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ADAPTIVE HISTOGRAM EQUALIZATION TECHNIQUE FOR ENHANCEMENT OF COLOURED IMAGE QUALITY

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Abstract- Image Enhancement is one of the vital prerequisites in Digital Image Processing which is critical in making a picture helpful for different applications which can be found in the zones of Digital photography, Medicine, Geographic Information System, Industrial Inspection, Law Enforcement and number of more Digital Image Applications. Image Enhancement is utilized to enhance the nature of poor images. The focus of this paper is an attempt to improve the quality of digital images using Adaptive Histogram Equalization. In this paper we are applying Adaptive Histogram Equalization on color images.

Keywords – Histogram equalization, Image, MSE, PSNR.

I. INTRODUCTION

Histogram equalization [1] is one of the techniques used for image enhancement. In Histogram Equalization a data image is represented in a predetermined number of gray levels. While ascertaining the probability density function of the dark levels of the data image, for use in histogram equalization, the number of occurrences of each gray level is constrained not to exceed a predetermined value. Then histogram equalization is performed on the data image based on the determined probability density function. As a consequence, the mean brightness of the data image does not change altogether by the histogram equalization. Additionally, noise is prevented from being greatly intensified. They are fundamental, quick, and with them some adequate consequences for a few applications can be accomplished. In HE, the equalization method is done globally. Let us suppose the f(x, y) is a data image which is having discrete gray levels in the dynamic range of [0, L-1].
Nowadays digital cameras [1] are certainly the most used devices to capture images. They are all over the place, including cellular telephones, individual advanced associates (PDAs - a.k.a. pocket PCs or palmtop PCs), robots, and observation and home security frame functions. There is most likely the nature of the pictures acquired by advanced cameras, paying little mind to the connection in which they are used, has enhanced fundamentally since early days. Part of these upgrades is because of the higher handling capacity of the frame functions they are inherent and memory accessibility.

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Adaptive histogram equalization (AHE) [2] enhances on this by transforming each pixel with a transformation function derived from a neighbourhood area. It was initially generated for use in aircraft cockpit displays. In its most straightforward structure, each pixel is transformed based on the histogram of a square encompassing the pixel, as in the figure 1. The derivation of the transformation functions from the histograms is precisely the same as for customary histogram equalization: The transformation function is corresponding to the cumulative distribution function (CDF) of pixel values in the area.

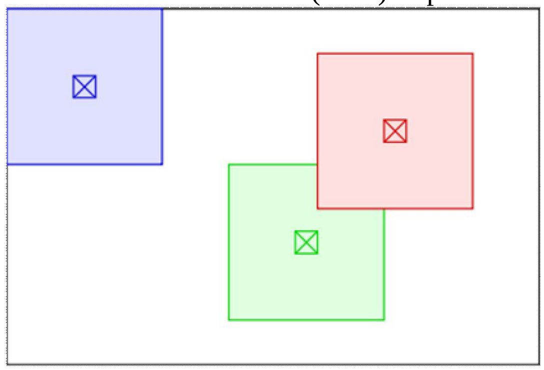

Figure 1. Illustration of pixel neighbourhoods for adaptive histogram equalisation

Contrast Constrained AHE (CLAHE) contrasts from customary adaptive histogram equalization in its contrast limiting. This feature can similarly be used to global histogram equalization, giving rise to contrast constrained histogram equalization (CLHE), which is very rare used in practice. On account of CLAHE, the contrast limiting method has to be used for each neighbourhood from which a transformation function is derived. CLAHE was generated to prevent the over-amplification of noise that adaptive histogram equalization can give rise to.

This is obtained by limiting the contrast enhancement of AHE. The contrast amplification in the vicinity of a given pixel value is given by the slope of the transformation function. This is corresponding to the slope of the neighbourhood cumulative distribution function (CDF) and so to the value of the histogram at that pixel value. CLAHE restricts the amplification by cut-out the histogram at a predefined value before computing the CDF. This restricts the slope of the CDF and so of the transformation function. The value at which the histogram is clipped, the so-called clip limit, relies on the normalization of the histogram and thereby on the size of the neighbourhood area. Common values limit the resulting amplification to somewhere around 3 and 4.

It is advantageous not to dispose the part of the histogram that exceeds the clip limit but to redistribute it equally among all histogram bins.

The redistribution will push some bins over the clip limit again (area shaded green in the figure 2), bringing around an viable clip limit that is larger than the prescribed limit and the exact value of which relies on the image. If this is undesirable, the redistribution method can be repeated recursively until the excess is negligible.

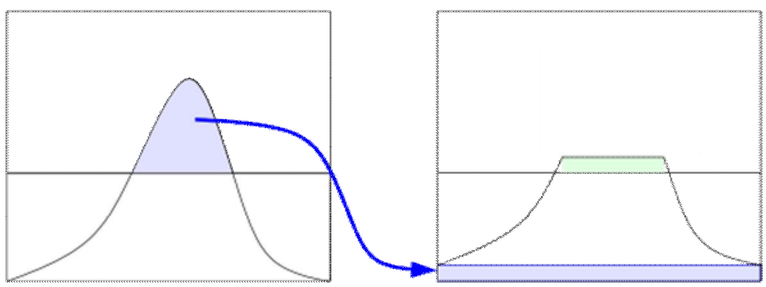

Figure 2: Excess redistribution in contrast-constrained adaptive histogram equalization

II. LITERATURE REVIEW

Celik et al.[3] proposed a work of fiction calculation which improved the contrast of a knowledge picture utilizing spatial data of pixels. The calculation presented a fresh out of the plastic new strategy of procedure the spatial entropy of pixels utilizing spatial dispersion of pixel dark levels. Distinctive set close by the customary techniques, this calculation considered the dispersion of spatial areas of dark level of a photo in the spot of gray level appropriation or joint measurements processed from the dim degrees of a picture. For every dark level, the comparing spatial circulation is processed utilizing a histogram of spatial areas of most pixels with precisely the same level. Moreover, this strategy is close by with change space coefficient weighting to achieve both neighborhood a worldwide difference improvement at precisely the same. Test results demonstrate that the proposed calculations create preferred or practically identical improved pictures over various state of the art calculations.

Cheng et al. [4] proposed a work of fiction methodology for the location of over enhancement. The fundamental component commitments of the paper are as per the following. The reasons for creating over enhancement are researched and dissected profoundly. A target standard for identifying over enhancement is proposed. The trial results show that the proposed methodology can find the over improved zones precisely and viablely, and offer a quantitative basis to gage the over enhancement levels well. The proposed methodology is likely be great for progressively observing the evaluation of the improved picture, and streamlining the parameter settings of the complexity upgrade calculations.

Chen et al. [5] proposed a focused complexity improvement algorithm which joins histogram equalization based techniques (HEBM) and a multiscales unsharp masking based techniques (UMBM). This proposed calculation utilizes HEBM to achieve global contrast enhancement and UMBM to accomplish neighborhood multiscales contrast upgrade. To start with, they reseen the techniques generated in the writing for contrast enhancement. After then, they presented the advanced calculation in points of interest. The execution of the proposed technique is examined on test IR information and compare to those yielded by two settled calculations. The produced calculation has great execution in worldwide differentiation and nearby balance upgrade with clamor and ancient rarity concealment.

Huang et al. [6] proposed a work of fiction hardware oriented contrast enhancement algorithm that will be frequently actualized viablely for equipment outline. The proposed h/woriented contrast upgrade calculation accomplishes great picture quality by measuring the results of subjective and quantitative analyses. To diminish equipment cost and enhance equipment use for realtime execution, a decrease in circuit zone is proposed through use of parameter controlled reconfigurable engineering. The investigation outcome demonstrated that the proposed hardware oriented contrast improvement calculation gives the run of the mill outline rate of 48.23 casings/s at hd determination 1920 × 1080.

Wongsritong et al.[7], has proposed Multi Peak Histogram Equalization with Brightness Protecting (MPHEBP) to enhance the shine ensuring of the image. In this procedure, the information histogram will be smoothed and partitioned in light of the neighborhood maxima. Wongsritong et al. guaranteed that the execution of MPHEBP in keeping up the mean brilliance is superior to anything BBHE.

Sim et al. [8] proposed the Histogram Equalization (RSIHE)and it separates the information histogram taking into account a dim level with middle, yet RMSHE utilizes mean-separation and both the systems have the same attributes in balancing the sub-histograms. Both methods indicated great brilliance ensuring due to multi partition of histogram, however for splendid pictures these procedures lead to over improvement.

Wadud et al. [9] presented the Dynamic Histogram Equalization (DHE) to wipe out the mastery of higher histogram sections on lower histogram segments in the picture histogram and to control the measure of extending of dim levels for sensible upgrade of the picture highlights by utilizing neighborhood minima partition of histogram. DHE has indicated better and a smooth upgrade of the picture. In any situation, the DHE disregards the mean brilliance ensuring and tends to force immersion ancient rarities.

Ibrahim and Kong[10] proposed the Brightness Protecting Dynamic Histogram Equalization (BPDHE) an extension system of the DHE and Multi Peak Histogram Equalization with Brightness Protecting (MPHEBP) and partitions the information histogram taking into account neighborhood most extreme worth to conquer the downside of the DHE.BPDHE indicated better difference improvement contrasted with MPHEBP and mean brightness protecting contrasted with DHE.

III. RESULTS

To see the qualitatively as well as quantitatively performance of the proposed algorithm, some experiments are conducted on various images. The viableness of the approach has been justified using different images. The consequences are processed qualitatively as well as quantitatively using quality measures.

The figures from Figure 3 to Figure 12 are the screenshots of the proposed work which shows the different images which consists of original images and output images.

Figure 3. Original image

Figure 3 shows the original image.

Figure 4 show the Grayscale image.

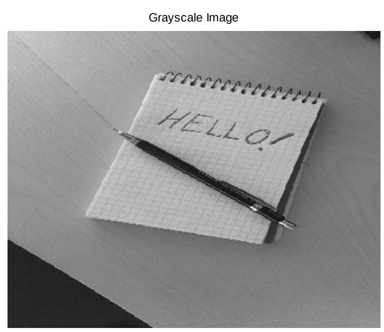

Figure 4. Grayscale Image

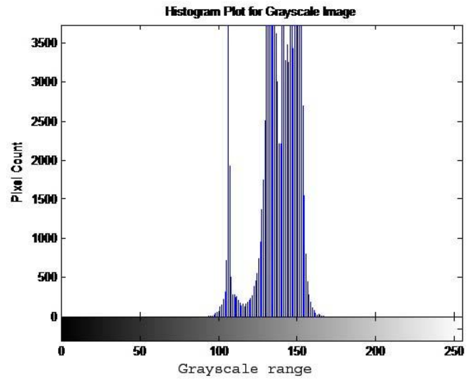

Figure 5. Histogram plot for Grayscale image

Figure 5 show the histogram plot of Grayscale image.

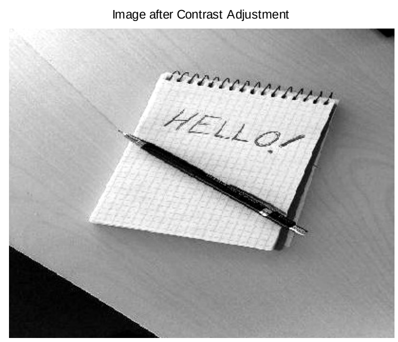

Figure 6. Image after Contrast adjustment

Figure 6 shows the image obtained after contrast adjustment of the original image.

Figure 7 shows the histogram plot for the original image after contrast adjustment.

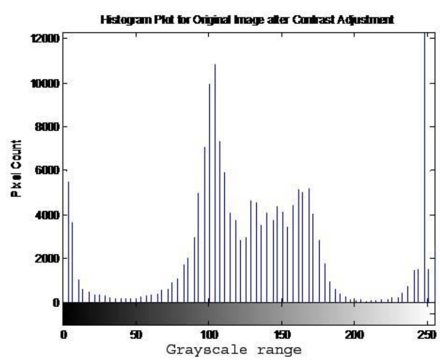

Figure 7. Histogram plot for original image after contrast adjustment

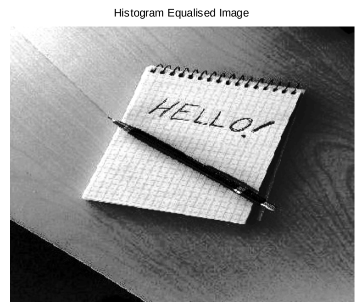

Figure 8. Histogram Equalised Image

Figure 8 shows the image obtained after applying the histogram Equalisation to the original image.

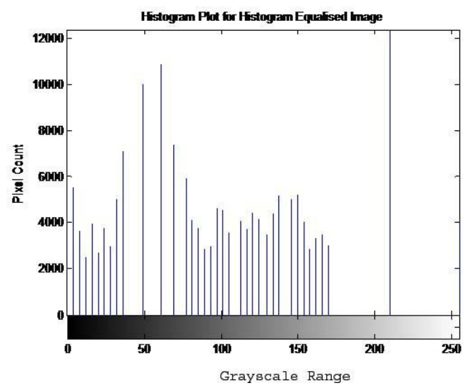

Figure 9. Histogram plot for histogram equalised Image

Figure 9 shows the histogram plot for histogram equalised image.

Figure 10 shows the image obtained after applying the adaptive histogram equalization.

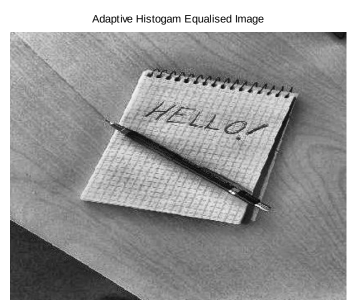

Figure 10. Adaptive Histogram equalised image

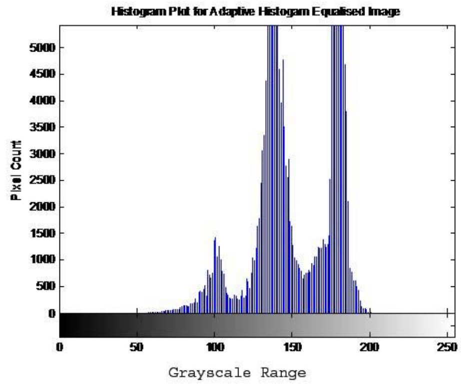

Figure 11. Histogram plot for adaptive histogram equalized image

Figure 11 shows the histogram plot for adaptive histogram equalized image.

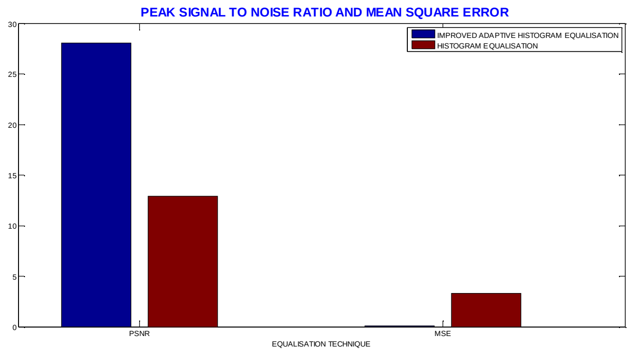

Figure 12. Peak signal to noise ratio and Mean square error of the image after applying the histogram equalization and adaptive histogram equalization technique

Figure 12 shows the Peak signal to noise ratio and Mean square error of the image after applying the histogram equalization and adaptive histogram equalization technique which shows that peak signal to noise ratio increases and Mean square error decreases in the adaptive histogram, equalization technique as compared to Histogram equalization technique.

IV. CONCLUSION

In this paper, techniques that we used balances the requirements of both appearance enhancement and being faithful to the original appearance of an image has been proposed and used to the enhancement of full color images. Results have shown the viableness of our algorithm in improving the contrast and colorfulness of the original images. We prove it experimentally that proposed technique is superior to conventional histogram equalization. The proposed algorithm has high value of PSNR than the conventional histogram equalization technique. Furthermore, the proposed algorithm has low value of mean square error than the conventional histogram equalization.

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