

# A new Image Enhancement methods and Its Simulation

Roshni kabir Panthi<sup>1</sup>, Suresh Gawande<sup>2</sup>, Anjali Shivhare<sup>3</sup>

<sup>1</sup> M.Tech. Scholar, Electronics & Communication Engineering, BERI Bhopal, M.P., India

<sup>2</sup> Assistant Professor, Electronics & Communication Engineering, BERI Bhopal, M.P., India

<sup>3</sup> Assistant Professor, Electronics & Communication Engineering, BERI Bhopal, M.P., India

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**Abstract** – This paper presents Histogram equalization techniques which provide most convenient and suitable technique for contrast enhancement. However some limitations are there which does not maintain its natural appearance of images. For image enhancement several methods are introduced like intensity transformation gray level, slicing histogram equalization, arithmetic and filtration method. In this paper introduced a novel approach gray scale image contrast enhancement by stretch composite histogram equalization method. In this technique firstly stretch the two neighborhood pixels and then ameliorate the appearance and eliminate dim brightness of the image and then by histogram equalization algorithm image enhancement is achieved.

**Key Words:** Histogram equalization, image enhancement, contrast enhancement.

## 1. INTRODUCTION

Now days digital cameras and mobile cell certainly the most used devices to capture image. They are used in many places like traffic system robot, surveillances and home security system to applications in medicine and the space program, digital image processing techniques now are used in a broad range of applications. Computer procedures are used to enhance the contrast or code the intensity levels into colour for easier interpretation of X-rays and other images used in industry, medicine, and the biological sciences. Geographers use the same or similar techniques to study pollution patterns from aerial and satellite imagery. Image enhancement and restoration procedures are used to process degraded images of unrecoverable objects or experimental results too expensive to duplicate. In archaeology, image processing methods have successfully restored blurred pictures that were the only available records of rare artefacts lost or damaged after being photographed. Off course the quality of images obtained by digital cameras good regardless of the context in which they are used have improved significantly since early days. Part of these improvements is due to higher processing capability of the systems.[2,3,5]

Contrast enhancement of digital images is used to process an input image such that the visual content of the output image is more pleasing or more useful for machine vision applications. However, choosing an appropriate

contrast enhancement algorithm is not an easy task due to the lack of the dependable measures to quantify the output image quality. Furthermore, enhancement algorithms usually rely on proper parameter to solve these problems; there are a large number of enhancement algorithms that have been proposed in the literature. Contrast enhancement algorithms can be categorized into two major groups according to the data domain they are applied to: (1) transform-domain algorithms; and (2) image-domain algorithms.

## 2. METHODS OF IMAGE ENHANCEMENTS

Image enhancement methods are used to make an image clearer. This may be to aid interpretation by humans or computers. Types of Image enhancement technique improves the appearance of image and enhances the finer details of image having low luminance noise reduction edge enhancement and contrast enhancement. Enhancement may be used to restore an image that has suffered some kind of deterioration due to optics, electronics and environment or to enhance certain features of an image. Image enhancement improves attributes of the original image such that resultant image is better visually or improved so that it can be used for many image processing algorithms. There exist many techniques that can enhance the digital image without spoiling it.[7,9,10]

The contrast of image can improved by different methods likes basic function algorithm pyramid based algorithm and fuzzy logic based algorithm but here we have basic considered basic function algorithm and the quality of image is justified with the help of grey level and contrast intensity.

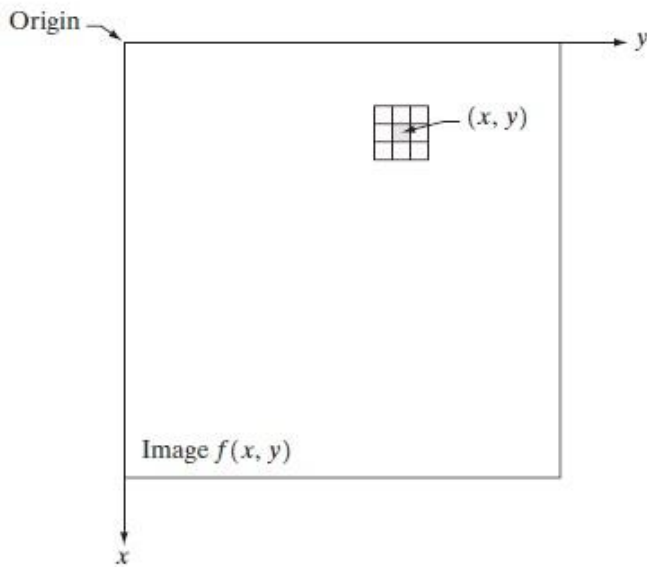
Basic function algorithm describes spatial domain analysis it is a direct method enhancement. Contrast measures the relative variation of the luminance/brightness in image and it highly correlated to intensity gradient [1]. The problem of the enhancing contrast of images enjoys much attention and attention and spans a wide gamut of application, ranging from improving visual quality of photographs acquired with poor illumination to medical imaging. The direct method enhances the detail by defining a function for contrast improvement [2]. The enhancement methods can be broadly divided into two categories – transform domain and spatial domain [3].

### 2.1 Spatial domain method

The term of spatial domain refers to the aggregate of pixels composing an image. Spatial domain methods are procedure that operates directly on these pixels. The spatial domain processes will be denoted by the expression.[5,6]]

$$g(x,y) = T[f(x,y)]$$

T operator on f defined over some neighborhood of (x,y):  
input, g : output (proposed image) Contrast and dynamic range modification.Noise reduction Edge enhancement and detection.



### 2.2 Frequency domain method

This method are mainly depend on Convolution theorem it can understood as follows Suppose g(x,y) is an image formed by the convolution of an image f(x,y) linear time invariant operator h(x,y):[4,7]

$$g(x,y) = h(x,y)*f(x,y)$$

Where h(x, y): operator

$$G(u,v) = H(u,v)F(u,v)$$

H(u,v) : Transfer function

### 3. GRAY LEVEL TRANSFORMATION (Enhancement by point processing)

Gray-leveltransformation functions.These are among the simplest of all image enhancement techniques.The values of pixels, before and after processing, will be denoted by rand s, respectively. Expression of the form s=T(r), where T is a transformation that maps a pixel value r into a pixel

value s. Since we are dealing with digital quantities, values of the transformation function typically are stored in a one-dimensional array

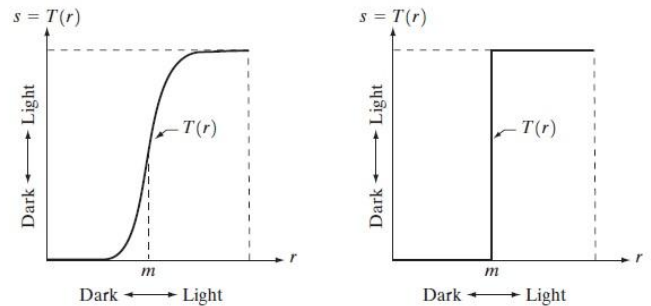


Figure 2 intensity transformation functions (grey level or mapping)

### 3.1 Contrast stretch

A high-contrast image spans the full range of gray-level values; therefore, a low contrast image can be transformed into a high-contrast image by remapping or stretching the gray-level values such that the histogram spans the full range [3]. The contrast stretch is often referred to as the dynamic range adjustment (DRA). The simplest contrast stretch is a linear transform that maps the lowest gray level GLmin in the image to zero and the highest value GLmax in the image to 255 (for an eight-bit image), with all other gray levels remapped linearly between zero and 255, to produce a high-contrast image that spans the full range of gray levels [10]. This linear transform is given by

$$g'(x,y) = INT\left\{\frac{255}{GLmax-GLmin} [g(x,y) - GLmin]\right\} \dots\dots\dots (3.1)$$

$$g'(x,y) = INT\left\{\frac{GL'max-GL'min}{GLmax-GLmin} [g(x,y) - GL] + GL'min\right\} \dots\dots\dots (3.2)$$

We can achieve additional contrast enhancement if we replace GLmin and GLmax in Eq. (4.2) with points that penetrate the gray-level histogram, with Pmin >GLmin penetrating the low end and Pmax <GLmax penetrating the high end. The gray-level transform is then given by

$$g'(x,y) = INT\left\{\frac{GL'max-GL'min}{Pmax-Pmin} [g(x,y) - Pmin] + GL'min\right\} \dots\dots\dots (3.3)$$

### 3.2 Global histogram equalization

The histogram of a digital image the pixel values of in the interval  $[0, L-1]$  is a discrete function  $g(X_k) = n_k$ , where  $X_k$  is the  $k^{th}$  gray level and  $n_k$  is the number of pixels in the image having gray level  $X_k$ . It is common practice to normalize a histogram by dividing each of its values by the total number of pixels in the image denoted by  $n$ . variable  $X$  represent the gray levels of the image to be enhanced. In the initial part of our discussion we assume that  $r$  has been normalized to the interval  $[0, 1]$ , with  $X=0$  representing black and  $X=1$  representing white.

The gray levels in an image may be viewed as random variables in the interval  $[0, 1]$

$$P(X_k) = n_k/n, \quad k= 0, 1 \dots L-1 \quad (3.2.1)$$

Let us suppose that  $\mathbf{X} = \{X(i, j)\}$  denotes a digital image, where  $X(i, j)$  denotes the gray level of the pixel at  $(i, j)$  place. The total number of the image pixels is  $n$ , and the image intensity is digitized  $\forall X(i, j) \in \{X_0, X_1, X_2, \dots, X_{L-1}\}$ . Suppose  $n_k$  denotes the total number of pixels with gray level of  $X_k$  in the image, and then the probability density of  $X_k$  will be Let  $p(r)$  and  $ps(s)$  denote the probability density functions of random variables  $X$  and  $s$ , respectively, where the subscripts

on  $p$  are used to denote that  $P_x$  and  $P_s$  are different functions. Then the probability density function  $p_s(s)$  of the transformed variable  $s$  can be obtained using a rather simple formula:

$$P_s(s) = P_x(X_k) \left| \frac{dX}{ds} \right| \quad (3.2.2)$$

The relationship between  $p(X_k)$  and  $X_k$  is defined as the probability density function (PDF), and the graphical appearance of PDF is known as the histogram. Based on the image's PDF, its cumulative distribution function is defined as

$$C(X_k) = \sum_{j=0}^{L-1} p(X_j) = \sum_{j=0}^{L-1} \frac{n_j}{n} \dots\dots\dots (3.2.3)$$

Where  $k = 0, 1 \dots L-1$ , and it is obvious that  $c(X_{L-1}) = 1$ . Let us define a transform function  $f(x)$  based on the cumulative density function as. Thus, a processed (output) image is obtained by mapping each pixel with level  $X_k$  in the input image into a corresponding pixel with level  $S_k$  in the output image via Eq. (3.2.3)). As indicated earlier, a plot of  $P_x(X_k)$  versus  $X_k$  is called a histogram. The transformation (mapping) given in Eq. (3.2.3) is called histogram equalization or histogram linearization.

### 4. IMAGE ENHANCEMENT

Image enhancement by histogram equalization:-Pout gray scale image have taken for enhancement see the pout image this image is very blurring and unclear image we cannot recognize pout background image in this image also have very low gray level that means contrast of image is very low so we take this image for enhancement. First method of enhancement have used histogram equalization method by this method enhancement has performed and we get enhanced pout2 image and generate the histogram of HE enhanced pout2 image clearly see that enhanced image2 is seen clearly and this image has visual appearance have better as compare to image 1 in enhanced image almost blurriness has improved but not desired.

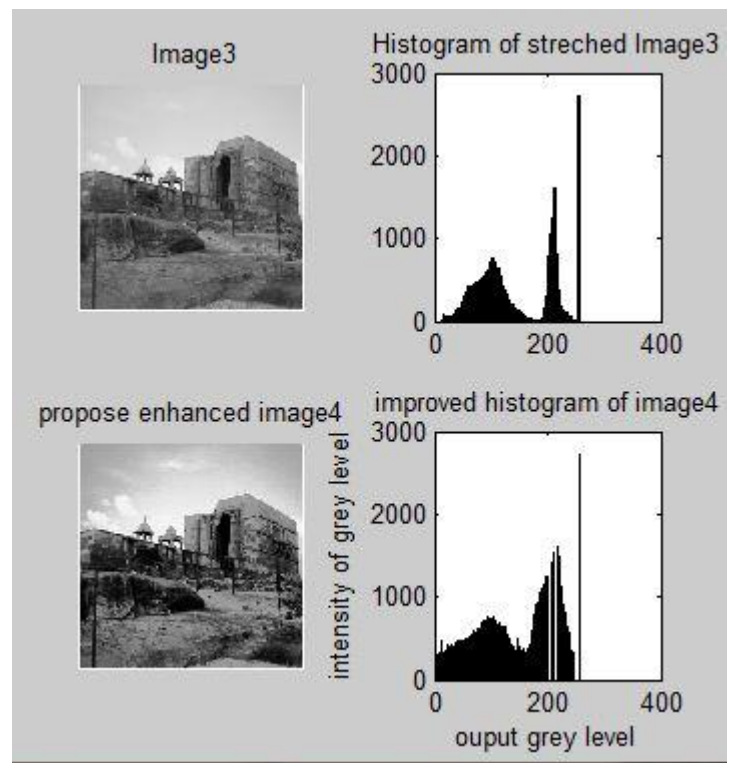


Figure 2 Enhanced image3 by proposed CESCHE and its histogram

Second camraman image have taken for enhancemnet. In this image visual apeareance is showing the darkness. So this type of image can enhance to make image higher contrast and more brightness. So it is pcessed by many method these given below. Firt method of enhancement is histogram equalization in this enhancement image contrast is increased and histogram peaks also increased.

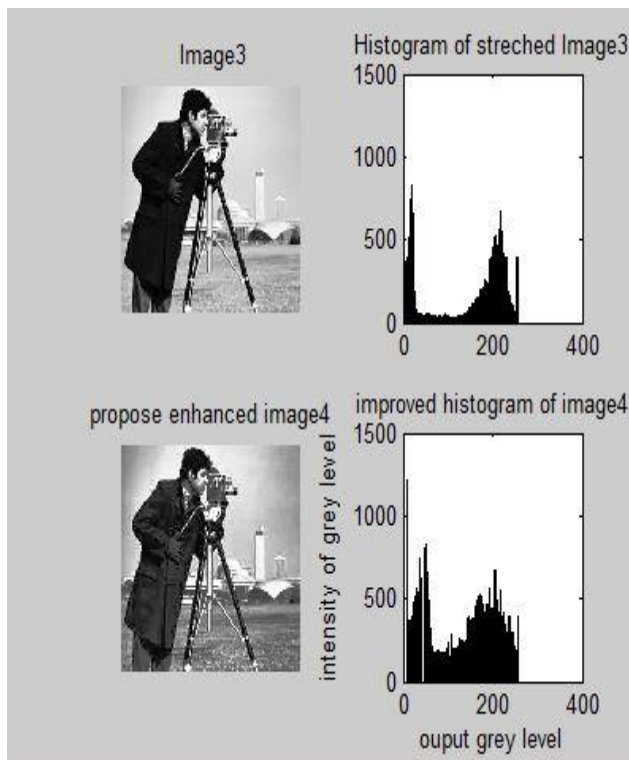


Fig 3(a) cameraman original image and enhance HE image with histogram

From the above result Fig 3(a) it's clear that contrast enhancement has reached specified gray level but in this process the entropy of image is low because its histogram peaks is low so it can be improves better.

So we enhance this image by proposed method in this process we take stretch parameters low gray level and high gray level respectively 10, 40 and their slopes respectively 1, 2, and 1 The result of proposed method contrast enhancement is quit better than other image enhancement methods. The various parameters improved like histogram peaks and entropy, brightness of image. The result of proposed method is given below figure 3 (b).

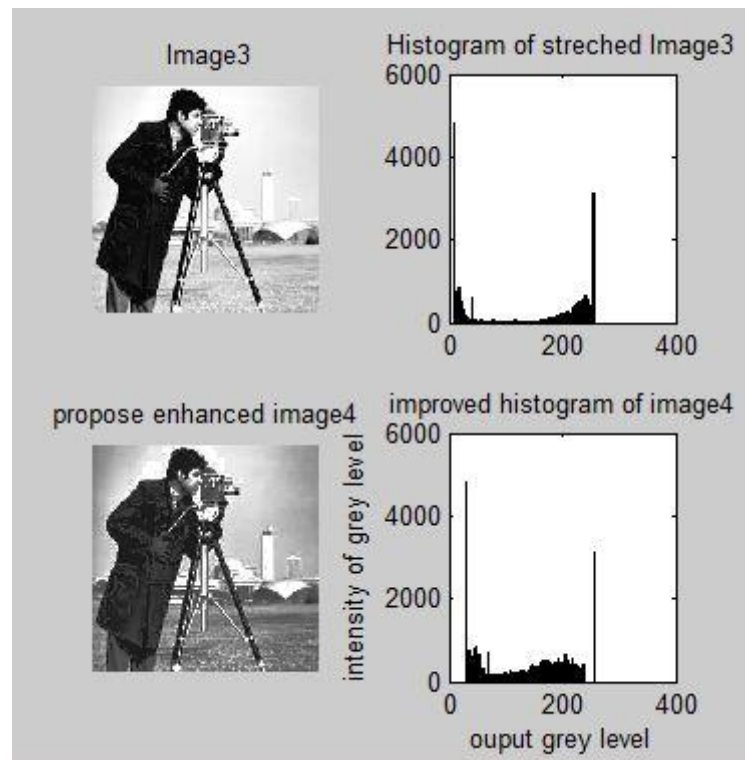


Figure 3(b) image1 enhanced by proposed CESCHE method and its histogram

#### 4. CONCLUSION

In This paper we have introduced a new method of image enhancement composite histogram equalization with the followed by contrast stretch enhancement process for gray scale images. All the methods using MATLAB programming are implemented to get optimal response. Composite method provides the way to integrate and complementary data to enhance information apparent in the image as well as to increase the reliability of the interpretation. The analysis of enhanced image on original images gives us an idea about the composite enhancement algorithm and their difference on original data and their relevance to extract the structural information.

The composite enhanced images are verified for their quality and histogram based on perfect image in each three sets . This methodology is well suited for many applications. Four various type images are used for enhancement purpose. These images result shows by composite histogram equalization method that shows are promising and composite histogram equalization method open a new perspective for contrast quality in different imaging applications. Composite histogram equalization method is tested and comparison is shown to justify the quality of different images with gray level .



## REFERENCES

- [1] Rafael C. Gonzalez, Richard E. Woods: digital image processing. Prentice Hall; 2002
- [2] S.E. Umbaugh, Computer Vision and Image Processing, Prentice Hall, New Jersey, 1998, p. 209.
- [3] [1] Rafael C. Gonzalez, Richard E. Woods: digital image processing. Prentice Hall; 2002
- [4] Chao Wang and Zhongfu Ye "Brightness Preserving Histogram Equalization with Maximum Entropy: A Variational Perspective" IEEE Transactions on Consumer Electronics, Vol. 51, No. 4, 1326-2005
- [5] K. Elissa, "Title of paper if known," unpubli Soong-Der Chen Abd. Rahman Ramli "Preserving brightness in histogram equalization based contrast enhancement techniques" Elsevier Digital Signal Processing 14 (2006) 413-428.
- [6] K.S. Sim, C.P. Tso, Y.Y. Tan "Tan Recursive sub-image histogram equalization applied to gray scale images" SCI Elsevier Pattern Recognition Letters 28 (2007) 1209-1221
- [7] Youlian Zhu, Cheng Huangin "An Adaptive Histogram Equalization Algorithm on the Image Gray Level Mapping" sci verse science direct International Conference on Solid State Devices and Materials Science Physics Procedia 25 (2009) 601 - 608
- [8] Jaspreet Kaur, Amita Choudhary International Journal of Engineering and Innovative Technology (IJEIT), July 2010 ISSN: 2277-3754
- [9] M. Sundarama, K. Ramaraj, N. Arumugama, G. Prabina "Histogram Modified Local Contrast Enhancement for mammogram images" Elsevier Applied Soft Computing 11 (2011) 5809-5816
- [10] Yu-Ren Lai Kuo-Liang Chung, Chyou-Hwa Chen, Guei-Yin Lin, Chao-Hsin Wang "Novel mean-shift based histogram equalization using textured regions" sci verse sciencedirect Expert Systems with Applications 39 (2012) 2750-2758