Region Based Contrast Enhancement Using AGCWD

Ramandeep Kaur Kaler[1], Baljit Singh Khehra[2]
[1, 2] Department of Computer Science
[1, 2] BBSB Engineering College, Fatehgarh Sahib

Abstract- *Image enhancement is a technique which is responsible for refining the image quality for better visibility. It is a process of altering the certain amount of image features by human interpretation to obtain enhanced image at the output. Basically, the images taken in low light can cause poor contrast which makes object and background non-differentiable and there is also a chance of involving noise in it. So, it becomes an important parameter to rectify these problems. Therefore many techniques have been developed. But most of these techniques are failed to preserve the brightness and naturalness of the image which results into washed out appearance with loss of information. Now, a new technique has been proposed to resolve these problems. In this technique, an image is divided into blocks and then passes through high pass filter as well as adaptive gamma correction weighted distribution method for preserving brightness without losing details.*

Keywords- Image Enhancement, Contrast Enhancement, Histogram Equalization, Adaptive Gamma Correction Weighted Distribution, Brightness Preservation.

I. INTRODUCTION

Image enhancement is one of the most important technique in image processing. Image enhancement stress on the improvement of the excellence of the input image which are captured by a camera or other device to make the output image looks better. Basically Image enhancement is the processing of adjustment of image so that the resulting image is more suitable for display or further analysis. The enhancement technique do not add the extra features in an image, instead it focus on specific details of interest in the image. The main objective of image enhancement is the processing of a given image so that the results are more suitable than the original image for a specific area.The principal objective of image enhancement is modification of attributes of an image for the purpose of makig it more suitable for a given task and specific observer. dynamic range Contrast enhancement is one of the known techniques for image enhancement. It enhance the quality standard by increasing the dynamic range of gray levels of the input image. It is a necessary method for the improvement of enhancement of video or images in imaging processing. Contrast enhancement has very wider range of areas and applications in image processing for both human and computer vision. HE(Histogram Equalization) is a famous and known method for enhancing contrast of an image. HE firstly transforming a distribution of the gray values for an image but then also it does not suits for electronics products as it has loss of naturalness in image, loss of image information, washed out appearance of images and there is change in brightness as well as in contrast enhancement, to make it consumer reliable and reducing the above problems, some operations has to be done on it and these type of important processes help the HE overall process to be very effective for giving good image quality. Histogram of an image shows the relative frequency of various gray levels that occurred in the image One of the known HE techniques which improves the contrast in low contrast images is AHE(Adaptive Histogram Equalization). This method is different from other HE techniques with respect to the adaptive method as this method generates multiple histograms and each of that histogram responds to a different section of the original and input image which further requires them for redistribute the brightness level of the image. Adaptive histogram equalization (AHE) is a image processing technique that is used to improve low contrast in images. It is different from ordinary histogram equalization in the respect that the adaptive method computes many histograms, each of them corresponding to a different section of the image, and then uses them to redistribute the lightness values of the image. This method is suitable for improving the local contrast and for enhancing th. AHE gives excellent results in enhancing the component of an image but in various cases it enhances noise too e definitions of edges in each part of an image. For some problems BBHE() is followed, this method is an advanced form of adaptive histogram equalization. Basically it is introduced for providing solutions regarding noise related problems. It perform functions on the small tiles which are the small regions in the image and not consider the entire image like other existed methods. Therefore each tile have contrast enhancement in that mode so the histograms which is generated at the output will match exactly as it is mentioned in the 'Distribution' parameter. Furthermore, adjacent tiles are combined together by using bilinear interpolation in order to removing unwanted local boundaries. firstly, BBHE(Bi Histogram Equalization) BROKE the input image into two images which are based on the mean brightness of the input image. One of the sub images having samples that is less than or equal to 2 the mean and the remaining set has samples

which are greater than the mean. Then the BBHE equalizes the sub images histograms with the concept that the samples in the set(formal set) are mapped in the range between the minimum gray level to the input mean and the samples in different set are mapped in the range from the mean to the maximum gray level. In this , input mean brightness level value is shown as separation intensity X T, i.e. the average intensity of all pixels that form the input image. Result show, the mean brightness can obtained because real mean brightness is retained.

II. LITERATURE SURVEY

Huang et.al.[1] proposed a method to modify histograms and enhance contrast in digital images. In this there is a transformation technique that improves brightness of dimmed images via gamma correction and probability distribution of luminance pixels. Experimental results shows that this method produces enhanced images of higher quality than those produced using other methods. This method enhance the overall image.

Kim[2] proposed a method in which input image is segregated into two sub images on basis of mean of the original image. Out of two sub images, first one contains the samples less than or equal to the mean and remaining one contains samples greater than the mean. Later on, sub images are equalized separately according to their corresponding histograms based on a fact that samples contained in the first set are stretched from minimum gray level values to the input mean and samples in the second set are stretched from mean to maximum gray level values.

Wang et.al.[3] discussed a method, which segregates histogram according to cumulative probability density of gray level having value 0.5 rather than mean method like in BBHE. Therefore, two sub histograms HL(X) and HU(X) generated from H(X) are emphasized by median XD. Afterwards, two sub histograms HL(X) and HU(X) generated from H(X) are equalized separately. The overall phenomenon responsible for this cause is that it would achieve the maximum entropy for the resultant image. This technique does not lead to sufficient shift as it is co-related with brightness of the original image. Basically, it focus on those, who have wider area with similar distribution of gray level. For ex- images contains very dark or light backgrounds with smaller objects.

Lee et.al.[5] presented a novel contrast enhancement approach based on dominant brightness level analysis and adaptive intensity transformation for remote sensing images. The proposed algorithm computes brightness-adaptive intensity transfer functions using the low-frequency luminance component in the wavelet domain and transforms intensity values according to the transfer function. More specifically, we first perform discrete wavelet transform (DWT) on the input images and then decompose the LL subband into low-, middle-, and high-intensity layers using the log-average luminance. Intensity transfer functions are adaptively estimated by using the knee transfer function and the gamma adjustment function based on the dominant brightness level of each layer. After the intensity transformation, the resulting enhanced image is obtained by using the inverse DWT. Although various histogram equalization approaches have been proposed in the literature, they tend to degrade the overall image quality by exhibiting saturation artifacts in both low- and high-intensity regions. The proposed algorithm overcomes this problem using the adaptive intensity transfer function. The experimental results show that the proposed algorithm enhances the overall contrast and visibility of local details better than existing techniques. The proposed method can effectively enhance any low-contrast images acquired by a satellite camera and is also suitable for other various imaging devices such as consumer digital cameras, photorealistic 3-D reconstruction systems, and computational cameras..

Cleik and tahajad[6] proposed an adaptive image equalization algorithm which automatically enhances the contrast in an input image. algorithm of this method uses Gaussian mixture model (GMM) to model the image grey-level distribution, and having the intersection points of the Gaussian components in the model are used for portioning the dynamic range of the image into input grey-level intervals. The contrast equalized image is generated by transforming the pixels' grey levels in each input interval to the appropriate output grey-level interval in accordance to the dominant Gaussian component and cumulative distribution function (CDF) of the input interval. To taking into account of human perception the Gaussian component having small variances are weighted with smaller values than the Gaussian components with larger variances, and the grey-level distribution is also used to weight the components in the mapping of the input interval to the output interval. Experimental results show that the algorithm gives better and enhanced images than several algorithms. like the other algorithm this algorithm is free from parameter setting for a given dynamic range of the enhanced image and applied to a large range of image types.

Rahman et.al.[7] proposed a method which describe that Histogram equalization is fine process carried out in electronic systems for contrast enhancement. And also to an increase in contrast, it required to preserve the mean brightness of an image for scene information to the viewer. A approach is to separate the image into sub-images and then process independently by histogram equalization . However, because of the variations or changes in image contents, the

histogram separation threshold greatly influences the level of shift in mean brightness with respect to the uniform histogram in the equalization process. the choice of a proper threshold, to broke the input image into sub-images, is very critical in order for preserving the mean brightness of the output image. In this research work, a dynamic range stretching approach is carried out to reduce the shift in output image mean brightness. Moreover golden section search algorithm is applied to get a separation into sub-images to preserve the mean brightness. on a large number of color images of natural scenes Experiments carried out . Results, with comparison to available approaches, showed that the method performed satisfactory results in mean brightness preservation and enhancement of image contrast.

Iwazami and Goto[8] proposed a new adaptive histogram equalization (HE) method., utilizing the DRSHE method to the block of the image in order to improve the regional image contrast with automatic parameter setting and in short computational time. We have compared the processed image of our method with those of the various conventional HE methods., obtained the best image that is close to the image bythe Retinex method which is considered at present to be the best contrast enhancement technology. The computational time is important merit of theproposed method. It is much smaller than that of the Retinex method and the local HE method. The automatic parameter setting is another important merit of the proposed method because many conventional HE method needs parameter setting in accordance with each image.

Wang and Ye[4] explained a new approach which use a variant approach to calculate the desired histogram which is followed up by mean brightness preservation limit based on maximum differential entropy and afterwards, required histogram obtained by analyzing histogram specification. As a result, histogram transformation is done for preserving maximum brightness so that entropy of histogram gets maximized below the limit of brightness.

III. PROPOSED METHODOLOGY

To discuss the limitations of the current method (AGCWD), a method must have developed to create an equal balance between the low computational costs and high levels of visual quality. Existed methods enhances the image but the issue is that these methods works average on the complete image whereas each region in an image requires variable enhancement in terms of contrast A combination of block implementation of Adaptive Gamma Correction with Weighing Distribution (AGCWD) is proposed. Now, the new technique is proposed to resolve these problems. In this technique, an image is divided into blocks and then passes through high pass filter as well as adaptive gamma correction weighted distribution method for preserving brightness without losing details.Particularly, the gamma parameter creates more significant adjustment. The observation has led us to assign a compensated cdf as adaptive parameter that changes the intensity of progressive increment with its original trend. The new value of a pixel in an image is given by:

$$T(l) = l_{max}(l/l_{max})^{\gamma} = l_{max}(l/l_{max})^{1-cdf(l)}$$

Where, $l_{max}$is the maximum gray scale level in a grayscale image, l is the value of the current pixel and *cdf(l)* is the cumulative distribution value at that particular level.CDF stands for cumulative distributive function. It is a function that calculates the cumulative sum of all the values that are calculated by PMF. It basically sums the previous one.

Proposed method involves: Block Processing, Gamma law Correction,. Append block

Block Processing involves:

a. Read image
b. Divide image into block
c. Convolute image through high pass filter
d. Calculate mean of each block
e. Assume value of alpha according to mean value i.e used in gamma correction.

Gamma law Correction involves:

$$T(l) = l_{max}(l/l_{max})^{\gamma} = l_{max}(l/l_{max})^{1-cdf(l)}$$

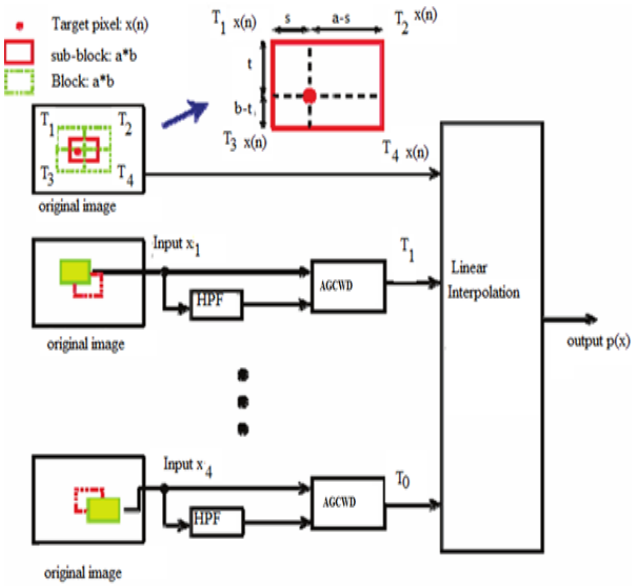

Fig. 2 Block diagram of proposed method

Gamma law correction method provide efficient contrast enhancement. Experimental results demonstrate that the proposed method produces enhanced images of comparable or higher quality than those produced using previous state-of-the-art methods**.** AGCWD (Adaptive gamma correction with weighting distriution)proposes a method to modify histograms and enhance contrast in digital images. In this the transformation technique that improves brightness of dimmed images via gamma correction and probability distribution of luminance pixels. Experimental results shows that this method produces enhanced images of higher quality than those produced using other methods. This method enhance the overall image.

IV. RESULTS

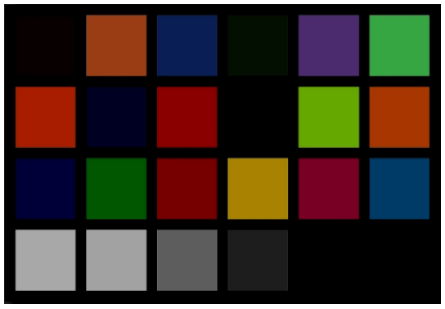

Fig.3 (a)

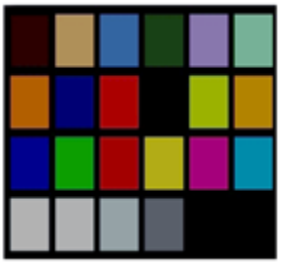

Fig 3 (b)

Fig 3 (c)

Fig. 3: (a) Original image, (b) AGCWD, (c) IAGCWD

Figure 3 shows the Macbeth Color Checker image for computing the standard AMBE for different approaches.

AMBE(Absolute mean brightness error) and PSNR(Peak signal to noise ratio)parameters are used to measure quality of image

TABLE 1. AMBE Comparison

AGCWD	IAGCWD
23.47	16.75

TABLE 2. PSNR Comparison

AGCWD	IAGCWD
0.4503	2.8570

V. CONCLUSION AND FUTURE SCOPE

In this work, we present a new enhancement method for images. The proposed method is composed of four major steps.

1. The image is divided into blocks of fixed size, so that the further processing will be done on each block.
2. The histogram of the image provides the spatial information of a single image based on probability and statistical inference.
3. The weighting distribution is used to smooth the fluctuant phenomenon and thus avoid generation of unfavorable artifacts.
4. Gamma correction can automatically enhance the image contrast through use of a smoothing curve.

With the results presented here, it can be concluded that the proposed method is found to be further effective than existing image enhancement techniques. The proposed method can be implemented in a real-time video system with limited resources.

Block processing results in block noise. So to overcome it, further research can be done. Therefore future work is required to make this method more effective for other images with less spatial variation. To discuss the restrictions of the proposed method, some working methodology has to be developed to create equilibrium between enhancement and block noise.

REFERENCES

[1] S.C Huang ,F.C. Cheng and Y.S Chiu, “Efficient contrast enhancement using adaptive gamma correction with weighting distribution”,IEEE Transactions on image processing, vol.22,no.3,pp.1032-1041, 2013.

[2] Y.T. Kim, "Contrast enhancement using brightness preserving bi-histogram equalization", IEEE Transactions on Consumer Electronics, vol. 43,no.1,pp.1-8, 1997.

[3] Y. Wang, Q. Chen and B. Zhang, "Image enhancement based on equal area dualistic sub-image histogram equalization method", IEEE Transactions on Consumer Electronics, vol. 45, no.1,pp.68-75, 1999

[4] C. Wang and Z. Ye, "Brightness preserving histogram equalization with maximum entropy: a variational perspective", IEEE Transactions on Consumer Electronics, vol. 51,no.4, pp.1326-1334, 2005.

[5] E. Lee, S. Kim, W.Kang, D. Seo, and J. Paik,"Contrast Enhancement Using Dominant Brightness Level Analysis and Adaptive Intensity Transformation for Remote Sensing Images",IEEE geoscience and remote sensing letters, vol. 10,pp. 62-66, no.1, 2013.

[6] T. Celik and T. Tjahjadi "Automatic Image Equalization and Contrast Enhancement Using Gaussian Mixture Modelling" Transactions on Image Processing IEEE, Vol. 21, No. 1, pp. 145-156.

[7] M.A. Rahman, S. Liu, S.C.F. Lin, C.Y. Wong and G. Jiang, "Image Contrast Enhancement for Brightness Preservation Based onDynamic Stretching'',International Journal of Image Processing , vol. 9,pp.241-253, 2015.

[8] T. Iwanami, T. Goto "An Adaptive Contrast Enhancement Using Regional Dynamic Histogram Equalization",IEEE international conference,pp. 719-722,2012.

[9] W.Kim,J.You and J.Jeong,"Contrast enhancement using histogram equalization based on logarithmic mapping",pp.1-10,vol. 51(6),2012.

[10] S.Tai,C.Chang,Y.Lin and Y.Liao, "Modified Histogram Equalization Based on thePartitioned Dynamic Range", 2014 ICCE-Taiwan,pp.107-108,2014.

[11] D.Zhang, W.Park, Seung-J.Lee, K. Choi, and S. Ko, "IEEE 16th International Symposium" Histogram Partition b a s e _d Gamma Correction for Image Contrast Enhancement"pp.1-4,2012.

[12] E. Lee, S. Kim, W.Kang, D. Seo, and J. Paik,"Contrast Enhancement Using Dominant Brightness Level Analysis and Adaptive Intensity Transformation for Remote Sensing Images",IEEE geoscience and remote sensing letters, vol. 10,pp. 62-66, no.1, 2013.