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Review on Efficient Contrast Enhancement Technique for Low Illumination Color Images

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Abstract—: A digital color image, as its fundamental purpose requires, is to provide a perception of the scene to a human viewer or a computer for carrying out automation tasks such as object recognition. An image of high quality that could truly represent the captured object and the scene is hence in great demand.Contrast is an important factor in any subjective evaluation of image quality. It is the difference in visual properties that makes an object distinguishable from other object and background. On the contrary, the human visual perception is interested in hue (H), saturation (S) and intensity (I) attributes that are carried by the color image. Therefore, when the image has to be processed, most approaches convert the RGB space into some convenient working signal spaces that are close to human perceptions.

IndexTerms— *Contrast enhancement, RGB color space, HSV color space, DWT*

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I. INTRODUCTION

In this digital era, digital image processing plays an important role. The objective of image enhancement is to improve visual quality of image depending on the application circumstances. Contrast is an important factor for any individual estimation of image quality. It can be used as controlling tool for documenting and presenting information collection during examination. The contrast enhancement of image refers to the amount of color or gray differentiation that exists between various features in digital images. It is the range of the brightness present in the image. The images having a higher contrast level usually display a larger degree of color or gray scale difference as compared to lower contrast level. The contrast enhancement is a process that allows image features to show up more visibly by making best use of the color presented on the display devices. The contrast enhancement techniques are commonly used in various applications where subjective quality of image is very important [1].

To human viewers, sharp contrast of edges and subtle tone of smooth surfaces in an image are often interpreted as high perceptual quality. But various condition, such as foggy weather, poor illumination, low grade imaging sensor, etc., can make an acquired image look faded and blurry. However, it is not uncommon that raw image with
low perceptual contrast still contains information on the details of the captured scene. Therefore, since every early days of image processing many contrast enhancement techniques have been proposed and used., aiming to fully utilize the dynamic range of the raw sensor data and reproduce a visually more appealing and informative image [2].

Elementary enhancement techniques are mainly histogram based as they are simple, fast and produces acceptable results. Histogram modification basically modifies the histogram of an input image so as to improve the visual quality of the image. Histogram equalization is a process that attempts to spread out the gray levels in an image so that they are evenly distributed across their range. Normal histogram equalization usually leads to over enhanced output image with raised noise level [3].

Based on the camera and display design characteristics, most images are coded in terms of three primary color channels, i.e., signals are represented in the red-green-blue (RGB) color space. RGB is frequently used in most computer applications since no transform is required to display information on the screen. For this reason it is commonly the base colour space for most applications, but it is non-linear with our visual perception. Converting it in the other color space such as HSV (Hue, Saturation, Value) which is describes the model similarly to visual perception gives the benifts over RGB color model.

II. LITERATURE REVIEW

This paper proposed an efficient algorithm for contrast enhancement of natural images. The contrast of images is very important characteristics by which the quality

of images can be judged as good or poor. The proposed algorithm consists of two stages: In the first stage the poor quality of an image is processed by modified sigmoid function. In the second stage the output of the first stage is further processed by contrast limited adaptive histogram equalization to enhance contrast of images. In order to achieve better contrast enhancement of images, a novel mask based on input value together with the modified sigmoid formula that will be used as contrast enhancer in addition to contrast limited adaptive histogram equalization. This new contrast enhancement algorithm passes over the input image which operates on its pixels one by one in spatial domain. Simulation and experimental results on benchmark test images demonstrates that proposed algorithm provides better results as compared to other state-of-art contrast enhancement techniques. Proposed algorithm performs efficiently in different dark and bright images by adjusting their contrast very frequently. Proposed algorithm is very simple and efficient approach for contrast enhancement of image. This algorithm can be used in various applications where images are suffering from different contrast problems [1].

This paper makes a review on Histogram equalization, contrast stretching, Dualistic Sub-Image Histogram Equalization, Dynamic Histogram Equalization For Image Contrast Enhancement and Contrast Limited Adaptive Histogram Equalization (CLAHE) techniques, stating that a directly processing histograms to achieve contrast enhancement is an ill-rooted approach. Following are the problems associated with use of histogram equalization.

1. The Histogram Equalization method does not consider mean brightness of an image into account.
2. The HE method may result in over enhancement and saturation artifacts due to the stretching of the gray levels over the full gray level range.
3. With the help of Histogram equalization it is possible to change brightness of an image after the histogram equalization.
4. Nevertheless, HE is not commonly used in consumer electronics such as TV because it may significantly change the brightness of an input image and cause undesirable artifacts.
5. It can be observed that the mean brightness of the histogram-equalized image is always the middle gray level regardless of the input mean [2].

This paper proposed an efficient contrast enhancement algorithm using Gaussian mixture modeling (GMM) for modeling the image gray level distribution. This paper incorporates an enhancement criterion based on image equalization with improved threshold median filter which aims at enhancing the contrast along with suppression of impulse noise and preservation of edges .The proposed algorithm is adaptive and is free of parameter setting for a given dynamic range of the enhanced image. It contributes effective enhancement and is applicable to both gray scale and color images.

Algorithm goes by following steps

A .Filtering

B. GMM Modeling

C. Histogram Partitioning

D. Mapping

The proposed algorithm produces good contrast enhancement results by utilizing the concept of histogram equalization. This algorithm can be applied to both gray scale and color images [3].

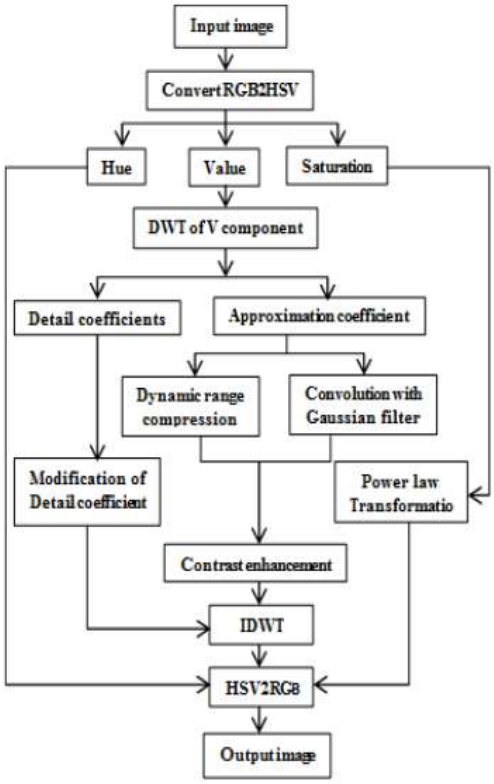
This paper presents a new method to enhance the non-uniformly illuminatedand low contrast images. This technique starts with the blurring of the input image.

This is because the purpose of introducing both enhancers into the proposed algorithm are to increase and decrease the intensity levels of low and high brightness areas, respectively. If the details of enhancer are not removed, then the details of the output image tends to be removed. The input image is divided into two regions: (1) bright region,(2) dark region. The image pixels with intensity level lower than the mean intensity level are considered as dark regions, while the pixels with intensity higher than mean intensity are considered as bright regions. The bright and dark enhancers shift the pixels but the mean pixels maintained as mean intensity value. Then dark ratio and bright ratio is used to limit level of enhancement of each image to prevent over enhancement and to preserve the naturalness of each image.

The proposed algorithm preserving the image details, considering that it enhances the given input image pixel by pixel by using the Bright enhancer and Dark enhancer The performance is compared with Histogram Equalization (HE), Contrast-Limited Adaptive Histogram Equalization (CLAHE) and Adjust Image Intensity Values (Imadjust) available in Matlab R2014a Image Processing Toolbox [4].

In this paper, a novel wavelet-based dynamic range compression algorithm is proposed to improve the visual quality of digital images captured under non-uniform illumination condition. In proposed method they first converted the RGB color space into HSV color space. Apply DWT on the value component of image. The approximation co-efficient obtained from the DWT are subjected to luminance enhancement using non-linear transfer function. Apply IDWT to get enhanced image. Then saturation component is enhanced simply by applying contrast stretching. The result in HSV is now converted back to the RGB color space.

Flowchart is as follows:



It says that the wavelet transform technique is used to reduce the dimension of the image such that the dynamic range compression with local contrast enhancement can be applied to only approximation coefficient of the image. The proposed method shows better results compare to the other methods and result shows by comparing the PSNR and entropy metrics[5].

In this paper "Brightness preserving weight clustering histogram equalization" (BPWCHE) is used.Intensity transformation function based on information extracted from image intensity histogram play a basic role in image processing, in areas such as enhancement. Histogram equalization (HE) is a conventional method for image contrast enhancement, it improves the contrast of image by changing the intensity level of the pixel based on the intensity distribution of the input image. However, Histogram equalization has some disadvantage. Therefore, "Brightness preserving weight clustering histogram equalization" (BPWCHE) showed that BPWCHE can preserve image brightness and enhance visualization of image more effectively than Histogram equalization method. BPWCHE assigns each non-zero bin of the original image histogram to a separate cluster, and computes each cluster's weight. Then, to reduce the number of clusters, use this criterion to merge pairs of neighboring clusters. The clusters acquire the same partitions as the resulting image histogram. Finally, transformation functions for each cluster's sub-histogram are calculated based on the traditional HE method in the new acquired partitions of the resulting image histogram, and the sub shistogram gray levels are mapped to the result image by the corresponding transformation functions showed that BPWCHE can preserve image brightness and enhance visualization of images more effectively than Histogram Equalization. There is a drawback of BPWCHE that it's visibility of images in underwater and satellite is poor, also light is strongly attenuated in water, produce images of low contrast [6].

This paper proposed a comparative analysis of contrast enhancement techniques such as contrast streching,histogram equalization and Contrast-limited adaptive histogram equalization applied on different types of gray images. Experimental result shows that Contrast-limited adaptive histogram equalization gives better result, and for some images contrast stretching gives better result. But in last concluded on bases of experimental results they states that Contrast-limited adaptive histogram equalization (CLAHE) gives better image quality as compare to other compared methods [7].

This paper presents a luminosity conserving and contrast enhancing histogram equalization method for color images. RGB color space is used for implementation details concerning the way RGB displays color. RGB image exists as 24-bits per pixel color coding, thus RGB color space does not have inherent relation to the natural color properties or human perception. Thus any inter-channel arithmetical operation is not applicable in RGB space. On the other hand, other color spaces such as LAB, YCbCr, YIQ and HSV are applicable.
The used approach is composed of five stages: smooth the histogram with Gaussian filter, fuzzy histogram computation, partitioning of the histogram, equalize each partition independently, and normalization of the image brightness. The process includes color space transform and inverse transform processes. The histogram equalization process is applied to pre-determined channels. Simulation results show that the HSV color space gives the best performance [8].

This paper proposes a contrast enhancement technique to enhance color images captured under poor illumination and varying environmental conditions. In this first RGB color space converted into HSV color space. DWT is applied to its saturation component. Use a derived mapping function to modify approximate coefficients. Reconstruct S using IDWT. Then enhance V component using CLAHE technique. Combine H, new S component, and V components to get the enhanced HSV image. Lastly image is converted back into the RGB color space and get the enhanced image in RGB space. Its performance is compared with HE and CLAHE techniques on the bases of AMBE, MSE and PSNR

parameters.The proposed method produces image with the lowest MSE,AMBE, and highest PSNR [9].

III. OVERALL ANALYSIS

Image enhancement is a processing on an image in order to make it more appropriate for certain applications. If the contrast of an image is highly concentrated on a specific range, the information may be lost in those areas which are excessively and uniformly concentrated. The problem is to optimize the contrast of an image in order to represent all the information in the input image. Contrast enhancement problem in digital images can be resolved using various methodologies, but Histogram Equalization (HE) technique is the widely used one due to its simplicity. But it has many flaws.

IV. CONCLUSION

Many algorithms for achieving contrast enhancement have been developed; among them is histogram equalization technique that is attractive due to its simplicity. Histogram equalization generates a grey map that changes the histogram of an image and redistributes all pixel values to be as close as possible to a user-specified desired histogram. An adaptation of histogram equalization is the contrast limited adaptive histogram equalization (CLAHE). CLAHE divides input image into a number of equal size blocks and then performs contrast limited histogram equalization on each block. The contrast limiting is done by clipping the histogram before histogram equalization. Other colour enhancement methods have been proposed based on histogram equalization, these also include multiscale approaches and other hue preservation contrast enhancement schemes. Earlier works have also shown that the performance of HSV colour space is good in colour improvement. Hue preservation methods keep the Hue constant to avoid the problem of colour shifting, while either only the Luminance (V) component or both Luminance (V) and Saturation (S) components are modified to make the image soft and vivid. Compared with other models such as CIE LUV colour space and CIE Lab colour space, it is easier to control the Hue component and still avoid colour shifting in the HSV colour space. Therefore, this work proposes a Hue preserving algorithm, which uses a derived mapping function to modify the saturation components, and CLAHE for Luminance components.

REFRENCES

[1] ShyamLal , Mahesh Chandra “Efficient Algorithm for Contrast Enhancement of Natural Images” The International Arab Journal of Information Technology, Vol. 11, No. 1, January 2014

[2] Ms. K.T.Chalekar, Prof T. Yengantiwar “Review Paper On Image Contrast Enhancement Techniques” International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 3 Issue 3, March 2014

[3] NiaAchuIssac, AnjalyViswan “An Efficient Contrast Enhancement Based On Image Equalization with Improved Threshold Median Filter” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Special Issue 1, December 2013

[4] Teck Long Kong, Nor Ashidi Mat Isa “Histogram Based Image Enhancement For Non-Uniformly Illuminated And Low Contrast Images” 978-1-4799-8389-6/15/$31.00_C 2015 IEEE

[5] Sunanda. S Alur and M. C Hanumantharaju “A Novel Approach Based On Wavelet and Non-Linear Transfer Function-Based Local Approach for Real Color Image Enhancement” 2012 International Conference on Computing Sciences 978-0-7695-4817-3/12 $26.00 © 2012 IEEE DOI 10.1109/ICCS.2012.2

[6] RituChauhan, Sarita Singh Bhadoria “An Improved Image Contrast Enhancement Based On Histogram Equalization And Brightness Preserving Weight Clustering Histogram Equalization”978-0-7695-4437-3/11 $26.00 © 2011 IEEE DOI 10.1109/CSNT.2011.128

[7] Dr Deepa Raj, MsPushpaMamoria “Comparative Analysis Of Contrast Enhancement Techniques On Different Images”978-1-4673-7910-6/15/$31.00 ©20 15 IEEE

[8] GwanggilJeon “Color Image Enhancement By Histogram Equalization In Heterogeneous Color Space” International Journal of Multimedia and Ubiquitous Engineering Vol.9,No.7(2014),pp.309-318

[9] Ojo J.A ,Solomon, I.D., Adeniran S.A. Department of Electronic and Electrical Engineering, LadokeAkintola University of Technology, “Contrast enhancement algorithm for color images,” in IEEE International Conference on Science & Information, 2015.