IJIREEICE

ISSN (Online) 2321 – 2004
ISSN (Print) 2321 – 5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

ISO 3297:2007 Certified

Vol. 5, Issue 2, February 2017

Enhancing Contrast of Image by Filtering and Brightness Preserving Algorithm

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Abstract: Visualisation of an image is an important parameter in the area of image processing. To obtain the better visualisation contrast enhancement is one of the important techniques. Contrast of an image is easily upgraded by maximize the difference between the adjacent pixel values, that can be obtained by the traditional technique histogram equalisation but in that some disadvantages like noise amplification, over and under enhancement may be present in that technique because of the uniform histogram in an output image. In order to minimise the presence of noise in an output image our proposed technique uses filtering operation before the enhancement process so the final image will have better visual quality with minimum brightness error value.

Keywords: Contrast Enhancement, Uniform Histogram Equalisation, Filtering Operation, Noise.

I. INTRODUCTION

Contrast enhancement can obtain by either direct or indirect enhancement technique. Direct enhancement is the process of modifying the histogram of an original image [1] on the other hand indirect enhancement is obtained by the modification in an image through transformation [2] of an original image from one domain to the another domain that is from spatial to frequency domain by the transformation techniques like Fourier or wavelet transformation techniques.

In the case of direct enhancement method histogram modification plays an important role [3]. Histogram modification can be performed by remapping the original image pixel values in to some other pixel values by performing some operations. [4]

In an indirect enhancement method the original image can be divided in to various frequency bands then that frequency bands can be processed using some algorithm which makes the better enhancement [5].

II. PREVIOUS WORK

This part describes previous algorithms and methods for contrast enhancement in the literature

A. Histogram Equalisation (HE)
Histogram equalization is the direct enhancement technique. That can be obtained by calculating the histogram of an original image [6], and the cumulative function of the histogram calculation it is use full for remapping of original pixel values in to the some other pixel value to obtain the uniform histogram at the output image, but output image is having the noise amplification and higher brightness error values because of over and under enhancement of this algorithm [7].

B. Brightness Preserving Bi-Histogram Equalization (BBHE)
BBHE sub divide the original image histogram in to two different histograms with the reference of the mean value of an original image. Then the sub divided image histograms are equalized separately by histogram equalization [8]. The following steps to be performed to obtain Brightness preserving Bi-Histogram Equalization (BBHE).

Step 1: Mean Computation: Mean value of the input image (x_m) is computed

STEP 2: Bi-Histogram Formation: From the mean value the input image histogram is decayed in to two sub image histogram x_a and x_b is represented by,
$x_a = \{x(i,j) | x(i,j) \leq x_m\}$
$x_b = \{x(i,j) | x(i,j) > x_m\}$
Where x is input image $x = x_a \cup x_b$, x_a and x_b are the sub image histogram.

STEP 3: Histogram Equalisation of Sub Images: Histogram equalisation of sub images is performed as same as the Traditional histogram equalisation [10].

C. Dualistic Sub-Image Histogram Equalization
The same steps are followed to obtain the DSIHE instead of mean value the median value is used to subdivide the input image histogram [9].

D. Gamma Correction (GC)
A gamma correction technique changes the pixel values of an image by varying the exponential value (i.e) gamma [10]. The gamma correction is obtained by,

$$T(k) = k_{max} \times \left(\frac{k}{k_{max}}\right)^{\gamma} \quad (1)$$

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The contrast of an image is improving in a better way but the enhancement is not depends on the input pixel values it enhances the image in a similar way[19].

III. PROPOSED ALGORITHM

The proposed algorithm is using the pre-processing technique by adding the filter also. The algorithm is as follows,

Step 1: Image Acquisition

Step 2: filtering

The original image is undergoes the filtering operation for removal of noise presence in an input image due the natural defects like lack of light, noise in image capturing device. In our method median filter is used because of maintain the originality of an input image after enhancement also it performs the filtering operation by using the adjacent image pixel values

Step 3: BBHE of filtered image

The filtered image is enhanced by BBHE technique

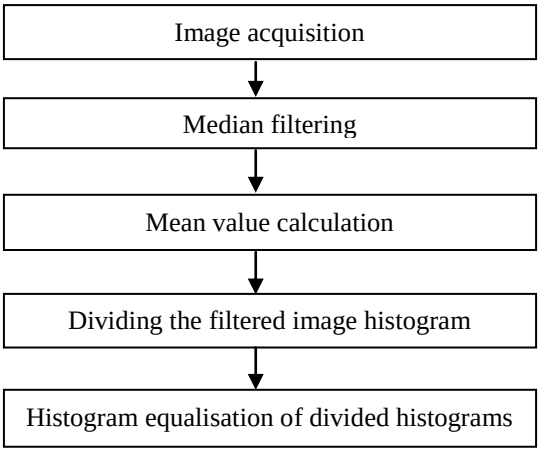
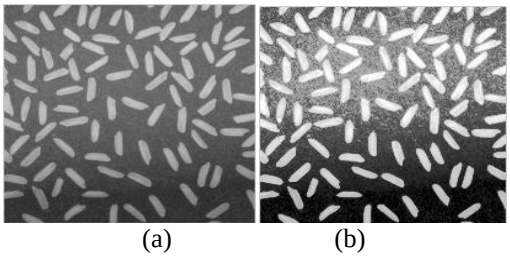


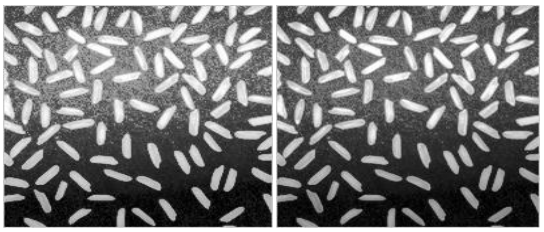
Fig. 1. Proposed algorithm steps

IV. RESULT AND DISCUSSION

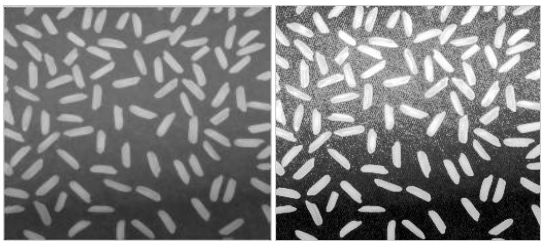
The proposed algorithm is analysed and implemented using MATLAB2013a.The proposed algorithm is compared with Histogram Equalisation (HE), Gamma Correction (GC), Brightness Preserving Bi-Histogram Equalisation (BBHE), Dualistic Sub-Image Histogram Equalisation (DSIHE).when compared with brightness preserving algorithm proposed algorithm is having minimum MSE value and the output image having improved visual quality than the BBHE algorithm.



(a) (b)



(c) (d)



(e) (f)

Fig. 2 .Simulation results of HE, GC, BBHE, DSIHE, AGC and LL band AGC algorithms (a)Original image (b) Histogram Equalised image (c)Brightness Preserving Bi-Histogram Equalised image (d)Dualistic Sub-Image Histogram Equalisation (e) Gamma Corrected image (f) Proposed image.

TABLE 1 Peak Signal to Noise Ratio (PSNR) For HE, BBHE, DSIHE, GC and proposed algorithms

ENHANCEMENT METHODS	PSNR (dB)
Histogram Equalisation	16.19
Brightness Preserving Bi-Histogram Equalisation	17.28
Dualistic Sub-Image Histogram Equalisation	18.24
Gamma Correction	16.17
Propded algorithm	38.92

TABLE 2 Mean Square Error (MSE) For HE, BBHE, DSIHE, GC and Proposed agorithm

ENHANCEMENT METHODS	MSE
HistogramEqualisation	16.17
Brightness Preserving Bi-Histogram Equalisation	9.98
Dualistic Sub-Image Histogram Equalisation	5.74
Gamma Correction	7.08
Proposed algorithm	4.78

V. CONCLUSION

In this project, the enhancement of an image is obtained by Brightness Preserving Bi-Histogram Equalization method followed by filtering of original image. The proposed method produces better visual quality as well as good performance in terms of MSE and PSNR values. The proposed method can be extended by varying the filter

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types for removal of noise also it can be applied for color images also.

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