Zimmerman, and E. V. Staab, "Adaptive grey level assignment in CT scan display," J. Comput. Assist. Tomogr., vol. 8, no. 2, pp. 300–305, 1984.
10. S. M. Pizer, E. P. Amburn, J. D. Austin, R. Cromartie, A. Geselowitz, T. Greer, B. H. Romeny, J. B. Zimmerman, and K. Zuiderveld, "Adaptive histogram equalization and its variations," Comput. Vision, Graphics, Image Processing, vol. 39, pp. 355–368, 1987.
11. Md. Foisal Hossain, Mohammad Reza Alsharif, "Image Enhancement Based on Logarithmic Transform Coefficient and Adaptive Histogram Equalization", 2007 International Conference on Convergence Information Technology, IEEE 2007.

12. K.Rajiv Gandhi, N.Nandhagopal, R.Sivasubramanian, "AutomaticSystem For Pre-Processing And Enhancement Of Magnetic Resonance Image (MRI)",International Journal of Applied Engineering Research (IJAER)vol.9 (22),pp. 15485-15499,2014.
13. J. Alex Stark "Adaptive Image Contrast Enhancement Using Generalizations of Histogram Equalization", IEEETransactions on ImageProcessing, Vol. 9, No. 5, May 2000.
14. Wang Yuanji. Li Jianhua, Lu E, Fu Yao, Jiang Qinzhong, "Image Quality Evaluation Based On Image Weighted Separating Block Peak Signal To Noise Ratio", IEEE Int.Conf. Neural Networks &Signal Processing, Nanjing, China, December 14-17, 2003.

Received: 15 Jan 2020 | Revised: 5 Feb 2020| Accepted: 30 Mar 2020