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A Review of Various Techniques for Contrast Image Enhancement

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ABSTRACT
There are some images which are taken in poor lighting condition. In order to enhance these kinds of images morphological transformation are used which are mainly used to detect the background of images. In order to enhance these images contrast image enhancement is used. Weber's law is used to enhance the contrast of image. It uses to operators, the first operator uses block analysis and the second uses opening by reconstruction. Other methods for contrast enhancement are logarithm transform, power-law transform, histogram statistics and contrast stretching.
Keywords:- weber's law, morphological transformation, block analysis, opening by reconstruction.

I. INTRODUCTION

In this world there are number of images. These images consist of objects and scenes. Images consists of grey level and colors which are represented by pixels. When the humans and machines analyses any image there is the necessity to improve the appearance of image. In order to increase appearance of image many image enhancement techniques are used. The image enhancement techniques can be objective or subjective. This depends upon the application where the image enhancement technique is to be used.

There are some methods which are used to increase the contrast of the image by using Fast Fourier Transform and histogram equalization technique. There are methods are used to detect the background of images. There are also some operators which are also used to enhance and normalize the contrast of image. These contrast operators are based on the logarithm function using Weber's law.

For the image processing technique there is the need to analyze the contrast sensitivity of any image. The contrast C of an object with luminance L max for the surrounding luminance L min is given as below

$$C = \frac{Lmax - Lmin}{Lmin} \quad (1)$$

C – Contrast of the image, L max - Luminance of the image and L min – Luminance of the surroundings.

Above equation can be written as can be rewritten as follows for the condition, L min = L and $\Delta L = L$ max – L min,

$$C = \frac{\Delta L}{L} \quad (2)$$

In the Weber's law by taking the luminance L is considered as the grey level intensity of an image. Above equation indicates that $\Delta(\log L)$ is proportional to C ; therefore above equation can be written as

$$C = k \log L + b \quad L > 0 \quad (3)$$

The above equation has the logarithmic relation. The significance of logarithm function is to avoid abrupt changes in lighting. 'C' is the contrast, 'k' and 'b' are constants, 'b' indicates the background parameter and 'k' is the scaling factor for enhancement.

The approximation to Weber's law is given by taking the luminance L as the grey level intensity of an image hence we get,

$$C = k \log f + b \quad f > 0 \quad (4)$$

Logarithm transform is a kind of method in which the narrow range of the low grey level values in the input image are mapped into the wider range of the output image. The general equation is given by

$$s = c * \log(1 + r) \quad (5)$$

where s is the output, r is the input and c is the constant

In power-law transform the value of each pixel is raised to a fixed power. The general equation is given by

$$s = cr^{\gamma} \quad (6)$$

where s is the output, r is the input and c and γ are the constants

One of the easiest methods for image enhancement is contrast stretching wherein we need to increase the dynamic range of the grey level of the image. Its general equation is given by

$$s = \frac{1}{1 + (m/r)^E} \quad (7)$$

where r are the input image values, s are the output image values, m is the thresholding value and E the slope

II. RELATED WORK

Akiko Yoshida, Grzegorz Krawczyk, Karol Myszkowski, Hans-Peter Seidel Max-Planck proposed perception based contrast enhancement which presents the contrast in the image which is described by using power function[1]. This method uses exponent which is used to specify the change in the contrast of image. In this method the authors build the model in such a way that it shows the relationship between physical and the contrast change in the image. In order to capture the change in the contrast of the image irrespective of the luminance and local contrast of the image, the contrast factor is used. The author conducts two images for the complex images one is the contrast scaling and the other is the contrast discrimination threshold. The image consists of varying luminance level. A model is built which establishes the relationship between the physical and the perceived contrast of the image at these luminance levels.

Ivan R. Terol-Villalobos describes contrast enhancement based on a composition of contrast operators. Contrast operators are constructed by using the opening and closing by reconstruction. In this method opening is used for the operator to be used in the bright region and closing is used for the operator in the dark region [2]. The author also uses top-hat transform so that the region will selected in such a way that this region remains with the original image and by using opening and closing the other regions are attenuated. Thus a good contrast is obtained in the output image. By using this method two state contrasts is formed and hence contrast of high level is obtained.

Alexander Toet, uses image fusion in which image is fused by using sensing modalities of visual display. The image is fused by nonlinear recombination of ratio of low pass pyramidal decomposition [3]. This method is dependent on contrast and mean grey level of input image. As stated above by the use of the nonlinear recombination of ratio of low pass pyramidal decomposition the author use the multiplication of the results obtained by the above method. In order to get the low pass pyramid for the combined image nodes are selected which has the maximum grey level contrast from the nodes of the individual images consisting of ratio of low pass pyramid.

Susanta Mukhopadhyay, Bhabatosh Chanda uses multiscale morphology. In this method the conventional method of local contrast enhancement is extended. The aim of this method is to filter the bright and the dark characteristics of the image. In order to achieve the low contrast enhancement of images the authors uses top-hat transform so as to extract the specific features of the image [4]. These extracted features are then enhanced and combined together to get the final image.

Tae Keun Kim, Joon Ki Paik and Bong Soon Kang propose the adaptive histogram equalization also called as blocked overlapped histogram equalization. In this method the contrast of the image sequences are enhanced. Contrast of the image is obtained by taking the ratio of the brightest and the darkest intensity pixel which provides the dynamic range of the image. In other words blocked overlapped algorithm depends on the intensity of the neighboring pixels [5].

Yu Wang, Qian Chen, Baomin Zhang describes sub image histogram equalization method. In this method, based on the probability function the image is divided into two parts and histogram equalization is applied on each of these images separately [6]. At the last stage these sub divided images are combined together to get the final results.

Yeong-Taeg Kim presents the Brightness Preserving Bi-Histogram Equalization method. The essence of the proposed algorithm is to utilize independent histogram equalizations separately over two sub images obtained by decomposing the input image based on its mean with a constraint that the resulting equalized sub images are bounded by each other around the input mean [7].

III. CONCLUSION

In this paper a method is introduced to detect the image background and to enhance the contrast in grey level images in poor lighting. In this paper, firstly we give introduction about basic concepts used in this methodology like Morphological operators, contrast enhancement operators. We have also discussed the various methods for enhancing the contrast of the image in which the first method is important for the CRT displays since the kinds of displays have wide luminance rage and this method reduces the non uniformity in the contrast of image. The second method uses the algorithm which enhances the contrast of the image from finer to the coarser scale of its contrast and hence these contrast operators do not increase the grey level of the image. The third method provides the very useful practical value since it reduces the workload of the human observer by fusing the images into a single image.

The fourth method uses multiscale morphology in which the results are compared with standard methods and these are found better. The fifth method blocks the artifacts as well as saves the computational time. This method seems to be highly efficient. The sixth method is highly useful in the video systems in which the luminance varies constantly. This method thus enhances the contrast in the video system and

also maintains the luminance of the videos. The seventh algorithm preserves the mean brightness of a given image significantly well compared to typical histogram equalization while enhancing the contrast and, thus, provides much natural enhancement that can be utilized in consumer electronic products. In this way we have studied the various methods for enhancing the contrast of the image.

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