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Clipping Based Hue Preserving Color Image Enhancement using Integrated 2-Dimensional Filter

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Abstract: ***The images, received from Black Lightening and Night vision, might go through from negative best or inappropriate brightness. Therefore, Image enhancements play a pivotal position to improve the quality of the image. In this paper, the approach focal point on bettering the quality, normalize brightness, and enlarge contrast. An approach known as Clipping is used to separate the RGB pix into different block sizes n*n. The present strategies Guided filter based totally Sub Image Histogram Equalization (GSIHE) is used to amplify the visual quality, which is pursued with the aid of integrated 2–dimensional filter for enhance the excellent of the image. Simulation demonstrate that this proposed approach has higher contrast, Hue preservation, elevated Correlation Coefficient and Entropy, PSNR and reduced MSE.***

Keywords: Clipping method, Exposure, Integrated 2-dimensional filter, Guided Image filter, Power law

1. Introduction

If the pictures are caught in black lightning and night vision in our daily lives, then the objects are very dark as a consequence and the contrast in pictures will be very poor as well. The pictures need to be improved to enhance the visual quality.

From the previous researches discussed in literature there are some issues that has now not yet been resolved. The hassle that has been mentioned in Gaps from study so to take away these gaps an approach need to be designed which is environment friendly in enhancing the quality of the image.

In proposed strategy integrated filter has been applied altogether to the image so as to beautify the first-rate of the image. The integrated filters are explained as:

- H**omomorphic filter** It is primarily used to correct non-uniform frequency to enhance contrast in the picture. It is referred to as a frequency filtering technique. It concurrently normalizes the brightness of the photograph and enlarges contrast. To make clear of a picture more, the high-frequency ingredients are accelerated and low-frequency factors are reduced, so that the high-frequency issue is supposed to depict basically the reflectance in the image, the place the low-frequency factors are supposed to represent the illumination in the vision
- **Gaussians filtering** it is used for blur pix and eliminate noise. The Gaussian function is used in numerous research areas like as to define likelihood distribution for noise or data, to use in mathematics. It is a smoothing operator. The filter function is said to be the kernel of an integral transform. The Gaussian kernel is continuous. Most commonly, the discrete equivalent is the sampled Gaussian kernel that is produced by sampling points from the continuous Gaussian
- **Laplacianfilter:** The Laplacian is a 2-D isotropic measure of the 2nd spatial by-product of an image. The Laplacian of a photograph highlights regions of fast intensity change and is consequently frequently used for facet detection. The operator usually takes a single gray level picture as enter and produces every other gray level photograph as output. It is described as sharpening a picture's limits. As a consequence, it offers the image scaling to offer the photo enhancement the extended methods. By darkening the darker components, it makes limits clearer and brighter the lighter pixels. It creates a sharp picture.

Nitish Vig, Sumit Budhiraja [2] this paper deals with a GFSIHE (Guided filter Based Sub Image Histogram Equalization) which is mostly used to beautify distinction enhancement, brightness conservation, hue preservation, improved entropy. In this approach the exposure feature is used which analyze the underexposed and exceedingly underexposed image. The parameter called Histogram matching, which is used to beautify the brightness of the picture .The existing approach is Exposure Based Sub Image Histogram Equalization (ESIHE) which is typically two used to beautify the visible pleasant which is pursued by using the Guided filter. This new method had elevated contrast enhancement, Brightness and Hue conservation & accelerated entropy.

K. Singh, R. Kapoor[17] This paper deals with new strategy called Exposure based Sub-Image Histogram Equalization (ESIHE) method. It is utilized for contrast enhancement for low exposure grey scale image. In this exposure threshold is calculated to partition the initial photo into sub-images of one-of-a-kind intensity tiers rate. The precise histogram of replacement photographs is equalized one after the other and finally all sub snap shots are combined into one whole photo for study. The end result suggests that ESIHE is higher than different conventional Histogram Equalization (HE) methods in phrases of photograph visual quality, entropy conservation and multiplied contrast enhancement.

This paper is arranged as follows: Section II for previous work, III for proposed work, IV for Results and Discussion and conclusion is concluded in V.

2. Related Work

In this work exposure [2] has been used to divide the image between underexposed and overexposed images, which will

be enhanced using MHE and Power law respectively. Proposed approach uses a histogram matching to improve the brightness of the image for exceptionally underexposed region, intensity bins exist in darken place due to such picture are lacks in saturation and suffers from low intensity. Power law transformation [2] affords answer to this problem. It enhances the brightness so that we get the seen image. If the depth increases then saturation will routinely increases. To regulate this depth level histogram equalization can be used. For that reason histogram equalization [17] can be applied to sub images. In this cumulative density characteristic and probabilistic density characteristic has been applied so as to divide the photograph into sub images, while ESIHE[17] works on enhancing the contrast. In this exposure based sub histogram correction technique has been combined with guided filter. The guided filter [12] affords the edge smoothing and alluring visible content. The padding array is applied to produces edges and then window size is various to look at change in images. It improves the brightness of images, enhancement in Entropy and Correlation Coefficient and maintaining hue error so that we can meet the hue preserving condition

3. Integrated Filter Based on Clipping Method

In proposed approach Homomorphic filter, Gaussian filter and modified Laplacian filter has been applied altogether. Fig 1 shows the framework of modified work. Integrated filter **work is explained in following steps:**

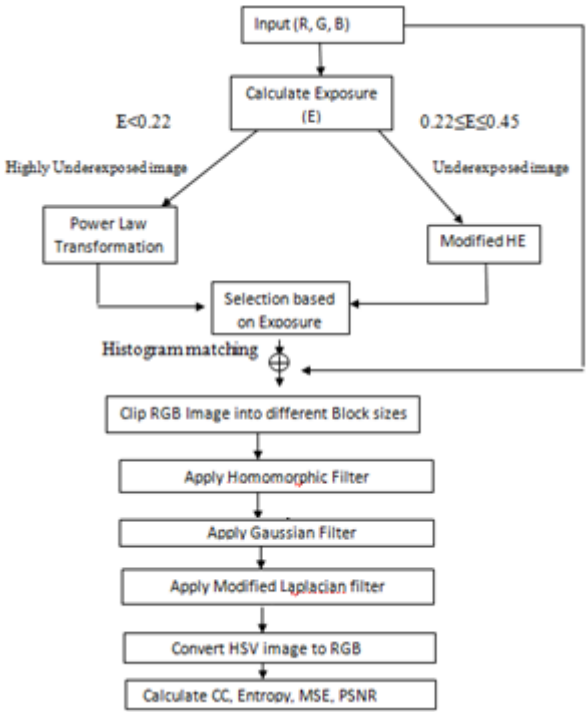


Figure 1: Block Diagram of Integrated Filter

A. Exposure Calculation

Exposure is defined as the measure of quantity of grey levels. The normalized range of exposure is between 0 and 1.

Exposure= $(\sum^{L}_{k=1}h(k).k)/Lx(\sum^{L}_{k=1}h(k))$

Where h(k) is histogram of image and L is total numbers of gray levels.

X_a=L(1-Exposure)

X_a .provides gray level boundary that divided the picture into underexposed and overexposed sub photos

B. Power Law Transformation

If Exposure < 0.22 then uses power law transformation otherwise Modified histogram equalization will be applied.

4. Results and Discussions

In this part immediately outcome obtained from the proposed methods, are in contrast with current approach GFSIHE In this part photographs are taken to evaluate the both method to improve higher result.

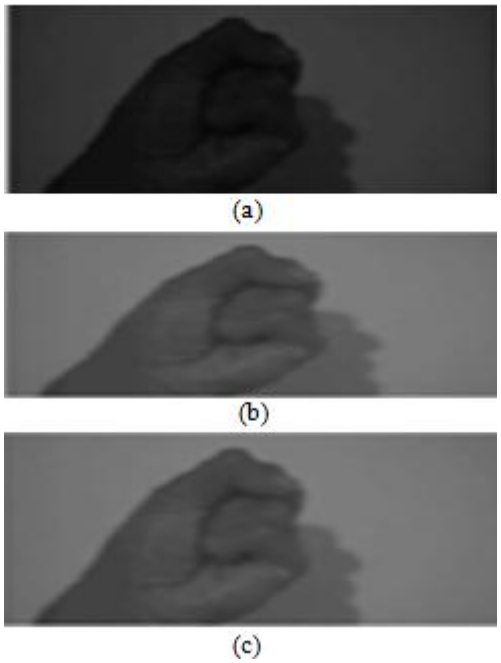


Figure 2: Results of Hand Picture (a) Original, (b) Combined images of all blocks (c) Modified Laplacian Filter

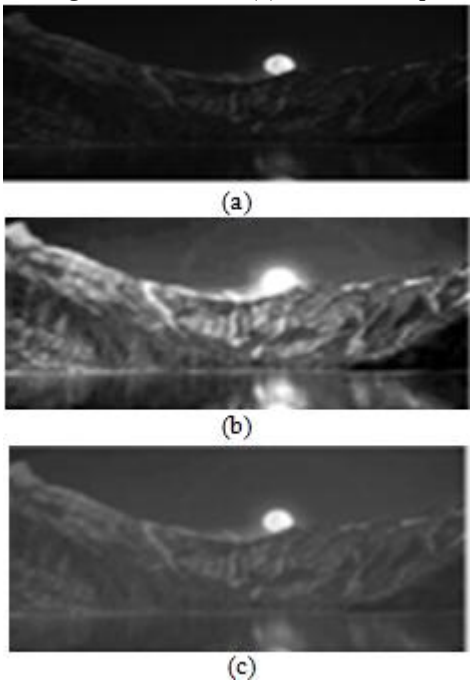


Figure 3: Results of Mountain Picture (a) Original (b) Combined images of all blocks (c) Modified Laplacian Filter

To analyze the performance of the new approach Entropy is used. Entropy is defined as to depict the `business' of a picture. For example the quantity of information which is required to be coded through a compression algorithm. A picture that is completely flat that has entropy zero so they should be compacted to a moderately small size. It is calculated by:

$$\text{Entropy}=\sum P_i log_2 p_i$$

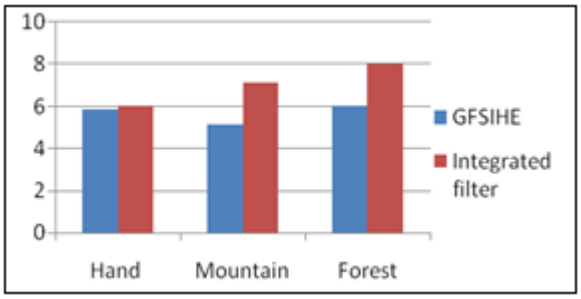
Where P_i is the probability density function of given intensity level i. The second parameter is Peak Signal to Noise Ratio.

PSNR is defined as for an efficient algorithm, PSNR should be large. It differs from 0 to 99. The method to compute PSNR is:

$$PSNR = 10log_{10}\left(\frac{255^2}{MSE}\right)$$

Table 1: Entropy in terms of different methods

Images	GFSIHE	Integrated filter
Hand	5.8438	6.02
Mountain	5.1646	7.1
Forest	6.0192	8.0

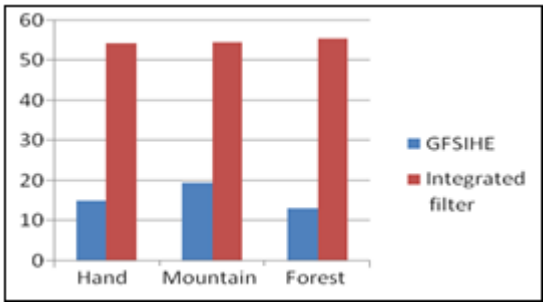


Graph 2: Comparison of entropy in terms of different methods

From table 1, 2 entropy, it can be concluded that the Integrated filter have highest value as compared to GFSIHE method.

Table 3: PSNR in terms of different methods

Images	GFSIHE	Integrated filter
Hand	14.9830	54.2226
Mountain	19.3463	54.6377
Forest	13.0353	55.4616



Graph 4: Comparison of PSNR in terms of different methods

From table 3, 4 PSNR, it can be concluded that the Integrated filter have highest value as compared to GFSIHE method.

5. Conclusions

The proposed strategies integrated filters concentrate on the trouble of the low exposure photographs in the RGB plane. This method used integrated filter like laplacian filter, homomorphic filter, Gaussian filter which is used to enhance the first-class of the image. Simulation indicates that we reap better effects as compared to current approach. The value of entropy and PSNR is more in forest picture at 8.0, 55.4616 is in integrated approach this leads to grant better contrast, preserving hue preservation.

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