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A Review on Image Enhancement Techniques

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Abstract— Image enhancement plays a fundamental role in vision applications. Enhancement is the manner of improving the superiority of an electronic digital stored image. Recently much work is completed in the field of images enhancement. Many techniques have previously been proposed up to now for enhancing the digital images. In this paper, a survey on various image enhancement techniques has been done. After surveying different techniques, it has been concluded that none of the techniques performs efficiently in all fields. Therefore the paper ends with the future scope to overcome these limitations.

Keywords: **- Image Enhancement, Clahe Contrast Enhancement.**

I. INTRODUCTION

Image enhancement plays a fundamental role in image processing applications where People (the expert) make decisions with respect to the image information. Form of image enhancement include noise reduction, edge enhancement and contrast enhancement. Enhancement may be the technique of improving the superiority of a electrically stored image. To produce a picture lighter or darker or to increase or decrease contrast. Image enhancement is to improve the sensitivity of information in images for human viewers, or to offer enhanced input for other regular image processing techniques. In this procedure, more than one attributes of the image are customized. The possibility of attributes and the direction they are customized are specific to certain task.

Fig 1: showing effects of image enhancement (a) Original image (b) Enhanced image

II. CONTRAST ENHANCEMENT

The target of contrast enhancement is to obtain better visibility of image details without introducing impractical visual appearances and unnecessary artifacts. Contrast Enhancement tunes the intensity f every pixels magnitude base on its surrounding pixels. Contrast enhancement is classified into indirect and direct method of contrast enhancement. Histogram equalization and histogram specification are two well-known indirect methods and contrast enhancement known as direct method.

Fig: (a) Original image (b) Enhanced image

III. CONTRAST ENHANCEMENT TECHNIQUES

Conventional techniques for contrast enhancement include gray-level transformation based techniques and histogram based processing techniques (viz., histogram equalization (HE), adaptive histogram equalization (AHE), etc.). Other advanced histogram based enhancement methods include bi-histogram equalization (BHE), block-overlapped histogram equalization, and multi-scale adaptive histogram equalization**.** Some techniques also explain that used for:

A. Histogram Equalization

Histogram basically is a graphic representation of the distribution of data. The histogram shows how certain times a specific gray level (intensity) appears in an image. Histogram equalization is a technique for enhancing the contrast and contrast adjustment in image processing. This technique utilized in various applications areas such as example for medical image processing, object tracking, speech recognition, give the better views of bone structure in x-ray images, and to enhanced detail in photographs backgrounds and foregrounds which can be both bright or both dark.

B. Adaptive Histogram Equalization(AHE)

It's used to enhance contrast in images. Histogram equalization emphasize only on local contrast place of overall contrast. Adaptive histogram equalization overcomes from this issue, this technique applicable for overall techniques. once the image contains regions that are extensively lighter and darker, the contrast in those regions will not be adequately enhanced. So adaptive histogram equalization computed properly image regions.

C. Gray Scale Grouping (GLG)

The fundamental objective of Gray Level Grouping (GLG) is to attain a uniform histogram for a low contrast color image. GLG utilizes the grayscale in a far more controlled and efficient manner, thus spreading the different parts of

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histogram by grouping the different section of in to a suitable amount of gray-level bins according for their amplitudes ensuring a decrease in how a lot of gray bins.

D. Fuzzy Logic

Fuzzy-logic has been efficiently found in different elements of image processing. Recently fuzzy based algorithms for image enhancement have been developed with better performance com-pared to conventional and other advanced techniques like GLG. Fuzzy image processing includes mainly three stages: image fuzzification, modification of membership values, and, if necessary, image defuzzification. After the image data are transformed from gray-level domain to the fuzzy membership domain (fuzzification), appropriate fuzzy techniques modify the membership values.

E. Tabu serach

Tabu searches actually a met heuristic based method, this algorithm that can be used for solving combinatorial optimization problems (problems where a maximum ordering and choice of options is desired) and mathematical optimization. Local searches have a potential means to fix a problem and check its immediate neighbors (solutions that are similar except for 1or 2 minor details) in the hope of finding a better solution and here many solutions are equally fit. Current applications use full for resource planning, telecommunications, VLSI design, scheduling, space planning, molecular engineering, logistics, pattern classification, biomedical analysis, etc. The memory structures used in tabu search can be divided into three categories: Short-term, intermediate-term, long-term.

IV. LITERATURE SURVEY

In this we make a short overview of most popular image enhancement methods. But we mainly focus on the functional aspects of the methods. A brief summary of the literature is given below: Aimi et al. (2010) [1] presented a two phase methodology to manage to obtain a totally segmented abnormal white blood cell (blast) and nucleus in acute leukemia images. In the initial phase, the three contrast enhancement techniques which are partial contrast, bright stretching and dark stretching were used to enhance the image quality.

Contrast enhancement techniques enhanced the region of interest of acute leukemia for easing the segmentation process. Within the next phase, image segmentation based on HSI (Hue, Saturation, and Intensity) color space has been proposed. The proposed technique helps to boost the image visibility and has successfully segmented the acute leukemia images into two primary components: blast and nucleus. The combination b/w contrast enhancements and image segmentation has good effect on improving the accuracy of segmentation. Hence, information gain from the resultant images would become useful for hematologists to help analysis the type of acute leukemia. Ahmed et al. (2012) [2] aimed to discover the factual nature of transformation functions employed by HE. To comprehend these mathematical calculations thoroughly, the paper dismantles HE into it building blocks. These blocks are, then, critically analyzed to comprehend the actual relationship between HE fundamentals and contrast. This analysis' determines that HE manipulates density - not contrast - which, consequently, achieves density changes but no contrast enhancement. Cao et al. (2014) [3] proposed two novel algorithm detect the contrast enhancement involved manipulations in digital images. First, they dedicated to the detection of global contrast enhancement placed to the previously JPEG-compressed images, which are widespread in real applications. The positions of detected block-wise peak/gap bins are clustered for recognizing the contrast enhancement mappings placed on different source regions. The consistency between regional artifacts is checked for discovering the image forgeries and locating the composition boundary. Extensive experiments have verified the effectiveness and efficacy of the proposed techniques. Celik et al. (2014) [4] proposed a work of fiction algorithm which enhanced the contrast of an insight image using spatial information of pixels. The algorithm introduced a brand new method of compute the spatial entropy of pixels using spatial distribution of pixel gray levels. Different set alongside the conventional methods, this algorithm considered the distribution of spatial locations of gray degree of a picture in the place of gray-level distribution or joint statistics computed from the gray degrees of an image. For each gray level, the corresponding spatial distribution is computed employing a histogram of spatial locations of most pixels with the exact same gray level. Furthermore, this technique is along side with transform domain coefficient weighting to attain both local an global contrast enhancement at the exact same time. Experimental results prove that the proposed algorithms produce better or comparable enhanced images than several state-of-the-art algorithms.

Cheng et al. (2012) [5] proposed a work of fiction approach for the detection of over-enhancement. The main element contributions of the paper are as follows. The causes for generating over-enhancement are investigated and analysed deeply. An objective criterion for detecting over-enhancement is proposed. The experimental results demonstrate that the proposed approach can locate the over enhanced areas accurately and effectively, and offer a quantitative criterion to gauge the over-enhancement levels well. The proposed approach is probably be great for dynamically monitoring the grade of the enhanced image, and optimizing the parameter settings of the contrast enhancement algorithms. Chen et al. (2013) [6] proposed a competitive contrast enhancement algorithm. which combines histogram equalization based methods (HEBM) and a multi-scales un-sharp masking based methods (UMBM). This proposed algorithm uses HEBM to attain global contrast enhancement and UMBM to attain local

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multi-scales contrast enhancement. First, they reviewed the techniques developed in the literature for contrast enhancement. After then, they introduced the modern algorithm in details. The performance of the proposed method is studied on experimental IR data and equate to those yielded by two well established algorithms. The developed algorithm has good performance in global contrast and local contrast enhancement with noise and artifact suppression Huang et al. (2014) [7] proposed a work of fiction hardware-oriented contrast enhancement algorithm that will be often implemented effectively for hardware design. The proposed h/w -oriented contrast enhancement algorithm achieves good image quality by measuring the outcomes of qualitative and quantitative analyses. To decrease hardware cost and improve hardware utilization for real-time performance, a decline in circuit area is proposed through utilization of parameter-controlled reconfigurable architecture. The experiment result proved that the proposed hardware-oriented contrast enhancement algorithm provides the typical frame rate of 48.23 frames/s at hd resolution 1920 × 1080.

Jha et al. (2013) [8] if A contrast enhancement technique using scaling of internal noise of a dark image in discrete cosine transform (DCT) domain. This transition is effected by the inner noise present because of not enough sufficient illumination and could be modelled with a general bit able system exhibiting dynamic stochastic resonance. The proposed technique adopts a near adaptive processing and significantly enhances the image contrast and color information while ascertaining good perceptual quality. When compared with the existing enhancement techniques such as for instance like adaptive histogram equalization, modified high-pass filtering, multi-contrast enhancement,multi-contrast enhancement with dynamic range compression, color enhancement by scaling, the proposed technique gives remarkable performance with regards to relative contrast enhancement, colourfulness and visual quality of enhanced image. Kil et al. (2013) [9] proposed a dehazing algorithm predicted on dark channel prior and contrast enhancement approaches. The typical dark channel prior method removes haze and thus restores colors of objects in the scene; nonetheless it doesn't consider the enhancement of image contrast.

On the contrary, the image contrast method improves the local contrast of objects, nevertheless the colors are generally distorted consequently of to the over-stretching of contrast. The proposed algorithm combines the advantages of those two conventional approaches for keeping the colour while dehazing. On the basis of the experimental results, the proposed approach compensates for the disadvantages of conventional methods, and enhances contrast with less color distortion. Madhu et al. (2013) [10] If discussed various enhancement schemes are used for enhancing A new fuzzy logic and histogram based algorithm for enhancing low contrast color images has been proposed here. It is based on two important parameters M and K, where M is the average intensity value of the image, calculated from the histogram and K is the contrast intensification parameter. The given RGB image is converted into HSV color space to preserve the chromatic information contained in the original image. To enhance the image, only the V component is stretched under the control of the parameters M and K. The performance of the different contrast enhancement algorithms are evaluated based on the visual quality, CII and the computational time. On the basis of the performance analysis, we advocate which our proposed Fuzzy Logic method is suitable for contrast enhancement of low contrast color images. Maragatham et al. (2013) [11] proposed an algorithm to model images which include local contrast measure to classify and distinguish relating to the images having different contrast level. The input image is classified either as low contrast or high contrast image used the model. If the classified image is low contrast it will be enhanced utilizing the Stochastic Resonance principle.

The outcomes demonstrate that the proposed automated procedure enhances the low contrast image better in comparison to conventional enhancement methods. Nercessian et al**.** (2013) [12] proposed an enhancement procedure. The advantages of the proposed method included the integration of both luminance and contrast masking phenomena; the extension of non-linear mapping schemes to human visual system inspired multi-scale contrast coefficients; the extension of human visual system-based image enhancement approaches to the stationary and dual-tree complex wavelet transforms, and an immediate way of; adjusting overall brightness; and achieving dynamic range compression image enhancement direct multi-scale enhancement framework. Experimental results demonstrated the ability of the proposed algorithm to attain simultaneous local and global enhancements. Reshmalakshmi et al. (2013) [13] managed with a new contrast enhancement algorithm, which maps elements from pixel plane to membership plane and to enhancement/transform plane. Shortcomings of existing contrast enhancement techniques are rectified to the help of mathematical tools is called `Fuzzy set '. These fuzzy sets could be modules to handled the uncertainty and/or vagueness linked to images. To assess the performance, this new algorithm is applied on different images and few evaluation parameters are calculated, which proved the improvement over several other existing contrast enhancement techniques predicated on fuzzy sets. Schouhan et al. (2013) [14] proposed a energetic stochastic resonance (DSR)-based technique in spatial domain for the enhancement of dark- and low-contrast images. Stochastic resonance (SR) is really a phenomenon in that your performance of a method (low-contrast image) could be improved by addition of noise. When compared with the existing enhancement techniques such as for example for instance adaptive histogram equalization, gamma correction, single-scale retinex,

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multi-scale retinex, modified high-pass filtering, edge-preserving multi-scale decomposition and automatic controls of popular imaging tools, such as for example for instance adaptive histogram equalization the proposed technique gives significant performance in terms of contrast and color enhancement alongside perceptual quality. Sundaram et al. (2014) [15] proposed the Histogram Modified Contrast Limited Adaptive Histogram Equalization (HM CLAHE) to regulate this level of contrast enhancement, which regularly give you the resultant image a strong contrast and brings the location details for more relevant interpretation. It incorporates both histogram modifications as an optimization technique and Contrast Limited Adaptive Histogram Equalization. This method has been tested for Mias mammogram images. The performance of this method is set utilizing the parameter like Enhancement Measure (EME). From the subjective and quantitative measures it's interesting this proposed technique provides better contrast enhancement with preserving the neighbourhood information of the mammogram images.

V. COMPARISON TABLE

Table 1: Comparison table for various techniques

REFERENCES	AUTHORS	YEAR	TECHNIQUES	FEATURES	LIMITATIONS
[1]	Aimi Salihah, A. N., M. Y. Mashor, Nor Hazlyna Harun, Azian Azamimi Abdullah, and H. Rosline	2010	partial contrast, bright stretching and dark stretching	improve the image visibility and has successfully segmented the acute leukaemia images	Used k adjustment factor statically i.e. 128
[2]	Ahmed, M. Mahmood, and Jasni Mohamad Zain.	2012	Histogram Equalization	achieves density changes	Imbalance the color of the output image
[3]	Cao, Gang, Yao Zhao, Rongrong Ni, and Xuelong Li	2014	global contrast enhancement	consistency between regional artifacts is checked	Lead to degraded edges
[4]	Celik, Turgay	2014	**II.** SPATIAL ENTROPY-BASED GLOBAL AND LOCAL IMAGE CONTRAST ENHANCEMENT	achieves contrast improvement in the case of low-contrast images	Used k adjustment factor statically i.e. 128
[5]	Cheng, H. D., and Yingtao Zhang	2012	contrast enhancement	useful for dynamically monitoring the quality of the enhanced image	Imbalance the color of the output image
[6]	Chen, Xiaoming, and Lili Lv	2013	histogram equalization based methods (HEBM) and an multi-scales unsharp masking based methods (UMBM)	good performance in global contrast and local contrast enhancement with noise and artifact suppression	Lead to degraded edges
[7]	Huang, S., and W. Chen	2014	hardware-oriented contrast enhancement algorithm	decrease hardware cost and improve hardware utilization for real-time performance	Used k adjustment factor statically i.e. 128

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[8]	Jha, Rajib Kumar, Rajlaxmi Chouhan, Prabir Kumar Biswas, and Kiyoharu Aizawa.	2012	discrete cosine transform (DCT) domain	remarkable performance in terms of relative contrast enhancement, colorfulness and visual quality of enhanced image	Imbalance the color of the output image
[9]	Kil, Tae Ho, Sang Hwa Lee, and Nam Ik Cho	2013	CHANNEL PRIOR AND CONTRAST ENHANCEMENT	enhances contrast with less color distortion	Lead to degraded edges
[10]	Madhu S. Nair. And G. Raju	2013	fuzzy logic and histogram based algorithm	well suited for contrast enhancement of low contrast color images	Used k adjustment factor statically i.e. 128
[11]	Maragatham, G., and S. Md Mansoor Roomi	2013	automatic contrast enhancement method based on stochastic resonance	enhances the low contrast image	Imbalance the color of the output image
[12]	Nercessian, Shahan C., Karen A. Panetta, and Sos S. Agaian	2013	multi-scale image enhancement algorithm	achieve simultaneous local and global enhancements.	Lead to degraded edges
[13]	Reshmalakshmi, C., and M. Sasikumar	2013	contrast enhancement algorithm	Shortcomings of existing contrast enhancement techniques are rectified	Used k adjustment factor statically i.e. 128
[14]	SChouhan, Rajlaxmi, Rajib Kumar Jha, and Prabir Kumar Biswas	2013	dynamic stochastic resonance (DSR)-based technique	gives significant performance in terms of contrast and colour enhancement	Imbalance the color of the output image.
[15]	Sundaram, M., K. Ramar, N. Arumugam, and G. Prabin	2011	Histogram Modified Contrast Limited Adaptive Histogram Equalization	provides better contrast enhancement	Lead to degraded edges

VI. CONCLUSION AND FUTURE SCOPE

In this paper, a survey on various image enhancement techniques has been done. From the survey, it has been found the existing fuzzy based image enhancement techniques have used k adjustment factor statically i.e. 128. Also most of the methods depends upon certain predefined rules no concentrate on the objects or regions in the given image; so may imbalance the color of the output image. Moreover edges plays significant role in vision processing but image enhancement technique may of the output image. More ever, edges plays significant role in vision processing but image enhancement technique may change the edges too. So can lead to degraded edges. Therefore to overcome these issues, in near future, a new technique will be proposed which will evaluate k factor automatically using the ant colony

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optimization to find the best similarity value among the given set of values which represents the image in more efficient manner.

REFERENCES

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

[2] 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.

[3] 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.

[4] Celik, Turgay. "Spatial Entropy-Based Global and Local Image Contrast Enhancement." (2014).

[5] 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.

[6] 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.

[7] Huang, S., and W. Chen. "A New Hardware-Efficient Algorithm and Reconfigurable Architecture for Image Contrast Enhancement." (2014).

[8] Jha, Rajib Kumar, Rajlaxmi Chouhan, Prabir Kumar Biswas, and Kiyoharu Aizawa. "Internal noise-induced contrast enhancement of dark images." In Image Processing (ICIP), 2012 19th IEEE International Conference on, pp. 973-976. IEEE, 2012.

[9] Kil, Tae Ho, Sang Hwa Lee, and Nam Ik Cho. "A dehazing algorithm using dark channel prior and contrast enhancement." In Acoustics, Speech and Signal Processing (ICASSP), 2013 IEEE International Conference on, pp. 2484-2487. IEEE, 2013.

[10] Madhu S. Nair. And G. Raju "A fast and efficient color image enhancement method based on fuzzy logic and histogram". IEEE Trans Syst Man Cybern 1981;SMC-11(July (2013):494–501ss[6]

[11] Maragatham, G., and S. Md Mansoor Roomi. "An automatic contrast enhancement method based on stochastic resonance." In 2013 Fourth International Conference on Computing, Communications and Networking Technologies (ICCCNT), pp. 1-7. IEEE, 2013.

[12] Nercessian, Shahan C., Karen A. Panetta, and Sos S. Agaian. "Non-linear direct multi-scale image enhancement based on the luminance and contrast masking characteristics of the human visual system." Image Processing, IEEE Transactions on 22, no. 9 (2013): 3549-3561.

[13] 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.

[14] SChouhan, Rajlaxmi, Rajib Kumar Jha, and Prabir Kumar Biswas. "Enhancement of dark and low-contrast images using dynamic stochastic resonance." *IET Image Processing* 7, no. 2 (2013): 174-184.

[15] Sundaram, M., K. Ramar, N. Arumugam, and G. Prabin. "Histogram based contrast enhancement for mammogram images." In Signal Processing, Communication, Computing and Networking Technologies (ICSCCN), 2011 International Conference on, pp. 842-846. IEEE, 2011.