Volume 5, Issue 12, December 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Histogram based Contrast Image Enhancement Overview and Survey

Samkit Jain
M.Tech Scholar, Computer Science
LNCT, Bhopal, India

Prof. Ratnesh Dubey
Assistant Professor, Computer Science
LNCT, Bhopal, India

Dr. Vineet Richhariya
Head of the Computer Science
Department LNCT, Bhopal, India

Abstract- ***Image enhancement processes increase the visual information of that image. Global Histogram Equalization (GHE), Local histogram equalization, Brightness preserving Dynamic Histogram equalization and adaptive based histogram equalization (AHE) are several method of image process enhancement. Histogram based techniques are used to enhance contrast of all type of images, but low contrast image analysis is a challenging problem and it has main constraint of efficiency of this method. In this paper we survey several methods of image enhancement technique that provieded flexible and effective way for image enhancement and can be used as pre-processing step for image understanding and analysis.***

Keywords- ***Image enhancement, Homomorphic Filtering, Contrast enhancement, Histogram equalization.***

I. INTRODUCTION

Image processing is a vast and demanding area and its Applications used in various fields like medical images, satellite images and also in industrial applications. Quality Of the image gets better by contrast Manipulation. A very well performance for contrast enhancement is Histogram Equalization (HE). The most part of the techniques is used, due to simplicity and moderately better perforrmance on images. Histogram Equalization (HE) is one of the simplest and effective technique to perform contrast enhancement. In histogram equalization we reduce the number of gray Levels by combining two or more less frequent gray levels having small probabilities in one gray level also we stretch high frequent intensities over high range of gray levels to achieve comparatively more sharpness. This flattering causes the overall enhancement of contrast of the input image. In histogram equalization we do not have any mechanism to control the enhancement level, due to this sometime output image have over enhanced regions. Also HE could not effectively work, when the input image contains regions that are significantly darker or brighter than other parts of the image.

To overcome above mentioned limitations of the traditional HE method and make it more flexible, a number of HE based methods proposed by various groups of researchers. One of the most significant contributions in this line was Adaptive Histogram Equalization proposed by Hummel , Ketchamand Pizer . In this method, authors proposed that each pixel should be mapped to intensity proportional to its rank in the pixels surrounding it. AHE has produced excellent results in enhancing the signal component of an image but in many cases it enhances noise too. Noise enhancement introduces the artifacts in the output image and theses artifact reduces the ability of observer to detect information contained in the image. All the above mentioned methods improve image contrast but they have a common drawback that they are not able to preserve image brightness. This paper is organised as follows: In section II, Litersture survey of histogram based enhancement methods is presented. In section III, parameters used in determination of image enhancement is discussed. In section IV comparision table of different method is mentioned.

II. LITERATURE SURVEY

The author Senthil kumaran N compared differnt Histogram Equalization Technique and explained Histogram Equalization (HE) and their complex methods for contrast enhancement of the images. Histrogram Equalization is one of the most important enhancement technique. Histogram equalization is a technique for adjusting image intensities to enhance contrast. The histogram of an image mostly represents the comparative frequency of occurrence of the various gray levels in the image [3] . tries to spread the pixels intensity of that image based on the whole image information [1][2]. An improved version of HE is Brightness preserving Bi-Histogram Equalization(BBHE) [3]. It produces better result compared to HE but cannot always preserve the original brightness. A method called equal area Dualistic Sub-image Histogram Equalization (DSIHE) [4] performs better than BBHE. It can preserve both brightness and image content but cannot preserve mean brightness. Histogram Equalization (HE) method has two main disadvantages which affect efficiency of this method. These two main disadvantages are followed:

1) Histogram Equalization (HE) assigns one gray level into two different neighbour gray levels with different intensities.

2) If most of an image includes a gray level, Histogram Equalization (HE) assign a gray level with higher intensity to

that gray level and it gives washed out appearance to the resultant image [1].

Global Histogram Equalization (GHE) is one another method of image process enhancement. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. The method is useful in images with backgrounds and foregrounds that are both bright or both dark.

This is a histogram technique which acquires the input image given by the user and enhances the image globally and displays both the initial and final images [5]. GHE offer a significant progress in image contrast. intensities. The histogram offers information for the contrast and overall intensity distribution of an image [2].

The one another image constrat method is Local Histogram Equalization (LHE),While GHE takes into description the global information and cannot adjust the local light condition. Local Histogram Equalization (LHE) carries out block-overlapped histogram equalization. LHE classify a sub-block and recovers the information [4]. Then, the histogram equalization is useful for the center pixel used in the CDF of the sub-block. Now, the sub-block is stimulated by one pixel and the sub-block histogram is repeated until the image achieve. LHE can not get used to well partial brightness in sequence, still more enhances some section depends on size of the mask [2].

Adaptive Histogram Equalization (AHE)

Adaptive Histogram Equalization (AHE) one another method of image process enhancement. This is a terrific contrast enhancement method for both Natural images and Medical images. The method engages applying to each pixel in HE [7]. Histogram equalization is classified into two categories: non adaptive and adaptive. In the non adaptive each pixel is customized by applying the same pattern of calculation that uses the histogram of complete original image. In works with better result for images that has details hidden in dark regions [6]. In this method, instead of applying transformation function directly on entire image, it is applied on sub images separately and then combined in proper manner .Steps for method are given as:

1) Divide the input image into an NxN matrix of sub images.
2) Compute the mapping from histogram equalization (HE) of each of these sub-images.
3) For each pixel in the input image, do the following:
i) If the pixel belongs to an internal region (IR), then
(a) Compute four weights, one for each of the four nearest sub-images, based on the proximity of the pixel to the centres of the four nearest sub-images (nearer the centre of the sub-image, larger the weight).
(b) Calculate the output mapping for the pixel as the weighted sum of the HE mappings for the four nearest sub-images using the weights computed above.
ii) If the pixel belongs to an border region (BR), then
(a) Compute two weights, one for each of the two nearest sub-images, based on the proximity of the pixel to the centres of the two nearest sub-images.
b) Calculate the output mapping for the pixel as the weighted sum of the HE mappings for the two nearest sub images using the weights computed above.
iii) If the pixel belongs to a corner region (CR), the output mapping for the pixel is the HE mapping for the sub image that contains the pixel. Apply the output mapping obtained to each of the pixels in the input image to obtain the image enhanced by AHE.[3]

The Brightness preserving dynamic histogram equalization (BPDHE).

The Brightness preserving dynamic histogram equalization (BPDHE), is also an expansion to HE they can create the Output image by mean intensity that is almost the same to the input mean intensity. It produce the output image with the mean intensity almost equal to the mean intensity of the input, thus fulfill the equirement of maintaining the mean brightness of the image The conditions maintain the brightness of the image [8]. For Preserving maximal brightness of an image, an extension form of BBHE and DSIHE is Minimum Mean Brightness Bi-Histogram Equalization (MBEBHE) [5]. In spite of performing almost highest contrast enhancement, MMBEBHE creates more side effects. Chao Wang and Zhongfu Ye[6] proposed the Brightness Preserving Histogram Equalization with Maximum Entropy (BPHEME).Though this algorithm provides acceptable results for continuous case, it fails for discrete ones.Chao Zuo et al. [7] proposed Range Limited Bi-Histogram Equalization (RLBHE) that preserve the mean brightness of the image. But it needs more time to compute. Based on the histogram equalization technique.

Modified Histogram Based Contrast Enhancement using Homomorphic Filtering (MH-FIL). has two step processing, in first step global contrast of image is enhanced using histogram modification followed by histogram equalization and then in second step homomorphic filtering is used for image sharpening, this sharpening is followed by image normalization.

III. PARAMETERS

1. Absolute Mean Brightness Error (AMBE).

AMBE is used to calculate difference in mean brightness between two images. AMBE is defined as the difference between the input and output mean.Mathematical expression to calculate AMBE between two images is given as:

$$AMBE = |Xm - Ym|,$$

where *Xm* and *Ym* are mean brightness of input and processed image respectively

2. Weber contrast

The Weber contrast is normally used in small fields on a large uniform background. It is one of the oldest luminance contrast statistics, Weber Contrast, is also often used for these patterns (small, sharp-edged graphic objects like symbols and text characters on larger uniform backgrounds):

$$C_W = \frac{L_s - L_b}{L_b}$$

where Ls is the luminance of the symbol and Lb is the luminance of the immediately adjacent background.

3. Michelson contrast

For simple periodic patterns (e.g., textures) there is no large area of uniform luminance that dominates the user's brightness adaptation. There is no clear choice for the denominator of the above statistics.

$$C_M = \frac{L_{\max} - L_{\min}}{L_{\max} + L_{\min}}$$

The denominator of CM is twice the mean of the maximum and minimum luminances, the adaptation luminance estimate is based on the space-average luminance.

4. Contrast

Contrast is mentioned as ratio, such at 3:1. An N: 1 Relation means that separating the brighter luminance with the darker luminance provide a number that is the same to N.

IV. TABLE OFMPARISION COMPARISION OF METHODS

METHOD NAME	ADVANTAGE	DISADVANTAGE
Histogram Equalization (HE)	Simple and enhance contrasts of an image.	It assigns one gray level into different neighbor gray levels with different ntensitie higher intensity to that gray level and it gives washed out appearance to the resultant image
Adaptive Histogram Equalization (AHE)	It is a terrific contrast enhancement method for both Natural images and Medical images.	It many cases it enhances noise too. Noise enhancment introduces the artifacts in the output image and this artifact reduces the ability of observer to detect information contained in the image
Global Histogram Equalization (GHE)	A single mapping derived from the image is used then it is a global method, and if the neighborhood of each pixel is used to obtain a local mapping function then it is a local method.	Its main disadvantage is that for some occasions where some of the intensity ranges, with zero counts of pixel intensity, have not been utilized for conveying scene information.

V. CONCLUSION

After reading the literatures, we find some comparative study of Histrogram Equlization based methods shows that the cases which require higher brightness preservation and not handled well by HE, AHE,GHE. Though these methods can perform good contrast enhancement, they also cause more annoying side effect. Image histogram based enhancement equalization methods are compared for particular enhancement like contrast of image. More popular HE methods like GHE, LHE, AHE and BPDHE are compared and some of image data sets and results from the HE methods are processed under the Quality metrics and results are analyzed. The good contrast image is useful for detail analysis and diagnosis. This contrast is measured with different objective quality metrics. The paper is a short description and analysis of the methods and approaches of image enhancement.

REFERENCES

[1] Ali Ziaei, Hojatollah Yeganeh, Karim Faez, Saman Sargolzaei, *"A Novel Approach for Contrast Enhancement in Biomedical Images Based on Histogram Equalization",* 2008 IEEE International Conference on BioMedical Engineering and Informatics.

[2] Pratik Vinayak Oak, R.S.Kamathe, "Contrast enhancement of brain MRI images using histogram based techniques", International journal of innovative research in electrical, electronics, instrumentation and control engineering, 2013..

[3] YEONG-TAEGI KIM ,*"Contrast Enhancement Using Brightness Preserving Bi-Histogram Equalization"* IEEE Trans. on Consumer Electronics, Vol.43, No.1, pp.1-8, Feb. 1997.

[4] Rajamani V, P.Babu, S. Jaiganesh, "A Review of various global contrast enhancement techniques for still images using histogram Modification Framework", International Journal of Engineering Trends and Technology, 2013.

[5] Abdullah Al Wadud M et al , "A Moderate histogram equalization method for image enhancement", International Journal of Science and Technology, Vol. 11(3), 706-712.

[6] Pradeep, Namratha M, Manu G V, "Global and localized histogram equalization of an image", International Journal Of Computational Engineering Research, Vol. 2,2012.

[7] Elisabeta Antonia Haller, "Adaptive histogram equalization in GIS", Mathematics and Computer Science Series, Volume , 2011.

[7] Alex Stark J, "Adaptive image contrast enhancement using generalizations of histogram equalization", IEEE Transactions on Image Processing, VOL. 9, 2000.

[8] Ramyashree N, Pavithra P, Shruti T V, Dr.Jharna Majumdar**,***"Enhancement of Aerial and Medical Image using Multi resolution pyramid",* Special Issue of IJCCT Vol.1 Issue 2, 3, 4; 2010 for International Conference [ACCTA-2010].

[9] Manpreet Kaur, Jasdeep Kaur, Jappreet Kaur "Survey of contrast enhancement techniques based on histogram equalization",International Journal of Advanced Computer Science and Applications, Vol. 2, 2011.

[9] Rajesh Garg, Bhawna Mittal, Sheetal Garg, "Histogram equalization techniques for image enhancement ", IJECT Vol. 2, Issue 1, March 2011.

[10] Annadurai s, Shanmugalakshmi R, "Fundamentals of digital image processing", Pearson Education 2007.

[11] N. Senthilkumaran, R. Rajesh, "Edge detection techniques for image segmentation – a survey of soft computing approaches", International Journal of Recent Trends in Engineering, Vol. 1, No. 2, May 2009.

[12] N.Senthilkumaran, R. Rajesh, "Brain image segmentation",international journal of wisdom based computing, vol. 1(3), december 2011.

