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Advanced Panel Splitting for Non-Uniform Illumination Images by using Transformation Technique

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***Abstract*—Image enhancement is an important tool for processing image. There exits many enhancement algorithms, in which Retinex algorithm enhance details of an image and is widely used. Retinex algorithm can remove illumination but cannot maintain the range of reflectance, hence it is not essential for non-uniform illumination images. So to preserve naturalness along with enhancing the details we propose an algorithm named naturalness preserved enhancement panel splitting algorithm. This paper mainly contributes three main issues. First, splitting a non-uniform illumination image into three coloured panels. Secondly, decomposing each and every image in the panel for brightness. Third, applying a bilog transformation to have a balance between the details and naturalness of an image. Experimental results for the proposed algorithm gives more enhanced naturalness preserved image.**

***Index Terms*—FFT-transformation, NTSC, Restoration factor, Bi-log transformation, synthesis, MSR.**

I. INTRODUCTION

The main objective of enhancing an image is to process an image so that the resulting output is more suitable for the specific application. There exists many algorithms for enhancing an image such as Retinex algorithm, the unsharped masking algorithm, histogram equalization (HE) algorithm. Many of these algorithms concentrate on details enhancing, but the naturality cannot be preserved, so that there is a light source confusion, and in some other cases there is an attempt of over enhancement.

Retinex theory assume that the colour sensations is having a strong correlation with reflectance. Most of the Retinex algorithms extract the reflectance and remove the illumination as a result image. But it is not possible to exactly remove the illumination for unsmooth depth of an image. And the reflectance should be with in 0 and 1.

The algorithms based on unsharped masking decompose an image into two terms which are high frequency and low frequency components. In these algorithms it is useful to restrain over enhancement by taking low frequency information into account.

However these unsharped masking algorithms integrate the high and low frequency information in which there is no balance between details and naturalness of an image. These algorithms need a rescaling process which is performed carefully for an image to get the good result.

HE algorithm result in over enhancement, and many algorithms with many restrictions for brightness preservation and contrast limitation have been proposed. But brightness preservation leads to get a disadvantage in detail enhancement in dark areas.

Naturalness preserved image enhancement for non-uniform illumination images result in more enhanced image but it cannot be implemented in video's and for images it can't consider high resolution with maximum size. Panel splitting image enhancement for preservation of naturalness has been applied to varied areas of science and engineering, such as atmospheric sciences, astrophotography, biomedicine, computer vision, biometrics etc. The image Enhancement tries to improve the visibility of one component of an image, but this is usually at the expense of the rest of the image whose visibility decreases. For many applications (including this visual tagging project) that look for image enhancement this is not really a problem. Most techniques fall under the spatial domain of image processing.

The goals of image enhancement can be differently stated depending on the particular application. For natural color image, very often, human visual system gives the final evaluation of the processed image. There are two major problems should be solved for natural color image enhancement: 1) for more detailed texture, and 2) color and brightness of the processed splitted images are perceptually better.

II. EXISTING METHODOLOGIES

In this section we present the observation on various papers and its drawbacks. Histogram equalization (HE) [8] is one of the common methods used for improving contrast in digital images. However, this technique is not very well suited to be implemented in consumer electronics, such as television, because the method tends to introduce unnecessary visual deterioration such as the saturation effect. One of the solutions to overcome this weakness is by preserving the mean brightness of the input image inside the output image.

In most cases, BPDHE successfully enhance the image without severe side effects, and at the same time, maintain the mean input brightness. BPDHE preserves the intensity of the input image, it is disadvantageous to highlight the details in areas of low intensity. Brightness preserving histogram equalization (BPDHE) is not suitable for non-uniform illumination images. LHE method tries to eliminate the above problem. It makes use of the local information remarkably. However, LHE [5] demands high computational cost and sometimes causes over enhancement in some portion of the image. Nonetheless, these methods produce an undesirable checkerboard effects on the enhanced images.

The BBHE method decomposes the original image into two sub-images, by using the image mean gray level, and then applies the HE method on each of the sub images independently. At some extent BBHE preserves brightness of image; however generated image might not have a natural appearance. DSIHE is similar to BBHE but DSIHE [5] uses median value as separation intensity to divide the histogram into two sub-histogram. The algorithm enhances only the image visual information effectively, but does not preserve the details and naturalness. The essence of the named Brightness Preserving Histogram Equalization with Maximum Entropy (BPHEME) [3] tries to find the mean brightness is fixed, then transforms the original histogram to that target one using histogram specification. In the consumer electronics [4] such as TV, the preservation of brightness is highly demanded.

MMBEBHE is an an extension of the BBHE method. In MMBEBHE [5] the separation intensity is minimum mean brightness error between input image and output image Then Minimum Mean Brightness Error Bi-Histogram Equalization (MMBEBHE) is proposed to preserve the brightness optimally. RMSHE [9] is an iterative technique of BBHE, instead of decomposing the image only once, the RMSHE method proposes for performing image decomposition recursively, up to a scalar r, generating 2r sub-image. Actually, when r grows to infinite, the output histogram is exactly the input histogram, and thus the input image will be output without any enhancement at all.

Multi histogram equalization(MHE) techniques have been proposed to further improve the mean image brightness preserving capability. MHE proposed a technique for image enhancement based on curvelet transform [2] and perceptron network. In the process of calculating the pixel difference some values are rejected but these values are part of actual image data. Calculation of pixel differences is difficult, also time complexity of perceptron network.

The theory based on retinex and lightness decomposition [6] is also an image enhancement method .This enhances details and preserves the naturalness simultaneously. The naturalness of non-uniform illumination images cannot be effectively preserved. Also, proposed finds complexity in real-time applications. The naturalness preserved enhancement algorithm for non-uniform illumination images discusses the three major issues, namely, the naturalness preservation, the intensity decomposition, and the illumination effect were discussed. However this algorithm can only enhance and preserve the naturalness of an image, but the enhanced output seems to be an animated image.

III. OBSERVATION

In this section, we present the observation mainly on the details enhancement and naturalness preservation. In Retinex based algorithms an image is decompose into illumination and reflectance. Illumination represents naturalness and reflectance represent details of an image, but the resolution of an image is limited so there should be a balance between details of an different images.

Fig.1 represents an image processed by generalized unsharp masking(GUM) and single scale Retinex(SSR) where SSR simply removes the illumination with out considering reflectance range into account. The effect of illumination of ID signal is as shown in the fig. 2. In naturalness preserved enhancement algorithm the image is decomposed and then applied a bilog transformation as shown in fig: 3, but the basic disadvantage is during processing there is a missing of pixel details.

Fig. 1. (a) Original image. (b) Image processed by GUM with contrast_factor= 0.0005 and maximum_gain= 3. (c) Image processed by GUM with contrast_factor= 0.005 and maximum_gain= 3. (d) Image processed by SSR.

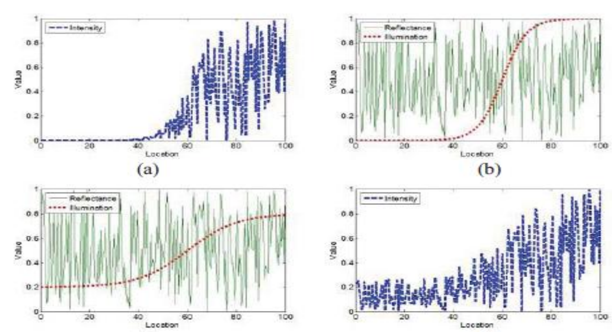


Fig. 2. 1D signal illustration. (a) Original intensity. (b) Reflectance and illumination
decomposed from (a). (c) Reflectance and compressed illumination of (b). (d) Product of the reflectance and illumination in (c).

As shown in figure.4 an image can be decomposed into different frequency domains. For example, the FFT transform, the curvelet based algorithms etc., then these zero frequency term is shifted to center of the spectrum which means after applying FFT transform the adjacent pixel of each colored image in each panel is substituted in an zero matrix having size same as the colored image. For this image then apply bi-log transformation and then add an restoration factor then synthesis this image to get an enhanced image as a result for an non-uniform illuminated image which is taken as input.

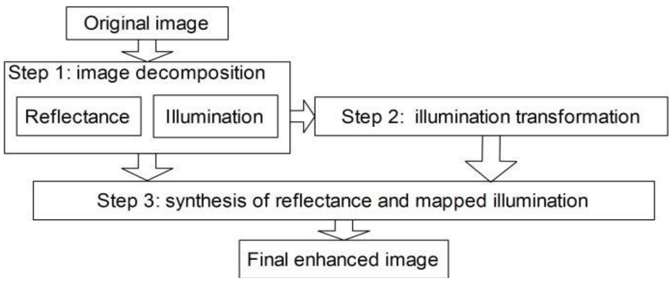


Fig.3 flowchart for naturalness preserved enhancement algorithm

Therefore in the proposed algorithm it aims to maintain the image clarity with better resolution than the naturalness preserved enhancement algorithm taking bi-log transformation into account

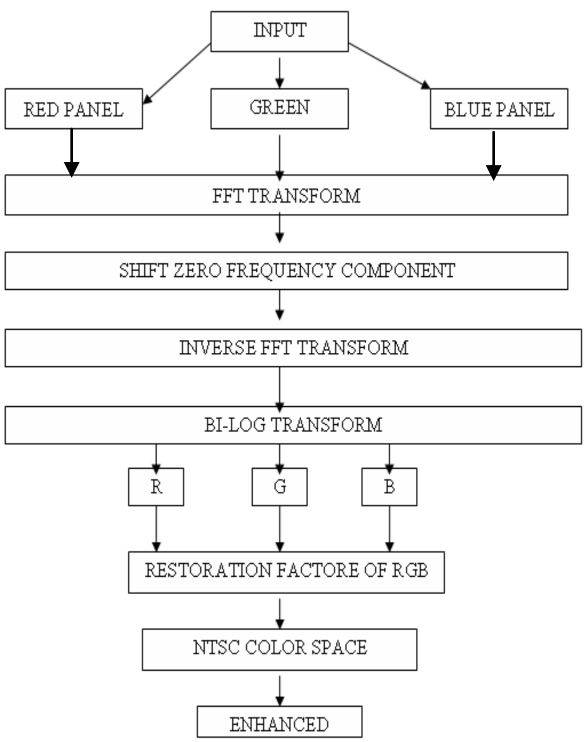
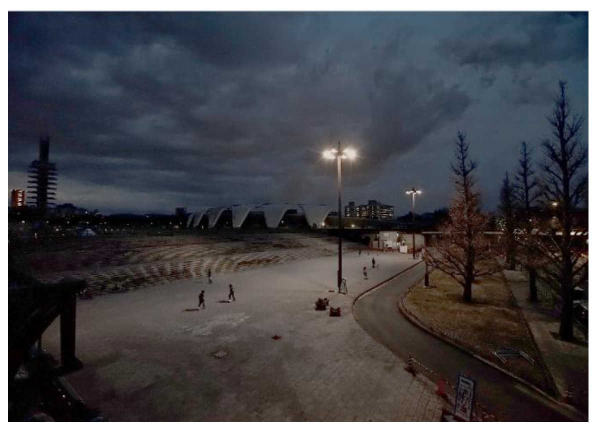


Fig.4. flowchart for proposed algorithm

(a)original image

(b) bi-log transformed image



(c) Image enhancement

In this section, we present the details of panel splitted proposed algorithm which explains mainly three parts as shown in Fig. V. firstly, the original image is decomposed by means of FFT transform. secondly, the decomposed images is processed using bilog-transformation. finally, for that image restoration factor is applied and then enhanced image is obtained by synthesizing it.

A. Definition of FFT transform

Firstly, the original images are saved in database such that, the image is read by means of specific variables which is converted into unsigned integer and then it is again converted into double datatype and then the original image is splitted into panels whaich are red, green and blue respectively. For each and every panel an FFT transform is applied for which the values in spatial domain is converted into frequency domain.

r_fft1 = transform(r);

Where r_fft1 represents FFT transform of an red panel and similarly for green and blue panels. Generally, after applying an FFT transform for each and every panel an empty zero matrix of same size as original image is created and then the adjacent pixels of each panel is taken and replaced in zero matrix in same position as on original image. Similarly, for each panel it is necessary to replace and then apply an inverse transform to get illumination free image as a result.
Here (n,m) represents row and column of an pixel.

```
a1=r_fft1(1,1);
a2=r_fft1(1,m);
a3=r_fft1(n,1);
a4=r_fft1(n,m);
% Shift zero frequency component to center of spectrum
r_fft1=zeros(n,m);
r_fft1(1,1)=a1;
r_fft1(1,m)=a2;
r_fft1(n,1)=a3;
r_fft1(n,m)=a4;
r_fft = r_fft1;
```

IV. THE PROPOSED ALGORITHM

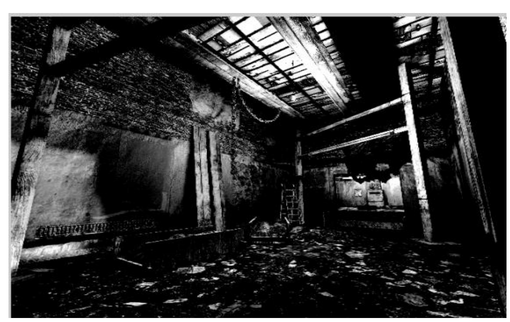
Image quality assessment is related to humanvision and therefore there is no prefect image enhancement exists for preserving naturalness.

(a)original image

(b) original red panel

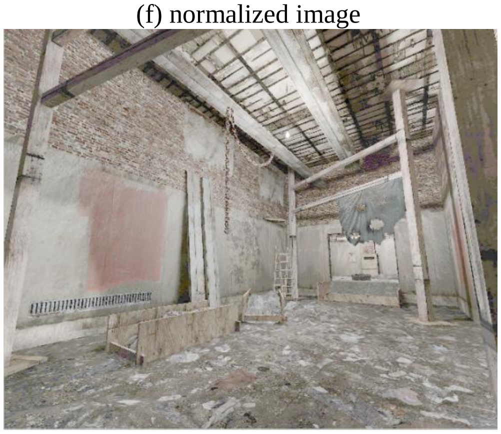
(c) original green panel

(d) original blue panel



(e) bi-log transformed image

(f) normalized image



(g) restored image

(h) Enhanced image

B. Bilog-transformation

In bilog-transformation after applying an inverse transformation to an image after doing FFT transform then logarithm is applied to inverse transformed image then difference of both the logarithmic of inverse image and original red panel image values is calculated to get the bilog-transformation of an original image which preserves the lightness and enhances the details and preserves the naturalness of an image respectively.

RInv=inverse_transform(r_fft);

Rabs=abs(RInv);
rlog=log(r);
Rablog=log(Rabs);
Rlog=rlog-Rablog;

Where RInv represents inverse transform of an image and SSA(Single scale retinex) and NPEA(naturalness preserved enhancement algorithm) respectively.

D. Synthesis of an image

As mentioned the sudden change in illumination is a disadvantage for details, but preserving naturalness it is necessary. We synthesize r(m.n).*G to get the final enhanced image.

MSRCR1(:,:,1)=mat2gray(G.*(cired.*(R(:,:,1)))+bvalue);

Where MSR represents multiscale Retinex and G represents gamma value and bvalue represents beta value respectively.

Images	SSA	NEPA	ASPNPEA
Road	0.4211	0.4293	0.5176
Girl	0.5998	0.5784	0.6569
Bird	0.6543	0.6685	0.7011
Building	0.5532	0.4645	0.5295
Avg	2.284	2.207	2.551

V. EXPERIMENTS AND DISCUSSION

The proposed algorithm has been tested on our database of more than 200 images, and compared with many algorithms. The database consists of: 100 images captured using the digital camera, and 150 images downloaded from NASA and Google. All the images taken are having more illumination.

VI. CONCLUSION

This paper describes an algorithm of panel splitting naturalness preserved enhancement algorithm for non-uniform illumination images, which enhances both details and preserves naturalness. Experimental results demonstrate the images enhanced by he proposed algorithm is perceptually better when compared to remaining algorithms. This algorithm can also be implemented in flickering videos in which we cannot take any type of videos respectively. This will be our future work.

REFERENCE'S

[1]. Shuhang Wang, Jin Zheng, Hai-Miao Hu, and Bo Li , ,‖ in Proc. IEEE 2013 ―Naturalness Preserved Enhancement Algorithm for Non-Uniform Illumination Images‖.

[2]. R. C. Gonzalez, R. E. Woods, and S. L. Eddins, Digital Image Processing. Upper Saddle River, NJ, USA: Prentice-Hall, 2004.

[3]. H. K. Sawant and M. Deore, ―A comprehensive review of image enhancement techniques,‖ Int. J. Comput. Technol. Electron. Eng., vol. 1,pp. 39–44, Mar. 2010.

[4]. J. C. Caicedo, A. Kapoor, and S. B. Kang, Collaborative personalization of image enhancement,‖ in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2011, pp. 249–256.

[5]. D. J. Jobson, Z. Rahman, and G. A. Woodell, ―Properties and performance of a center/surround retinex,‖ IEEE Trans. Image Process., vol. 6, no. 3, pp. 451–462, Mar. 1996.

[6]. Z. Rahman, D. J. Jobson, and G. A. Woodell, ―Multi-scale retinex for color image enhancement,‖ in Proc. Int. Conf. Image Process., Sep. 1996, pp. 1003–1006.

[7]. D. J. Jobson, Z. Rahman, and G. A. Woodell, ―A multi-scale retinex for bridging the gap between color images and the human observation of scenes,‖ IEEE Trans. Image Process., vol. 6, no. 7, pp. 965–976, Jul. 1997.

[8]. G. Deng, ―A generalized unsharp masking algorithm,‖ IEEE Trans. Image Process., vol. 20, no. 5, pp. 1249–1261, May 2011.

[9]. C. Wang and Z. Ye, ―Brightness preserving histogram equalization with maximum entropy: A variational perspective,‖ IEEE Trans. Consum. Electron., vol. 51, no. 4, pp. 1326–1334, Nov. 2005.