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Image Enhancement Using Modified Exposure Based Histogram

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Abstract: This paper addresses the contrast enhancement of low gray scale images by implementing the Histogram Equalization method using Exposure value. The Exposure value of an image is calculated using the maximum intensity present in the histogram and the image gets divided into sub-images using exposure value. The enhancement rate of the image is controlled by performing histogram clipping. The individual histogram of sub images is equalized independently by using equalization based on exposure and integrated into one image for analysis. The proposed method results in a better contrast enhancement of gray scale images as well as for color images and improves image quality, entropy preservation.

Keywords: Image Enhancement, Image Segmentation, Image Exposure, Histogram, Histogram clipping.

1. INTRODUCTION

Now-a-days, Image enhancement methods have picked up consideration of analysts. Picture upgrade enhances the presence of picture and improves the better subtle elements of picture having low luminance. Image enhancement gives the picture great quality furthermore fineness. These enhancement procedures can be extensively isolated into two classifications: 1. Transform domain and 2.Spatial domain.

Transform domain includes in systems working on recurrence change of a picture. Spatial domain procedures, for example, contrast improvement work specifically on the pixel level of the picture. Histogram Equalization (HE) is most widely used contrast enhancement procedure because of its straightforwardness and simplicity of execution. Histogram equalization out levels the thickness appropriation and extends the dynamic scope of dark levels to enhance the general difference of the picture. HE uses the cumulative density function (CDF) of picture for change of the dark levels of unique picture to levels of enhanced picture.

The HE tends to change the mean shine of the picture to the center level of the dynamic extent and this outcomes in irritating relics and force immersion impacts. This drawback makes HE system inadmissible for the vast majority of customer hardware applications, for example, TV and Cameras. Different strategies have been proposed in the writing to beat the aforementioned deficiencies. Kim was the first to propose Brightness preserving bi histogram equalization (BBHE) for saving the mean shine of picture while enhancing the difference. BBHE isolates the histogram into two sections in view of the information mean shine and evens out the two sub histograms freely.

Dualistic sub image histogram equalization (DSIHE) strategy asserted that it is superior to anything BBHE regarding safeguarding of shine and normal data content (entropy) of a picture. DSIHE separates the histogram into two sub histograms containing level with number of bins and the division depends on median worth rather than mean brightness. Chen and Ramli presented minimum mean brightness error bi histogram equalization (MMBEBHE) for protecting the mean brightness ideally. This strategy is a change on BBHE, which ascertains indisputably the absolute mean brightness error (AMBE) for gray levels 0 to L_1 and divides the histogram taking into account the power esteem XT, which yields least AMBE.

Chen and Ramli proposed another methodology named recursive mean-separate histogram equalization (RMSHE). This strategy recursively plays out the BBHE in which the histogram is isolated into two sections on the basis of normal info shine and BBHE is performed to every sub histogram autonomously.

Sim et al acquainted a comparable method with RMSHE known as recursive sub-image histogram equalization (RSIHE). This calculation plays out the division of histogram in light of median estimation of brightness rather than mean brightness. Finding the ideal estimation of iteration element is a major test for delivering huge enhancement results in RMSHE and RSIHE techniques. These above methods don't provide mechanism to modifying the level of improvement. New class of strategies are taking into account of clipping for controlling the enhancement rate and in addition safeguarding the original brightness. These strategies

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control most extreme estimation of histogram by clipping histograms higher than the pre determined . These techniques give diverse way to deal with the determination of clipping edge. Although different systems are accessible to provide particular issue of differentiation improvement, enhancement for low presentation pictures is still less explored area.

Exposure based Sub-Image Histogram Equalization is exceptionally compelling for low exposure dark scale images and preserves entropy alongside control on enhancement rate. The proposed exposure strategy system that accomplishes the various destinations of entropy augmentation and control on over enhancement is a superior way to deal with picture improvement particularly for under exposure pictures.

The proposed method assigns the L value as the maximum intensity level present in the image instead of taking L as 255. This method leads to sharp and exact histogram equalization by reducing the time complexity and entropy. This method is adaptable for any image either gray scale images or color images.

2. EXPOSURE BASED SUB IMAGE HISTOGRAM EQUALIZATION

Poor complexity pictures don't possess complete element range. Pictures having histogram bins concentrated toward a lower part or the darker gray levels have low intensity exposure though pictures having histogram bins concentrated toward a higher part or the brighter part have high intensity exposure. Pictures can be extensively named under exposed and over exposed taking into account of intensity exposure.

2.1. Exposure threshold computation:

A parameter named as exposure threshold is characterized which indicates the measure of force presentation of the picture. This parameter is being utilized to isolate the picture in under exposed and over exposed sub pictures .The standardized scope of presentation worth is 0_1. In the event that the estimation of exposure for a specific picture is more than 0.5 and inclines toward 1, it implies that the picture has larger part of overexposed region and on the off chance that this worth is under 0.5 and inclining toward 0 then picture is containing majority of underexposed regions. In both cases picture contains poor complexity and requires contrast improvement.

The Exposure value of an image can be calculated as:

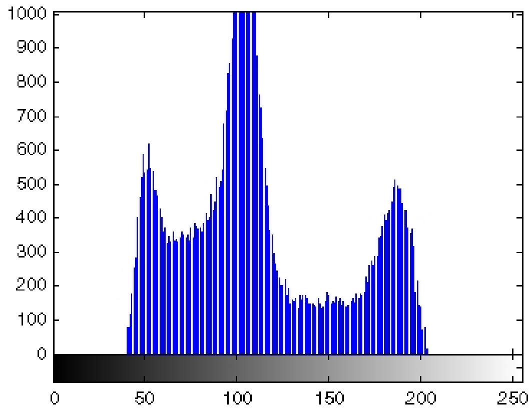
$$\text{Exp}=\frac{\sum(h*x)}{(\sum(h)/(L))}$$

Where h is the histogram of image and L is the maximum intensity level of image.A parameter Xa is calculated as it provides the exact gray level that isolates the picture as under exposed and over exposed sub images.

a=(1-Exp)

Xa=round(L*a)

This parameter accomplishes an estimation of more prominent or lesser than L/2 (dark level) for exposure esteem lesser or more noteworthy than 0.5 separately for a picture having a dynamic reach 0 to L.



2.2. Histogram clipping:

The thought behind histogram clipping is to forestall over enhancement prompting normal appearance of picture. For constraining the improvement rate, we have to restrict the primary subsidiary of histogram or the histogram itself. The histogram bins having the worth more noteworthy than the clipping threshold are restricted to the edge (Fig. 1). The clipping limit is figured as a normal number of gray level events.

The equation used to calculate the clipping threshold is as follows

$$\text{Tc}=\frac{1}{L}\sum_{k=L}^{1}(h)$$

hc=Tc for h>Tc

hc(i)=h(i) for h(i)==0

Here h and hc represents the original and clipped histograms of image. This method gives efficiency in computation and acquires less time.

2.3. Histogram Sub Division and Equalization:

The histogram of the original image is isolated depend upon exposure threshold value Xa which results in two sub images ranging from gray level 0 to Xa and Xa+1 to L-1 and can be termed as under exposed and over exposed sub images.cdf_l and cdf_u are corresponding CDF of sub images.hence can be calculated as follows:

cdf_l =zeros(1,Xa)

cdf_u=zeros(1,(L -(Xa+1)))

$$\text{total\_l} = \sum_{Xa}^{1}(hc)$$

$$\text{total\_u} = \sum_{L}^{xa+1}(hc)$$

Here total_l and total_u are the corresponding total number of pixels in sub images respectively .whereas

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pdf_l and pdf_u are the corresponding PDF of these sub images.

$$\text{Pdf\_l} = \frac{\sum_{xa}^{1}(hc)}{total\ \_l}$$

$$\text{pdf\_u} = \frac{\sum_{L}^{Xa+1}(hc)}{total\ \_u}$$

The equations of transfer functions for histogram equalization are as follows:

cdf_l(k)=pdf_l(k)+cdf_l(k-1)
for k=2:length(pdf_l)

cdf_u(k)=pdf_u(k)+cdf_u(k-1)
for k=2:(length(pdf_u))

f= xa*cdf_l(img(i,j)+1) for img(i,j)<xa
else

f=(xa+1)+(L-xa)*cdf_u((img(i,j)-(xa+1))+1)
for img>xa

here f represents the final output that gives the result.

2.4. Algorithm of proposed exposure based method:
Step 1: Compute the histogram h(k) of image.
Step 2: Compute the value of exposure and threshold parameter Xa.
Step 3: Compute the clipping threshold Tc and clip the histogram hc(k).
Step 4: clipped histogram is divided into two parts based using the threshold parameter Xa.
Step 5: Apply the histogram equalization on individual sub histograms.
Step 6: Combine the sub images into one image for analysis.

3. RESULTS AND DISCUSSION

In this section, the results of the proposed method are compared with existing histogram equalization based methods:

Example1:

(a) (b)

Fig 1: Exposure based image enhancement
(a) Original Image , (b) ESIHE Image

Example2:

(a) (b)

Fig 2: For a low contrast color image
(a)Original Image , (b)ESIHE Image

3.1. Assessment of visual quality Qualitative assessment of contrast enhancement:
It is fundamental alongside quantitative evaluation. The upgrade results must be acknowledged if the resultant picture gives satisfying impact in appearance. By Visual Quality assessment the judgment of annoying artifacts, over upgrade and unnatural improvement should be possible. The visual assessment results are successful quality measures to judge the execution of differentiation upgrade calculation. Wide assortments of standard pictures running from under exposed to over exposed low differentiation to high difference, dull back ground to splendid background, are tried to check the power and flexibility of the proposed strategy. The analysis of visual results demonstrates the amazingness of proposed technique in every one of the pictures as far as contrast enhancement and control on over enhancement. The solid results as far as contrast enhancement can be clearly watched. However picture gives control on over enhancement prompting great contrast enhancement results. The first Fish picture is a low exposed picture despite the fact that proposed introduction based strategy has enhanced the nature of picture highly demonstrates that the proposed presentation based technique produces pictures with lavishness of points of interest.

3.2. Summary of assessment and discussion:
After visual examination and appraisal of entropy measures it can be reasoned that:

(i) Proposed exposure based strategy is appropriate for under exposed pictures in correlation with different strategies.
(ii) Proposed exposure based strategy procedure is the best among different techniques in wording of extravagance of points of interest i.e. gives most astounding entropy.
(iii) Proposed exposure based strategy produces pictures with great contrast enhancement and control on over enhancement.
The goal of this paper is to expand entropy, improve underexposed pictures and control the over upgrade. Bisecting the picture on the premise of a parameter identified with introduction esteem.

The integral variable for division of picture relies on upon presentation quality and it have values more prominent then L/2 gray level for under exposed pictures (introduction esteem under 0.5) and makes up for low introduction by presenting higher gray levels in sub picture so that after individual histogram adjustment prepare the general presentation esteem increments. The opposite is valid for the over exposed pictures where the sub division of pictures is done on thegray level lesser than L/2 gray level. Over enhancement can be controlled by histogram clipping methodology by confining the enhancement rate. The blend of all aforementioned procedure termed as proposed introduction based technique meets the goal of the paper and delivers pictures which are quantitatively better as well as better as far as quality in contrast with other routine HE strategies.

4. CONCLUSION

This paper proposes another technique for sub division of picture taking into account presentation parameter. Isolating picture and histogram equalizing out of sub pictures utilizing Exposure based strategy demonstrated extremely viable procedure for upgrading under exposed pictures. The histogram clipping procedure is likewise consolidated with histogram leveling to give control on over improvement that prompts normal contrast. The entropy measures of the proposed presentation based technique obviously demonstrate that it beats other HE based strategies. The Visual nature of pictures demonstrates the subjective execution and the power of the technique and matchless quality on different strategies for a wide assortment of pictures. The strategy can be utilized to picture where there is a need to uncover the presentation esteem.

REFERENCES

[1]. Singh K, Kapoor R. Image enhancement using exposure based sub image histogram equalization. Pattern Recognition Letters. 2014 Jan 15;36:10-4.
[2]. Kim YT. Contrast enhancement using brightness preserving bi-histogram equalization. IEEE transactions on Consumer Electronics. 1997 Feb;43(1):1-8.
[3], Stark JA. Adaptive image contrast enhancement using generalizations of histogram equalization. IEEE Transactions on image processing. 2000 May;9(5):889-96.
[4]. Chen SD, Ramli AR. Contrast enhancement using recursive mean-separate histogram equalization for scalable brightness preservation. IEEE Transactions on Consumer Electronics. 2003 Nov;49(4):1301-9.
[5]. Abdullah-Al-Wadud M, Kabir MH, Dewan MA, Chae O. A dynamic histogram equalization for image contrast enhancement. IEEE Transactions on Consumer Electronics. 2007 May;53(2):593-600.
[6]. Ibrahim H, Kong NS. Brightness preserving dynamic histogram equalization for image contrast enhancement. IEEE Transactions on Consumer Electronics. 2007 Nov;53(4):1752-8.
[7]. Bassiou N, Kotropoulos C. Color image histogram equalization by absolute discounting back-off. Computer Vision and Image Understanding. 2007 Aug 31;107(1):108-22.
[8]. Cheng HD, Shi XJ. A simple and effective histogram equalization approach to image enhancement. Digital signal processing. 2004 Mar 31;14(2):158-70.
[9]. Pizer SM, Amburn EP, Austin JD, Cromartie R, Geselowitz A, Greer T, ter Haar Romeny B, Zimmerman JB, Zuiderveld K. Adaptive histogram equalization and its variations. Computer vision, graphics, and image processing. 1987 Sep 30;39(3):355-68.
[10]. Zuiderveld K. Contrast limited adaptive histogram equalization. InGraphics gems IV 1994 Aug 1 (pp. 474-485). Academic Press Professional, Inc..
[11]. Kim JY, Kim LS, Hwang SH. An advanced contrast enhancement using partially overlapped sub-block histogram equalization. IEEE transactions on circuits and systems for video technology. 2001 Apr;11(4):475-84.
[12]. Kim TK, Paik JK, Kang BS. Contrast enhancement system using spatially adaptive histogram equalization with temporal filtering. IEEE Transactions on Consumer Electronics. 1998 Feb 1;44(1):82-7.