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Modified Contrast Enhancement using Laplacian and Gaussians Fusion Technique

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Abstract: *The aim of image fusion is to mix images of a scene captured below totally different illumination. One image contains most of information from the whole supply images automatically. Contrast enhancement is employed to enhance the standard of visible image with none introducing unrealistic visual appearances. Fusion technique is employed for the important applications like medical imaging, microscopic imaging, remote sensing, and laptop vision and robotics. Contrast enhancement improves the brightness differences within the dark, gray or bright regions at the expense of the brightness differences within the alternative regions. During this paper methodology of the contrast enhancement for images that improves the local image contrast by controlling the local image gradient. The proposed methodology improves the improvement drawback and maximizes the local contrast and global contrast of an image.*

Keywords: *Contrast Enhancement, image fusion, Laplacian and Gaussians pyramid decomposition, Image blending, brightness*

I. Introduction

Contrast enhancement improves the perceptibility of objects within the scene by enhancing the brightness difference between objects and their background [1]. It removing of noise, 'blur' and improves contrast of an image. Many digital contrast improvement techniques are employed in order to optimize the visual quality of the image for human or machine vision through gray scale or histogram modification [2]. The noise removal is the most vital area for an image to extend its visibility and neutrality. Smoothing, detection and localization are the necessary areas of the sting detection techniques without degrading the standard or features of an image. Most contrast improvement strategies are applied to boost the grayscale of image. Contrast measures the relative variation of the luminousness in image and it's extremely correlated to the intensity gradient [3]. The problem of enhancing contrast of images enjoys much attention and improves the

Visual image acquired with poor illumination to medical imaging. Enhancement improvement technique ways classified strategies into two categories: direct and indirect strategies. Direct image an appropriate approach is that the establishment of an appropriate abundant of image contrast i.e. and indirect contrast improvement is to boost of contrast with none specific noise [4]. A limit on the level of contrast improvement will be set and prevent the over saturation caused by histogram equalization. Contrast enhances by transforming the worth in an intensity image in order that histogram of the output image approximately matches a specified bar graph. Weber contrast is employed to live the local contrast of a small target of uniform brightness against a homogenous background. These measurements a suitable effective for actual image with totally different lightning or shadows [5]. The aim of this paper is to line out a concise mathematical description of adaptive histogram effort. It's a method that adjusts the relative brightness and darkness of objects within the scene to improve their visibility.

II. Fusion

Fusion technique could be a method of choosing the relevant info from the set of images into one image whereby the output image are more informative and complete than mixing images [4]. The used technique relies on the essential and pyramid algorithmic program during this paper. This method is wont to improve the standard of information from a collection of images [6].The problem of fusion is truly the way to outline weight and therefore the combination rules for fusion techniques. Image fusion is classified into three categories: straightforward image fusion, pyramid decomposition and separate wavelet transform based mostly fusion. Decomposition could be a method that the output image is finally completed from the pyramids formed at every level of decomposition. Straightforward image fusion techniques chiefly operated with terribly basic operations like pixel addition, subtraction etc. Pyramid decomposition could be a collection of copies of an inspired image within which each sample density and determination area unit reduced. Pyramid decomposition is that the method wherever image is with success united at every level. Laplacian pyramid is rotten into the set of parts of band pass filtering pictures [8], whereas Gaussian pyramid rotten in low pass part pictures. Pyramids are employed in several applications like as image alignment, mixing images, and data composition etc. Laplacian pyramid decomposition processes are initial order and second order. Input image I(x, y) wherever x

and y are the row and column by coordinates, any pixel location is calculated by applying two dimension derivatives. The image fusion techniques are categorized purpose wise in different ways that like multi-view fusion, multi-dimensional fusion, multi-temporal fusion and fusion for restoration. The image restoration is employed to increase the resolution of a blurred image. Within the image fusion technique one image isn't enough, want over one image i.e. acquisition of various pictures is needed. The Laplacian pyramid fusion technique is employed to boost the standard of an image it's a pattern selective approach in order that the feature of composite image is made at a time.

First order derivative:

$$\nabla I(x,y) = \begin{pmatrix} \partial I(x,y)/\partial x \\ \partial I(x,y)/\partial y \end{pmatrix}$$

$$\partial I(x,y)/\partial x = I(x,y) - I(x+1,y)$$
$$\partial I(x,y)/\partial y = I(x,y) - I(x,y+1)$$

$$|\nabla I| = \sqrt{(\partial I(x,y)/\partial x)^2 + (\partial I(x,y)/\partial y)^2}$$

The first order Laplacian derivative is used to distinguish the gray level of an image (provides the difference of two neighbor pixels gray level characteristics).

Second order derivative:

$$\nabla I^2(x,y) = \frac{\partial^2 I}{\partial x^2} + \frac{\partial^2 I}{\partial y^2}$$

$$\frac{\partial^2 I}{\partial x^2} = I(x+1,y) + I(x-1,y) - 2I(x,y)$$

$$\frac{\partial^2 I}{\partial y^2} = I(x,y+1) + I(x,y-1) - 2I(x,y)$$

$$\nabla I^2(x,y) = [I(x+1,y) + I(x-1,y) + I(x,y+1) + I(x,y-1) - 4I(x,y)]$$

III. Grayscale Image Enhancement

Grayscale image enhancement is the task of transformation of input image such as visual clearity or less noisy output images. The Laplacian operator high lights the gray level discontinuities, deemphasizes slowly varying gray level changes and superimpose on a dark featureless background. The featureless background can be recovered by adding the original and Laplacian images if the center is positive coefficient or subtraction if center is negative coefficient.

So new image-

$$g(x,y) = \begin{Bmatrix} I(x,y) - \nabla I^2(x,y) \\ I(x,y) + \nabla I^2(x,y) \end{Bmatrix}$$

In this paper, three enhancement techniques for the performing fusion technique i.e., Histogram Equalization method, Contrast limited adaptive histogram equalization and Imadjust function. Histogram equalization usually increases the global contrast of many images, when the usable data of image is represented by close contrast values.

$$I(x,y)=\begin{Bmatrix} A_i(x,y), for\left|A_i(x,y)\right| > B_i(x,y) \\ B_i(x,y), otherwise \end{Bmatrix}$$

Average is calculated as-

$$I_N(x,y)=\frac{A_N(x,y)+B_N(x,y)}{2}$$

The signals levels are $0 \le l \le$ N-1 i.e. N levels are decided.

Histogram of the processed image will not uniform due to the discrete nature of the variable. HE spreads out intensity over brightness in higher ontrast of output image. HE technique is useful in image with background and foregrounds that are low contrast, bright and dark [7]. Contrast limited adaptive histogram equalization (CLAHE) is used to improve contrast in images. CLAHE is differing from HE with respect to method of adaption. CLAHE method improves with transforming each pixel and equalizing the histogram of the neighborhood region. CLAHE was originally developed for medical imaging. Adjustment technique based on contrast enhancement techniques i.e., maps in image's intensity value to new range. Adjustment method improves the contrast of the images with its histogram.

IV. Proposed Method

The Laplacian pyramid (fundamental tool in image processing) of an image could be a set of band pass images; during which each is a band pass filtered copy of its predecessor. Band pass copies are often obtained by calculating the distinction between low pass images at successive levels of a gaussian pyramid. during this approach, the Laplacian pyramids for every image component (IR and Visible) are used. A strength live is employed to determine from that supply what pixels contribute at every specific sample location. Take the common of the two pyramids such as every level and add them. The ensuing image is easy average of two low resolution images at every level. Here we describe the step by step procedure of the propose fusion technique based contrast enhancement technique. Flow diagram of which is shown in figure 2–

1. . At first, the image is segmented is taken as input in jpg format.
2. The image is read by MATLAB with the help of *'imread'* command and returns the image data in the array RGB (M×N×3).
3. Next, the image is converted from RGB to grayscale image with the help of 'rgb2gray' command.
4. The fusion of various gray scale images is maintained by local contrast enhancement method.
5. Three enhancement techniques are used for performing of fusion method. First we use CLAHE method, the contrast enhancement method can be limited in orderly avoid noise which might be present in the image. HE is used for intensity value over brightness in orderly achieve high contrast. Adjustment based contrast enhancement is based Matlab imadjust function. Imadjust function increases the contrast of the image.
6. In proposed fusion technique, first we take two input image i.e., HE is first input and second is adjust input image. Both input images Decompose using Laplacian pyramid decomposition. Laplacian used in term of first derivation and second derivation. Next step is to compute the Gaussian pyramid decomposition. The process of the proposed work is shown below in fig.1 by blocks.

Figure 1 Image Enhancement Parts

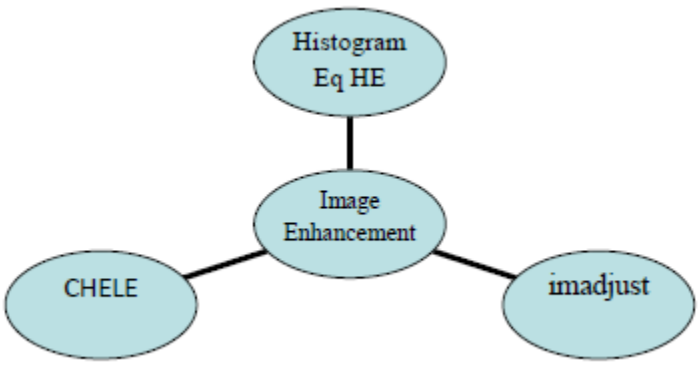


Figure – 2 Flow chart of proposed Method

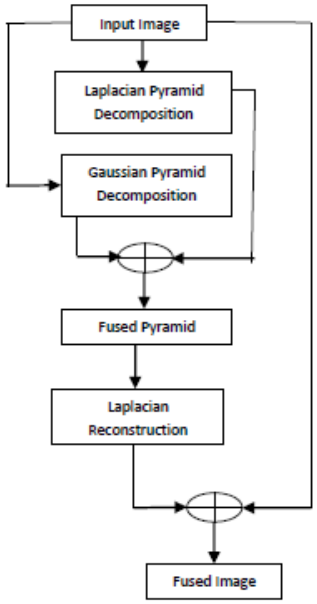


Figure – 2 Flow chart of proposed Method

V. Result

The proposed algorithm is simulated on the MATLAB software here we have use R- 2013b. The proposed methods flow chart is shown in figure 2. Flow chart shows each and every step of our proposed method. . For testing of our proposed method we have take a two back bone image of digital image processing there are the 'Lena' and 'Mandril' for calculations of Entropy. E has been used to measure the content of an image, with higher values indicating images which are richer in details. The first-order entropy corresponds to the global entropy as used for gray level image thresholding [9]. The higher value of entropy indicates that image is of good quality so it is necessary to evaluate the entropy value returns E, a scalar value representing the entropy of grayscale image I. Entropy is a statistical measure of randomness that can be used to characterize the texture of the input image. Entropy is defined as –

. E = entropy(I)

$$H = -\sum_{i}\sum_{j} p_{i,j} \quad \log p_{i,j}$$

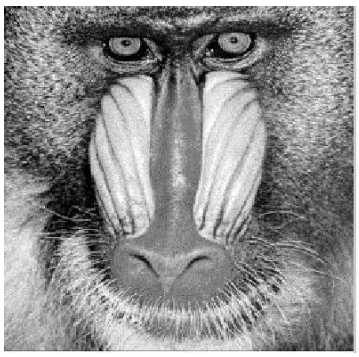
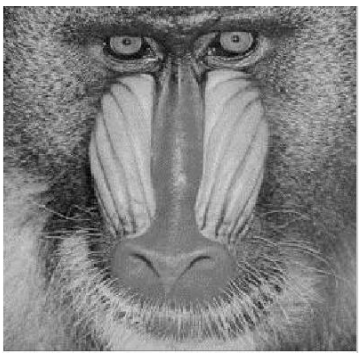
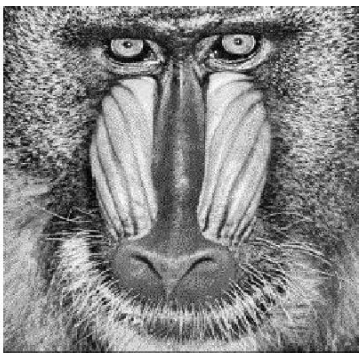
Here the experimentation of the proposed technique over a number of sample images and some of the results are displayed in fig. 3 and 4. We can see that the fused as obtained by MATLAB technique are different to other ways. fig. 3 and 4 shows the results on monochrome images Mandrill and Lena, respectively.

Image	**Entropy(fig no. 3)**	**Entropy(fig no. 4)**
HE Image	5.7418	6.1468
CLAHE Image	7.4136	7.9637
Adjust Image	6.7148	7.71467
Proposed Image	7.5215	7.6839

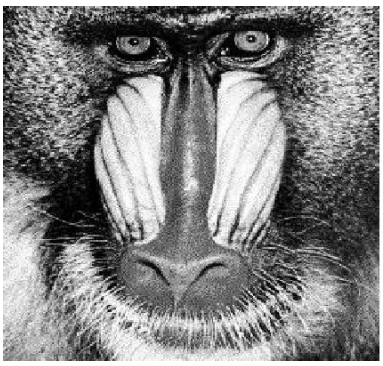
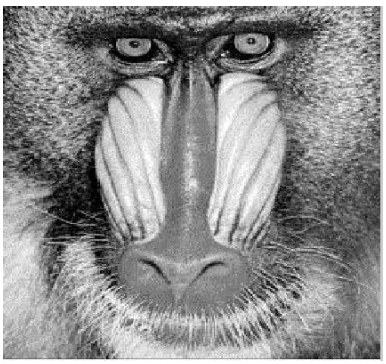
Table 1 Entropy Compression of different image enhancement values

The visual result of proposed method is compare with other different method is shown in figure 3. In this figure

(a) shows the base image gray level in figure (b) shows the CLAHE of the image and figure (c) shows the HE and now finally we have simulated the last one that is (e), this is our proposed result. We can see easily our proposed result better then other method that is shown in figure 3 (a), (b). (c), (d).

(a). Original Mandrill Image (b). CLAHE Image (c). HE Image

(d). Adjust Image (e). Proposed Image

Fig.3. Simulation result for Mandrill Image

Similar we have simulate the result for LENA image in figure 4. The visual result of proposed method is compare with other different method is shown in figure 4. In this figure (a) shows the base image gray level in figure (b) shows the CLAHE of the image and figure (c) shows the HE and now finally we have simulated the last one that is (e), this is our proposed result. We can see easily our proposed result better than other method that is shown in figure 4 (a), (b). (c), (d). This is our all compression of our result with different methods that is shown in figure 3 and figure 4.



(a). Original Lena Image (b). CLAHE Image (c). HE Image

(d). Adjust Image (e). Proposed Image
Fig.4. Simulation result for Lena image

VI. Conclusion

This paper represent a new method for contract enhancement fusion based for different gray-scale image like medical image, satellite image. Our proposed method also the quality of preservation of naturalness of image as compare to other famous image like HE, Imadjust and CHELE. In future we will try to improve more contrast in different images like satellite and medical image. At this stage still our main target to improve the quality as well as preserve the naturalness of image. At the end our proposed fusion based image enhancement shows better result in terms of entropy and also histogram graph that is shown in figure and table 1. Also we will implemented on the very large scale integration system with the help of FPGA technology and further implemented on the hardware device.

References

[1] Gonzalez RC, Woods RE: Digital Image Processing Prentice Hall, Upper Saddle River, NJ; 2002
[2] Beghdadi A, Negrate AL: Contrast enhancement technique based on local detection of edges. Comput Visual Graph Image Process 1989
[3] Saleem1, Azeddine Beghdadi1and Boualem Boashash, Image fusion based contrast enhancement. Paris : Springer-Verlag, 2012
[4] Tang J, Peli E, Acton S: Image enhancement using a contrast measure in the compressed domain. IEEE Signal Process Lett 2003, 10(10):289-292
[5] Tang J, Kim J, Peli E: Image enhancement in the JPEG domain for people with vision impairment. IEEE Trans Biomed Eng 2004, 51(11):2013-2023
[6] Shivsubramani Krishnamoorthy, K P Soman. "Implementation and Comparative Study of Image Fusion Algorithms", IJCA (0975 – 8887) Volume 9– No.2, November 2010
[7] Stark JA: Adaptive image contrast enhancement using generalizations of Histogram equalization. IEEE Trans Image Process 2000, 9(5):889-896.
[8] Burt P, Adelson T: The laplacian pyramid as a compact image code. IEEE Trans Commun 1983, COM-31:532-540
[9] Amina Saleem, Azeddine Beghdadi and Boualem Boashash "Image fusion-based contrast enhancement", EURASIP Journal on Image and Video Processing 2012, 2012:10.