Recursive & Successive Contrast Adjustment of Image with Reflection Reduction & Saturation Adjustment

Saniya Khan[1], Nidhi Singh[2], Prof. Vineet Richhariya[3]

[1]M. Tech. Scholar, [2]Research Guide, [3]HOD

Department of Computer Science and Engineering, LNCT, Bhopal

Abstract - Images are the integrated part of human lives and all are capturing and storing to save special moments and memories for future. The capturing of images and its quality are depends on the environmental factors which is not in our control so images get corrupted due to low light, reflections, fog or moistures etc. The corrupted images are need to be enhanced to increase its visuality to get rid of following effects and the field of research dealing with is called as image enhancement. In this work contrast and saturation improvements are being done on corrupted images using recursive algorithm and reflection reduction with successive contrast adjustments. The experimental results shows the effectiveness of the algorithm. For calculation of effectiveness of proposed algorithm we have compared PSNR with existing work and found better.

Keywords - Successive Approach, Recursive Color Adjustment, Reflection Reduction, PSNR, Entropy.

I. INTRODUCTION

Image enhancement methods referred to a collection of different techniques that search forth improvement of the photographic appearance of an image or for converting the image to a form which is better suitable for the analysis of a machine or a human. In many applications and research areas the enhancement of noisy image data is a big technical problem. Image enhancement approaches can be grouped into three extensive categories such as Frequency domain methods, which are based on the Fourier transformation of an image, spatial domain techniques, which are based on the pixels directly, and Fuzzy domain techniques, which comprise the use of knowledge-based systems that are able to imitate the activities of a human expert. The main advantages of spatial based domain techniques are the low complexity which brings the favors in real time implementations and they are conceptually simple to understand. However, these methods commonly lack in providing imperceptibility and adequate robustness requirements. Fuzzy logic is a good measured frame to handle the problem of uncertainty in the image information.

The real world scenarios usually suffer from lack of clarity and effects with low light. High dynamic range image is more effective in extraction of contextual information from the image. Where night time images taken may exists low intensities values and have suffer from noise due to very low signal power.

The aim of the project is to increase the contrast and color in order to improve the visual appearance of valuable information. These techniques can be used for analyze the detection and pixel segmentation purposes. Normally several application require this low light image enhancement including surveillance, astronomical and medical imaging.

Early approaches in the problem relied on Sparse Representation technique. It is simplistic strategy which introduces necessary information from the image and there is a need to increase the reconstruction quality and alternative feature operators. HE (histogram equalization) it is relatively simple to introduce this technique and usually introduces multiple artifacts and leads to significant loss of details in the image. To enhance the low light image, that inverts the dark input frames and then provide a de-haze algorithm to improve the illuminant component. Problems arrived due to the component and parameter leads to introduce the artifacts in reconstruction of the image.

The methods rely on a single image for estimation of the enhanced image, using these algorithms SMQT (Successive mean Quantization Transform), V Transform, histogram equalization method techniques. Particularly Successive mean Quantization Transform and V Transform enhances better luminance values in the image. Histogram equalization is better to increase the contrast level and enhance the grey scale images all the algorithms accomplished with high computational power and obtained in great visual quality.

Our goal is to improve the picture differentiation while saving the shine of the image. Various contrast upgrade procedures are utilized as a part of picture and feature transforming for attaining to better visual standpoint. Histogram leveling based systems means to achieve contrast upgrade by redistributing the power estimations of

an info picture, in this way straightening the histogram. Histogram change is a profoundly utilized method as a part of a hefty portion of the complexity upgrade techniques. In general, Histogram Equalization (HE) is a standout amongst the most favored methods to attain to difference improvement, because of its adequacy and straightforwardness.

II. SYSTEM MODEL

To process an image there are two main methods defined by the domain in which image in processed, they are namely spatial domain and frequency domain. The spatial domain processing mainly refers to image plane in which it directly manipulated the pixels in the image. Frequency domain processing is based modifying the spatial frequency spectrum of the image as obtained by Fourier transform.

A. Spatial domain enhancement methods:

Spatial domain technique refers to the aggregate of pixels composed in the image and operate directly on these pixels. The image processing function in spatial domain is given as:

$$g(X,Y) = T[f(X,Y)] \dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Here, $f(x,y)$ is the input image data, $g(x,y)$ is the proceed image data, here T is the operation used on set of input images, for example performing pixel by pixel sum and to make average a number of images for noise removal. Here the resultant is stored separately instead of changing the pixel values to avoid the snowballing effect of the altered gray levels.

B. Frequency domain enhancement methods:

Frequency domain technique is operated on convolution theorem. Processed image is obtained by convolution of an image $f(x,y)$ with position invariant operation $h(x,y)$.

$$g(X,Y) = f(X,Y) * h(X,Y) \dots\dots\dots\dots\dots\dots (2)$$

By the convolution theorem, the following frequency domain relation is obtained:

Here the frequency domain with DFT is performed in 2D convolution.

$$G(u,v) = F(u,v)H(u,v) \dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Where G, H, and F are the Fourier transforms of g, h, and f respectively. H(u, v) represents the transfer function of the process.

C. Histogram Equalization

1) The main aim of histogram equalization is to relate an input image with output image in histogram such that it is uniform after relating.
2) Here gray levels of the image to be enhanced will be represented by r and enhanced output be s with transformation from s= T(r).
3) Using a transformation function which equal to the cumulative distribution of the probability density of the image pixels r to produce an image of gray levels with uniform density, it involves an increase of dynamic range of pixels.

C. Contrast Adjustment.

In Matlab tool recursive colour adjustment is used for Image enhancement to improve image contrast and colour, by increase the signal-to-noise ratio, and sometimes subjectively e.g., make certain features easier to see by modifying the colors or intensities.

III. PROPOSED METHODOLOGY

Figure below demonstrate the flow chart of proposed work has done on MATLAB the proposed image enhancement algorithm is dealing with imprecise data vague and uncertain information in images.

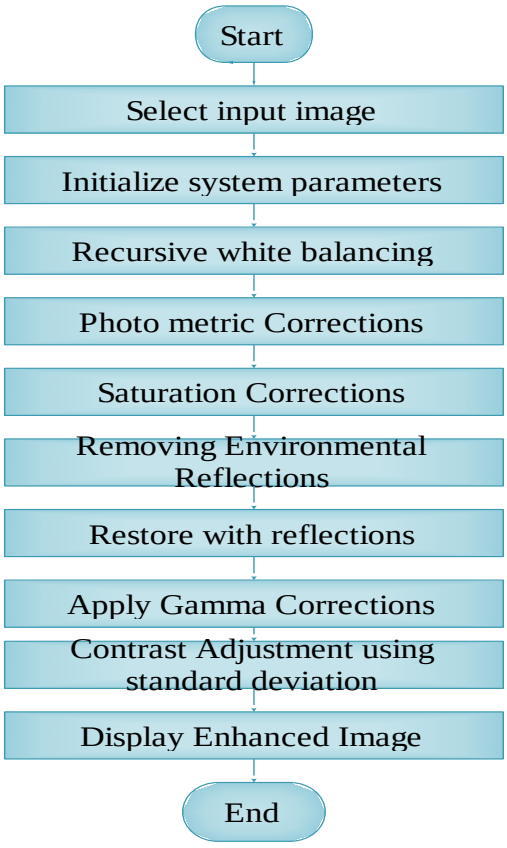


Figure 3.1: Flow chart of proposed system.

The algorithm provides the satisfactory result in low contrast and light variation areas the proposed

methodology has following steps demonstrated in flow chart

(1) Select Input Image

(2) Initialize system parameters

(3) Recursive white balancing

(4) Photometric Correction

(5) Saturation correction

(6) Removing Environmental reflections

(7) Restore with Reflections

(8) Apply gamma Correction

(9) Contrast Adjustment using standard deviation

(10) Display enhance Image

The block diagram of the proposed system has shown in figure 3.2 having five blocks

(a) White Balancing

Apply white balancing to input image to remove unrealistic colour casts, so the object is rendered white in input image.

(b) Photo Metrics and soft correction

Convert the image in the form of matrix and apply soft correction on the pixels of images.

(c) Remove Reflections

Remove the unwanted reflections and lights from the image. to enhance the contrast of the image .

(d) Gamma Corrections

Apply gamma correction on test image it is a nonlinear operation used to encode and decode luminance or tristimulus values in image systems.

(e) Contrast Adjustment

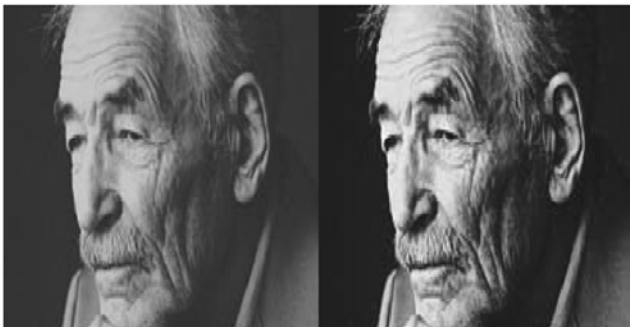
Adjust the contrast of the input image to enhance the quality and brightness of the test image.

Figure 3.2: Block diagram of the proposed system.

IV. EXPERIMENTAL RESULTS

The simulation of the proposed system has done on Simulink simulation tool of MATLAB to enhance the contrast and quality of the proposed image PSNR value has improvement the results of the simulation of the proposed work has give in figure below.

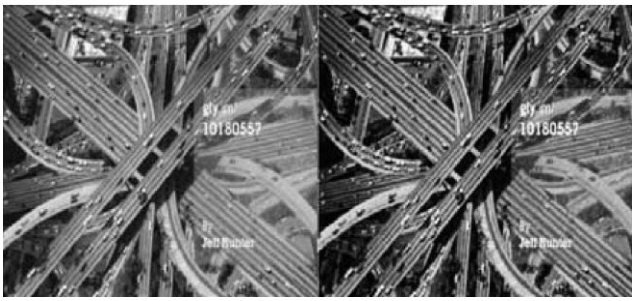
Corrupted Input Image Enhanced Image



(a)

(b)

(c)



(d)

(e)

Figure 4.1: Input Image and Enhanced Image of (a) face, (b) Street View, (c) Cars Model, (d) Road Map, (e) Magazine Cover.

Table 1: Comparison of PSNR with Existing Work

Image	Existing (Base Paper) Work	Proposed(Our) Work
face	85.21 dB	92.34 dB
Street view	91.29 dB	83.01 dB
Cars model	75.55 dB	83.08 dB
Road map	75.93 dB	89.71 dB
Magazine cover	85.11 dB	86.41 dB

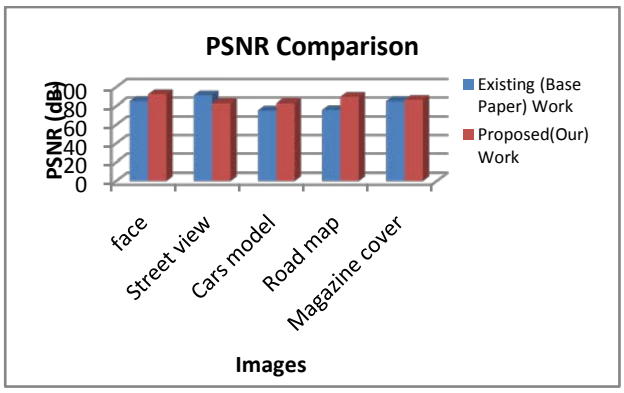


Figure 4.2. Bar chart comparison with Existing Work.

The comprehensive analysis of the result of the proposed system with existing system has give in table 1 where its clear that the proposed system outperform against the existing system. test images are give in figure 1.1

(a) For face Image PSNR is 92 dB for proposed work .

(b) For Street view PSNR is 83dB.

(c) For Cars model image 83.08 dB.

(d) For Road map image 89.71 dB.

(e) For magazine cover 86.41 dB

In all cases the value of PSNR for proposed system is high which is consider best here.

Graphical representation of the result analysis is shown in figure 4.2 in bar chart blue color represent to the base work and red colour represent to the proposed work.

V. CONCLUSION AND FUTURE SCOPES

The methods that applied balances the requisites of the developed contrast enhancement and being faithful to original image is applied to the enhancement of both RGB and grey scale images demonstrated in figure 4.1. The results show the effectiveness of the algorithm in improving both contrast and color of the original image. In the measure of PSNR illustrated in table 1 comparison table. Finally its conclude that proposed work is good for enhancing natural images facing nature effects in independent color planes in the image.

In future It can be useful for in mobile image enhancement application with a low computational power and fast execution.

REFERENCES

[1] Thakur and D. Mishra, "Fuzzy contrast mapping for image enhancement," 2015 2nd International Conference on Signal Processing and Integrated Networks (SPIN), Noida, 2015, pp. 549-552.

[2] G. Ganapathi and N. Rethinaswamy, "A fuzzy framework for offline signature verification," 2014 IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT), Bangalore, 2014, pp. 1-6.

[3] Y. Hu, S. Dai and J. Liu, "Contrast enhancement based on fuzzy clustering," 2014 4th IEEE International Conference on Information Science and Technology, Shenzhen, 2014, pp. 751-754.

[4] Reshmalakshmi and M. Sasikumar, "Image contrast enhancement using fuzzy technique," 2013 International Conference on Circuits, Power and Computing Technologies (ICCPCT), Nagercoil, 2013, pp. 861-865.

[5] T. Chaira, "Contrast enhancement of medical images using type II fuzzy set," 2013 National Conference on Communications (NCC), New Delhi, India, 2013, pp. 1-5.

[6] H. Hahn, "Image Enhancement using FCM Algorithm Based on HSV Color Model [Plenary Talks]," 2013 Seventh International Conference on Image and Graphics, Qingdao, 2013, pp. xxv-xxvi.

[7] Y. Zhang, "A novel contrast enhancement and denoising method for borescope images," 2012 IEEE Fifth International Conference on Advanced Computational Intelligence (ICACI), Nanjing, 2012, pp. 570-573.

[8] Atam P. Dhawan, GianlucaBuellon, & Richard Gordon"Enhancement of Mammographic Features by Optimal Adaptive Neighborhood Image Processing" IEEE transactions onmedical imaging, vol.MI-5, no.1, March 1986.

[9] J. B. Zimmerman, S. B. Cousins, K. M. Hartzell, M. E. Frisse, and M. G. Kahn, “A psychophysical comparison of two methods for adaptive histogram equalization,” Journal of Digital Imaging, vol. 2, pp. 82-91 (1989).

[10] BalasubramaniamJayaram, Kakarla V.V.D.L. Narayana,V. Vetrivel, "Fuzzy Inference System based Contrast Enhancement", EUSFLAT- LFA July,2011 Aix-les-Bains, France.

[11] Choi Y.S., Krishnapuram R. “A robust approach to image enhancement based on fuzzy logic”, IEEE Trans. on Image Processing, 6(6):808-825, 1997.

[12] Li Jiuxian, Sun Wei, Xia Liangzheng, "Novel fuzzy contrast enhancement algorithm", Journal of south east university (Natural Science Edition), Vol. 34 No 15, 2004.

[13] H R.Tizhoosh, “Fast fuzzy edge detection,” in proceedings NAFIPS 2002 Annual Meeting of the North American Fuzzy Information Processing Society,pp. 239-242, 27-29 June 2002.