An Optimized Technique For Image Enhancement:A Review

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Abstract- *The image improvement is a process to visually improve the image for different application. Improvement on the image is done to provide clearness to the image here we are going study about different improvement way of doing things to provide a much clear digital image.*

Keywords- image, image enhancement, enhancement, digital image

I. INTRODUCTION

The enhancement of image is a process through which we can improve the visualization of the image for the human visual. The image enhancement is a process used to increase the clarity and to decrease the ambiguity of an image. Due to the lack of the hardware capabilities the image captured is effected by lighting, focusing, and other factors.
Application of image enhancement:

- Military
- Forensics
- Textiles
- Robotics surgery
- Biomedical analysis
- Machine vision

Techniques of Image enhancement:

Image enhancement techniques are dividedinto two types:

1. Spatial domain:

The spatial domain technique pixels of captured images are directly manipulated to get the desired output. The aim of the technique is to increase the ability of the data that is processed by the picture [1].

A (s,t)= T [B (s,t)]
Output image= A (s,t)
T = transformation on the input image.
Input image= B (s,t)

A. Histogram Equalization (HE):

It's one of the most widespread approaches for distinction enhancement of picture. HE is a technique based in SD using histogram of the picture. A histogram plots the frequency of grey level, at each and every pixel of the picture, varying from zero (black) to 255(white). Histogram is a discrete performs given with the aid of:

$$h(rk)=(nk)/N$$

The place, rk and nk are depth phases of the pixels; N is the number of pixels within the photo with intensity resp. HE is a technique that transforms given histogram of the picture by way of spreading the gray-stage clusters over a dynamic range. It remaps the grey level frequency situated on a probability distribution of enter grey-level of the long-established image to histogram with close-to uniform probability density operate. This system redistributes the intensity distribution. Histogram having top and valleys can have top and valleys even after equalization however these will probably be shifted. HE can also be labeled into 2 precepts classes-international and local HE. Global histogram equalization (GHE) uses entire input for transformation function of the input histogram. Even as, Local Histogram Equalization (LHE) makes use of a sliding window that slides by method for every pixel or piece of pixels successively and gray stage mapping is performed on the middle pixel of that square handiest Another methods based on histograms are HS that transforms histogram of one image into the histogram of another image, and Dynamic HS works on critical points from the input histogram.

B. Global Histogram Equalization:

In this way of doing things, each pixel of the image is assigned a new strength value based on previous (the total of something over time) density function. To participate in GHE, the real histogram of the grayscale picture needs to be made equal. GHE accounts the worldwide know-how. The resulting picture of GHE is more desirable in honor/difference. However, it is going to have unnatural looks because of over improvement of brightness. Also, GHE way of doing things is not able to change to local light conditions.

C. Local Histogram Equalization:

This way of doing things uses sub-blocks of the enter image and use these blocks to retrieve their histograms. HE is applied to the important pixel of that block by way of creation use of Density function. The procedure is frequent for every pixel until the end-pixel is made equal. This way of doing things results in over-improved portions. This way of doing things is not able to change with partial light information. Also, costs are high for this way of doing things.

D. Histogram Specification (HS):

Below this manner, histogram of enter picture is modified into the histogram of an additional image. This procedure is used at the times when output is required to form a specific histogram by achieving highlighted gray-level ranges. This technique enables obtaining the favored output. Creation use of this technique is bit elaborate, when you consider that it's complicated to identify the output histogram as it varies for the entire pictures.

E. Dynamic Histogram Specification (DHS):

In these approaches, some Critical Points (CPs) of the enter picture are chosen. On the groundwork of CPs and other variations, a unique histogram is created dynamically. This approach enhances the image, by preserving some of the characteristics of the input image's histogram. But, it doesn't improve the on the whole contrast of the picture. HE techniques suffer from mean-shift problem [4]. The mean intensity value of the picture is shifted to the middle gray-level of the intensity range. Thus, HE based techniques are not useful in the cases where intensity protection is required.

2. Frequency Domain Technique

Frequency domain ways of doing things are based on the moving around/misleading and tricking of the orthogonal change of the image rather than the image itself. Frequency domain ways of doing things are suited for processing the image according to the frequency content. The way of thinking/basic truth/rule behind the frequency domain methods of image improvement consists of figuring out/calculating a 2-D separate unitary change of the image, for instance the 2-D DFT, controlling/moving around/misleading the change coefficients by an operator M, and then (doing/completing) the inverse change. The orthogonal change of the image has two parts/pieces importance and phase. The importance consists of the frequency content of the image. The phase is used to restore the image back to the (related to space or existing in space) domain. The usual orthogonal changes are separate cosine change, separate Fourier change, Hartley Change etc. The change domain enables operation on the frequency content of the image, and therefore high frequency content such as edges and other difficult to notice/skillful information can easily be improved. Frequency domain which operate on the Fourier change of an image.

- Edges and sharp changes (from one thing to another) (e.g. noise) in an image add/give significantly to high frequency content of Fourier change.
- Low frequency contents in the Fourier change are responsible to the general appearance of theimage over smooth areas.

The idea of filtering is easier to see (in your mind) in the frequency domain. Therefore, improvement of image f(x, y) can be done in the frequency domain based on DFT. This is especially useful in convolution if the (related to space or existing in space) extent of the point spread sequence h(x, y) is large then convolution explanation.

$$g(x, y)= h(x, y)* f(x, y)$$

where g(x, y) is enhanced image. [16]

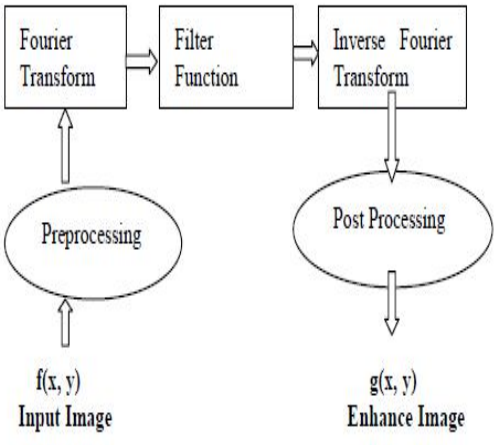

Figure 1: Flow Diagram of Frequency Domain Technique

II. LITERATURE SURVEY

Here we make a short summary on some of the image enhancement techniques. A short summary of the literature survey is as follows:

Aimi [2010] presented a dual phase technique to achieve a fully segmented irregular WBC. In the initial step of the three contrast enhancement technique are used which are partially contrast technique, bright and dark stretching technique are used to enhance the image feature. In the secondary phase of

image segmentation is done to build on the HSI colour model has been proposed. The suggested system gives a better image visibility and good effect on improving the accuracy of segmentation. [9]

Ahmed [2012] discovered the accurate nature of transformation using Histogram equalisation. His analysis shows that Histogram equalisation changes density not contrast. [10]

Cheng [2012] recommended a method for detection of over enhancement. The causes for making over enhancement are surveyed and studied intensely. The research displays that the proposed technique can locate the over improved areas efficiently and correctly. The proposed method is great for dynamically checking the status of the enhanced image and optimize the parameter of the contrast enhancement procedure. [12]

Chen [2013] proposed a contrast enhancement procedure which associations HE and an un-sharp masking based methods. They presented a new procedure. The performance of the suggested technique is studied on experiment and compared to the previous algorithms. The algorithm developed has improved performance than the earlier algorithm. [13]

Reshmalakshmi [2013] showed a new contrast enhancement algorithm plots elements from pixel level to membership level and then to enhancement level. Limitation of the existing contrast enhancement techniques are resolved to support the mathematical tool "fuzzy set". These fuzzy set could handle the uncertainty in the image. To measure the performance new algorithm is applied on different images which proved the improvement over the existing contrast enhancement algorithm.[14]

A.R. Ramli , S.D. Chen et.al[2003] gave a method called as RMSHE which was extension of the already existing method named as BBHE. In this image, is separated on the basis of mean value and this separation is done recursively and histogram equalization is applied on the sub parts of the images. This is repeated until the average brightness of the output image converges to that of the input image. [17]
Wangmeng [2013] proposed a technique based on gradient method for image enhancement. This paper implement a method called novel gradient histogram preservation (GHP) algorithm in which noise was removed and texture features are enhanced. The simulation results concluded that the method worked well in removing the noise from the image and made them look much natural. [18]

Anisimova. E [2013] presented that image acquisition under low light conditions. It also presented two approaches for image enhancement that are lifting wavelet transforms and discrete wavelet transform. Discrete method enhances image quality and also decreases noise signal. The author compared lifting and discrete enhancement methods with the help of MSE, PSNR and elapsed time. In lifting method, image is decomposed into four sub images, then gain coefficient was calculated and finally lifting wavelet inverse transform was applied. Better results were obtained from lifting wavelet transform method that gives a wide range of gray scale and details are clearer as comparability to traditional wavelet algorithms. [19]

Xin Xang [2010] presented two approaches for image enhancement that are lifting wavelet transforms and discrete wavelet transform. Discrete image enhancement method enhanced the image quality and decreased the noise signal from the image. In this paper lifting and discrete methods were compared using MSE, PSNR and elapsed time. In lifting method, image is divided into four sub parts, then gain coefficient was calculated and finally lifting wavelet inverse transform was applied. In the end SVM has been utilised for better noise reduction. Better results are obtained from lifting wavelet transform method that gives a wide range of gray scale and details are clearer as comparability to traditional wavelet algorithms. [20]

Knous [2014] presented an image enlargement way of doing things which was based on the grey polynomial (figuring something unknown out based on things that are already known) with edge improvement (EE). Image was made better with the help of laplacian filter and smart edge detector. Results point to/show that enlarged image received/got with GPI/EE has good visual quality. [21]

Talebhi.H [2014] presented a hybrid approach of the image denoising method by using a fusion method that involves bilateral filter, wavelet thresholding and multiscale products wavelet thresholding. In this method, firstly image containing noise was passed through the bilateral filter and it reduced some noise from it. For preserving edge details and reducing blur effect, output of bilateral filter was passed through wavelet thresholding method and adaptive wavelet thresholding methods. For achieving better results, dyadic wavelet transforms was applied. The performance of this fusion method was measured with the help of MSE and PSNR. This method not only preserved edges while removing noise but alsoenhanced performance. It provides an efficient model for image denoising. [22]

Rahman .S[2014] proposed a novel histogram mapping function that visualizes voxels local means along with grey scales of the images. A technique combines fast local feature generation technique with representing voxels as well as grey scale images. Various sections of this combined histogram, decomposed by separate peaks, are profiled independently into the target histogram scale with the constraint to maintain the uniformity of overall histogram. Thus the hurry of histogram equalization was refined this way, and the required enhancements results are also achieved. [23]

Yi Qing [2014] represents a new technique for improving and sharpening medical color digital images. Major problems in the medical images are low contrast and poor quality. To overcome them, first of all wavelet change was applied to given image. Then haar change was applied to all high frequency sub images. For noise reduction, soft (dividing line/point where something begins or changes)ing method was applied to high frequency parts/pieces. Different values of weight were added in different sub images for improving high frequency parts/pieces. Then, inverse wavelet changes and inverse haar change was applied to get an improved image. Lastly, Sobel and Laplacian filters are applied to sharpen the image. This new technique with Laplacian filter produces better result as compare to Sobel filtering way of doing things. In the end nerve-related/brain-related network has been used. [24]

Table 1: Comparison of image enhancement technique

REFERENCES	AUTHORS	YEAR	TECHNIQUES	FEATURE	LIMITATION
9	Aimi Salihah, A.N, M. Y Mashor,N H Harun, Azian Azamimi Abdullah, and H. Rosline	2010	Partial Contrast, Bright And Dark Stretching	visibility of image is improved	Used n factor adjustment that is 128
10	Ahmed, M.Mahmood and JasniMohamadZain.	2012	Histogram Equalization	Density changes is fulfilled	Inequality in the colour of the output
11	Cao, Gang, Yao Zhao, Rongrong Ni, and Xuelong Li	2014	Global Contrast Enhancement	Checked the stability betweenregional artifacts	Edges are degraded
12	Cheng, H. D., and Yingtao Zhang	2012	Contrast Enhancement	Used to monitor the quality of the enhanced image dynamic	Inequality in the colour of the output
13	Chen, Xiaoming, and Lili Lv	2013	Histogram Equalization Based Methods	performance is good in global contrast and local contrast enhancement with noise	Edges are degraded
14	Reshmalakshmi and M. Sasikumar	2013	Contrast Enhancement Algorithm	Resolved the limitation of the existing contrast enhancement techniques	Use n modification factor statically that is 128

III. CONCLUSION AND FUTURE SCOPE

In this paper we have discussed about various image enhancement technique and the comparison of those method are done in Table 1. Image Enhancement method are applied to provide visual clarity to the image. The algorithms used in image enhancement are effective in different type of application. When we are going to choose any of the image enhancement technique for enhancing the quality of an image we must choose the algorithm which is suitable for that condition and also check the computational cost and outcome of the image. We have seen that each technique has its own limitation. So in future we can improve the technique so that the limitation of an image can be removed and we can enhance the image in better way.

REFERENCES

[1] Haris K, Efstratiadis SN, Maglaveras N, Katsaggelos AK; Hybrid image segmentation using watersheds and fast region merging. Image Processing, IEEE Transactions on, 1998; 7(12):1684-1699.

[2] Manjot Kaur Khehra, MandeepDevgun; Survey on Image Enhancement Techniques for Digital Images, Sch. J. Eng. Tech., 2015; 3(2B):202-206.

[3] Jain AK; Fundamentals of digital image processing, Vol. 3. Englewood Cliffs: prenticeHall. 1989.

[4] Kanwal N, Girdhar A, Gupta S; Region Based Adaptive Contrast Enhancement of Medical X-Ray Images. In Bioinformatics and Biomedical Engineering,(iCBBE) 2011 5th International Conference on (pp. 1-5). IEEE. 2011.

[5] Mohanapriya N, Kalaavathi B; Comparative Study of Different Enhancement Techniques for Medical Images. International Journal of Computer Applications, 2013; 61(20).

[6] Maini R, Aggarwal H; A comprehensive review of image enhancement techniques. 2010. arXiv preprint arXiv:1003.4053.

[7] Jain R, Kasturi R, Schunck BG; Machine Vision McGRAW-HILL International Editions. New York. 1995.

[8] Russ JC; The Image Processing Handbook, CRC Press, Boca Raton, FL., 1992.

[9] Aimi Salihah, A. N., M. Y. Mashor, nor Hazlyna Harun, AzianAzamimi Abdullah, and H. Rosline. "Improving color image segmentation on acute my elogenousleukemia images using contrast enhancement techniques." In Biomedical Engineering and Sciences (IECBES), 2010 IEEE EMBS Conference on, pp. 246-251. IEEE, 2010.

[10] Ahmed, M. Mahmood, and Jasni Mohamad Zain. "A study on the validation of histogram equalization as a contrast enhancement technique." In Advanced Computer Science Applications and Technologies (ACSAT), 2012 International Conference on, pp. 253-256. IEEE, 2012.

[11] Cao, Gang, Yao Zhao, Rongrong Ni, and Xuelong Li. "Contrast enhancement-based forensics in digital images." Information Forensics and Security, IEEE Transactions on 9, no. 3 (2014): 515-525.

[12] Cheng, H. D., and Yingtao Zhang. "Detecting of contrast over-enhancement." In Image Processing (ICIP), 2012 19th IEEE International Conference on, pp. 961-964. IEEE, 2012.
[13] Chen, Xiaoming, and Lili Lv. "A Compositive Contrast Enhancement Algorithm of IR Image." In Information Technology and Applications (ITA), 2013 International Conference on, pp. 58-62. IEEE, 2013.
[14] Reshmalakshmi, C., and M. Sasikumar. "Image contrast enhancement using fuzzy technique." In Circuits, Power and Computing Technologies (ICCPCT), 2013 International Conference on, pp. 861-865. IEEE, 2013.
[15] J. Duan, G. Qiu, "Novel histogram processing for colour image enhancement", Third International Conference on Image and Graphics, 4, 2004, 55–58.
[16] S.S.Bedi, Rati Kahndelwal, "Various Image Enhancement Techniques- A Critical Review", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, Issue 3, March 2013
[17] S.D. Chen, A.R. Ramli, Contrast enhancement using recursive mean-separate histogram equalization for scalable brightness preservation, IEEE Trans. Consumer Electron. 49 (2003) 1301–1309.
[18] WangmengZuo; Lei Zhang; Chunwei Song; Zhang, D., "Texture Enhanced Image Denoising via Gradient Histogram Preservation," in Computer Vision and Pattern Recognition (CVPR), 2013 IEEE Conference on , vol., no., pp.1203-1210, 23-28 June 2013.
[19] Anisimova, E.; Bednar, J.; Pata, P., "Astronomical image denoising using curvelet and starlet transform," in Radioelektronika (RADIOELEKTRONIKA), 2013 23rd International Conference , vol., no., pp.255-260, 16-17 April 2013.
[20] Xin Zhang, Xili Jing, Image denoising in contourlet domain based on a normal inverse Gaussian prior, Digital Signal Processing, Vol.20 no.5, p.1439-1446, September, 2010.
[21] Knaus, C.; Zwicker, M., "Progressive Image Denoising," in Image Processing, IEEE Transactions on , vol.23, no.7, pp.3114-3125, July 2014.
[22] Talebi, H.; Milanfar, P., "Global Image Denoising," in Image Processing, IEEE Transactions on , vol.23, no.2, pp.755-768, Feb. 2014.
[23] Rahman, S.; Banik, P.; Naha, S., "LDA based paper currency recognition system using edge histogram descriptor," in Computer and Information Technology (ICCIT), 2014 17th International Conference on , vol., no., pp.326-331, 22-23 Dec. 2014.
[24] Yi-Qing Wang; Morel, J.-M., "Can a Single Image Denoising Neural Network Handle All Levels of Gaussian Noise," in Signal Processing Letters, IEEE , vol.21, no.9, pp.1150-1153, Sept. 2014.