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REVIEW ARTICLE

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CONTRAST ENRICHMENT TECHNIQUES: A REVIEW

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ABSTRACT
Image enhancement plays an important role in computer vision. The degraded image, blurred image and noised image effect the medical diagnosis of image data, satellite image for information retrieval. Various authors and researcher propose a method of image enhancement such as histogram equalization, multi-point histogram equalization and some method based on neural network and wavelet threshold. Wavelet is very important transform function for image enhancement. Wavelet transform function decomposed layer wise one layer is called details layer and another layer is called approximation layer. The details layer acts as threshold function and approximate layer is processing of image enhancement. For the processing of neural network used approximate layer data. The use of neural network in image enhancement gives a better performance in compression of all conventional enhancement technique. This paper contains a short introduction of latest literature on image enrichment techniques studied for finding best image enhancement technique for the future work of our project work.

Key Words—image enhancement, histogram equalization

I. INTRODUCTION

Image enhancement is basically improving the interpretabil- ity or perception of information in images for human viewers and providing better input for other automated image process- ing techniques. The main objective of image enhancement is to modify attributes of an image to make it more suitable for a given task and a specific spectator. For the duration of this process, one or more characteristic of the image are customized. The alternative of attributes and the way they are customized are specific to a given problem. Moreover, observer-specific factor, such as the person visual system and the observer's experience, will bring in a great deal of subjectivity into the choice of image enhancement methods. There exist many methods that can enhance a digital image without spoiling it. Image enhancement improves the quality (clarity) of images for human presentation. Eliminating blur- ring and noise, increasing contrast, and enlightening details are examples of enhancement operations. For example, an image might be chosen of an endothelial cell, which may be of low contrast and little blurred. Decrementing the noise and blurring and incrementing the contrast range could enhance the image. The real image might have areas of very high and very near to the ground intensity, which facade details [ ]. An adaptive enhancement algorithm unhides these de- tails. Adaptive

algorithms correct their operation based on the image information (pixels) which is processed. In this scenario the mean intensity, contrast, and sharpness (amount of blur removal) could be adjusted based on the pixel intensity statistics in various areas of the image. Contrast enhancement is essential to improve substandard images that are captured in extreme lighting conditions, such as excessively bright ordark environments that produce low contrast images, This paper is organized as follows. In Section II short review of the latest papers on Image contrast Enhancement techniques is presented. Section III contains list of different contrast Enhancement techniques. finally we conclude about this work on the basis of this literature survey.

II. LITERATURE SURVEY

This section contains short review on latest literature pub- lished in year 2014-15 in various IEEE journals or conferences on different contrast enhancement techniques

Wei Fan, Kai Wang, Francois Cayre, and Zhang Xiong [1] proposed an image variational deconvolution framework for both quality enhancement and antiforensics of median filtered images. The proposed optimizationbased framework consists of a convolution term, a fidelity term with respect to the median filtered image, and a prior term. The first term is for the approximation of the median filtering process, using a con- volution kernel. The second fidelity term keeps the processed image to some extent still close to the median filtered image, retaining some denoising or other image processing artifact hiding effects.

Hongteng Xu, Guangtao Zhai, Xiaolin Wu, and Xiaokang Yang[2] proposed a generalized equalization model for image enhancement. Based on analysis on the relationships between image histogram and contrast enhancement/ white balancing, first establish a generalized equalization model integrating contrast enhancement and white balancing into a unified framework of convex programming of image histogram. They show that many image enhancement tasks can be accomplished by the proposed model using different configurations of pa- rameters. With two defining properties of histogram transform, namely contrast gain and nonlinearity, the model parameters for different enhancement applications can be optimized.

Tarun Kumar Agarwal, Mayank Tiwari, Subir Singh Lamba[3] proposed a method named Modified Histogram Based Contrast Enhancement using Homomorphic Filtering" (MH-FIL) for medical images. This method uses two step processing, in first step global contrast of image is enhanced using histogram modification followed by histogram equal- ization and then in second step homomorphic filtering is used for image sharpening, this filtering if followed by image normalization. To evaluate the effectiveness of method choose two widely used metrics Absolute Mean Brightness Error (AMBE) and Entropy.

David Menotti, Laurent Najman, Jacques Facon, Arnaldo deA. Araujo and Gisele L. Pappa [4] proposed two methodolo- gies for fast image contrast enhancement based on histogram equalization (HE), one for gray-level images, and other for colour images. For gray-level images, they propose a technique called Multi-HE, which decomposes the input image into sev- eral sub-images, and then applies the classical HE process to each one of them. In order to decompose the input image, we propose two different discrepancy functions, conceiving two new methods. Experimental results show that both methods are better in preserving the brightness and producing more natural looking images than other HE methods. For colour images, they introduce a generic fast hue-preserving histogram equalization method based on the RGB colour space, and two instantiations of the proposed generic method, using 1D and 2D histograms.

Bibo Lu, Hui Wang, Chunli Miao et. al [5] proposed a method which is based on wavelet of coefficient which merge the coefficients in an appropriate way in order to obtain the best quality in the fused image. In This method first source images are decomposed into low frequency and high frequency sub-bands then the wavelet coefficients are combined to obtain the new coefficients of the fused image. Different strategies are performed for

low and high frequency coefficients. In low frequency coefficient, most of image information is concentrated and combined with weighted average to yield new coefficients. Wavelet method is an efficient tool for image enhancement. The critical task in image fusion is the combination rules for high frequency coefficients, which contain an abundance of image edge information.

In this paper Amir Yavariabdi, Chafik Samir, Chafik Samir et.al [6] proposed a method for 3D image resolution en- hancement based on discrete stationary wavelet transforms to generate sharp high resolution images. They first increase the quality of edges using a shape function and then use both the discrete and stationary wavelet transforms to decompose the resulting image into low and high frequency sub-bands. The proposed method shows that the results obtained in [6], in the 2D case. To assess the efficiency of our method, we have considered comparisons with some conventional and state-of- art image resolution techniques such as bi-linear, Wavelet Zero Padding (WZP), Discrete Wavelet Transform Based Image Enhancement and Image Enhancement by using Discrete and Stationary Wavelet Decomposition [6]. In this Paper the 2D version of the proposed method outperforms. The proposed method preserves more high frequency components after the corrections obtained by computing the mean of high frequency sub-bands than interpolating the input image directly.

N. Mohanapriya et.al [7], B. Kalaavathi, takes the compar- ative study of enhancement technique, described the Spatial domain method briefly. Spatial domain refers to the aggregate of pixels composing an image and it is denoted by P (X, Y) = output image, input image is a transformation operator; it is to define the some near point of (x, y). To defining the near point of (X, Y) can use a square or rectangular sub image at (X, Y). The centre of image is moved from pixel to pixel and starting at the top left corner. T is the transform operator applied to each location (X, Y) to yield the output of that location. Spatial Enhancement methods are mainly used in different field like satellite image and medical image analysis. The results showed that improved image quality, structural appearance of input image and also noises were removed from an image. This method implemented only for grey level images. The same process can be extended for the color images too.

Chaira et.al [8] author proposed a type II fuzzy set method. In this first upper and lower membership functions are cal- culated by using eq. Fuzzy linguistic hedges generate lower and upper membership function of type I fuzzy membership function. In this proposed method used a function alpha with some values. When the value of the function is increased then the quality of the image is also increased and the obtained enhanced image has a better contrast. Thus, with a higher value of function the membership values are feasible and so enhanced image are also better. In this method enhanced image is less than original image.

Adin Ramirez Rivera, Byungyong Ryu, and Oksam Chae, Content-Aware Dark Image Enhancement Through Channel Division, 2012[9] proposed a content-aware algorithm that enhances dark images, sharpens edges, reveals details in textured regions, and preserves the smoothness of flat regions. This algorithm produces an ad hoc transformation for each image, adapting the mapping functions to each images characteristics to produce the maximum enhancement. They analyzed the contrast of the image in the boundary and textured regions, and group the information with common characteristics. These groups model the relations within the image, from which the transformation functions were extracted. The results were then adaptively mixed, by considering the human vision system characteristics, to boost the details in the image.

Deepak Ghimire and Joonwhoan Lee Nonlinear Transfer Function-Based Local Approach for Color Image Enhance- ment 2011[10] proposed a method in which the image en- hancement was applied only on the V (luminance value) component of the HSV color image and H and S component were kept unchanged to prevent the degradation of color balance between HSV components. The V channel was enhanced in two steps. First the V component image was divided into

smaller overlapping blocks and for each pixel inside the block the luminance enhancement was carried out using nonlinear transfer function. In the second step, each pixel was further enhanced for the adjustment of the image contrast depending upon the center pixel value and its neighborhood pixel values. Finally, original H and S component image and enhanced V component image were converted back to RGB image.

Sudharsan Parthasarathy, Praveen Sankaran Fusion Based Multi Scale RETINEX with Color Restoration for Image En- hancement 2012[11] proposed that a fusion based approach on Multi Scale Retinex with Color Restoration(MSRCR) would give better image enhancement. Lower dynamic range of a camera as compared to human visual system causes images taken to be extremely dependent on illuminant conditions. MSRCR algorithm enhances images taken under a wide range of nonlinear illumination conditions to the level that a user would have perceived it in real time. One of the enhancement techniques that tries to achieve color constancy is Retinex. In Multi Scale Retinex(MSR),they average multiple SSR(Single Scale Retinex) images to obtain a net improved image.

S. Bronte, L. M. Bergasa, P. F. Alcantarilla, Fog Detection System Based on Computer Vision Techniques, [12] proposed a real-time fog detection system using an on-board low cost black and white camera, for a driving application. This system was based on two clues: estimation of the visibility distance, which was calculated from the camera projection equations and the blurring due to the fog. Because of the water particles floating in the air, sky light gets diffuse and, focus on the road zone, which is one of the darkest zones on the image. The apparent effect is that some part of the sky introduces in the road. Also in foggy scenes, the border strength is reduced in the upper part of the image. These two sources of information were used to make the system more robust. The final purpose of this system was to develop an automatic vision-based diagnostic system for warning ADAS of possible wrong working conditions.

Zhang Chaofu, MA Li-ni, Jing Lu-na , Mixed Frequency domain and spatial of enhancement algorithm for infrared image, 2012 [13] proposed a hybrid technique to enhance the image. It makes use of the Gauss filter processing to enhance image details in the frequency domain and smooth the contours of the image by the top-hat and bot-hat transforms in spatial domain. To enhance the infrared image, this algorithm did not enhanced only the details of the image, but the outline of the image had also been smooth.

F. A. Poljicak, L. Mandic, M. Strgar Kurecic , Improvement of the Watermark Detector Performance Using Image En- hancement Filters,2012[14] considered the influence of some image processing techniques on the watermark detection rate. Watermarking methods are still very sensitive to complex degradation attacks such are JPEG compression, or printscan process, so the detection rate of a watermark method decreases considerably after such attacks on a watermarked image. To improve the detection rate they reduced the degradation of the image by using unsharp, Laplacian or deconvolution filter. For the experiment dataset of 1000 images were watermarked and then compressed or printed and scanned. Degraded images were enhanced using unsharp, Laplacian and blind deconvo- lution filter. The watermark detection rate before and after enhancement was measured and compared.

Seung-Won Jung, Jae-Yun Jeong, and Sung-Jea Ko , Sharp- ness Enhancement of Stereo Images Using Binocular Just- Noticeable Difference,2012 [15] proposed a new sharpness enhancement algorithm for stereo images.. They introduced a novel application of the BJND model for the sharpness en- hancement of stereo images. An efficient soliution for reducing the overenhancement problem in the sharpness enhancement of stereo images was proposed. The solution was found within an optimization framework with additional constraint terms to suppress the unnecessary increase in luminance values. In addition, the reliability of the BJND model was taken into account by estimating the accuracy of stereo matching.

Hong ZhangQian ZhaoLu Li, Yue-cheng LiYu-hu You , Muti-scale Image Enhancement Based on

Properties of Human Visual System,2011[16] utilized the LIP(logarithmic image processing) model and considered the characteristics of the human visual system (HVS) to propose a new multi-scale enhancement algorithm. Then a new measure of enhancement based on JND model (Just Noticeable Difference, JND) of human visual system was proposed and used as a tool for evaluating the performance of the enhancement technique. Rajib Kumar Jha, Rajlaxmi Chouhan, P. K. Biswas, Noise-induced Contrast Enhancement of Dark Images using Non- dynamic Stochastic Resonance, 2012 [17] proposed a non- linear non-dynamic stochastic resonance-based technique for enhancement of dark and low contrast images. A low contrast image was treated as a subthreshold signal and noise-enhanced signal processing was applied to improve its contrast. The proposed technique uniquely utilized the addition of exter- nal noise to neutralize the effect of internal noise (due to insufficient illumination) of a low contrast image. Random noise was added repeatedly to an image and was successively hard-thresholded followed by overall averaging. By varying the noise intensities, noise induced resonance was obtained at a particular optimum noise intensity. Performance of the proposed technique had been investigated for four types of noise distributions - gaussian, uniform, poisson and gamma. Quantitative evaluation of their performances had been done in terms of contrast enhancement factor, color enhancement and perceptual quality measure.

Khairunnisa Hasikin, Nor Ashidi Mat Isa, Enhancement of the low contrast image using fuzzy set theory, 2012[18] proposed a fuzzy grayscale enhancement technique for low contrast image. This technique was proposed by maximizing fuzzy measures contained in the image. The membership function was then modified to enhance the image by using power-law transformation and saturation operator.

K. Mussarat Yasmin, Muhammad Sharif, Saleha Masood, Mudassar Raza and Sajjad Mohsin , Brain Image Enhancement A Survey,2011 [19] The basic purpose of enhancement operation is to analyze the brain images precisely in order to effectively diagnose and examine the diseases and problems. Brain imaging provides a way to investigate and determine brain related diseases in an efficient and effective manner. The basic objective of this study was to evaluate and discuss different techniques and approaches proposed in order to handle different brain imaging types. The paper provided a short overview of different methods presented in the prospect of brain image enhancement.

III. CONCLUSION

Finally we conclude our work based on the literature studied as per previous literature if we choose generalized equalization model other than various contrast enhancement techniques such as Histogram equalization, Bi-histogram equalization, Neuro-Fuzzy System, Artificial Neural Network An Arti- ficial Neural Network etc. equalization model gives good performances in many typical applications including image contrast enhancement, tone correction, white balancing and post-processing of de-hazed images. it a also offers the fast speed of convergence and outstanding results problems and present both the best cost function and the best visual aspects of the enhanced images

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