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Image Enhancement and Quality Analysis Using the Biolog Transformation

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ABSTRACT: Digital image processing forms core research area with in computer science disciplines. Rapid growth of image processing technologies has been used digital images more and more prominent in our daily life. Brightness preservation is a technique of improving the image brightness so that the limitations contained in these images is used for various applications in a better way. The contrast enhancement techniques capable to clean up the unwanted noises and enhance the image's brightness and contrast. In this project aimed to recover the original form of the image and video taken without presence of proper lighting effect. The previous techniques used are histogram equalization, gamma correction for contrast and brightness enhancement in image, here the improved version to overcome the noise and contrast enhancement by the FFT, Bi-log transformation and NTSC are used for both image and video quality improvement.

KEYWORDS: FFT, BI-LOG TRANSFORM, NTSC AND WHITE BALANCING, CONTRAST ENHANCEENT, BRIGHTNESS PRESERVASION.

I. INTRODUCTION

With the fast advance of technologies and the prevalence of imaging devices, billions of digital images are being created every day. Due to undesirable light source, unfavorable weather or failure of the imaging device itself, the contrast and tone of the captured image may not always be satisfactory. Therefore, image enhancement is often required for both the aesthetic and pragmatic purposes. In fact, image enhancement algorithms have already been widely applied in imaging devices for tone mapping. For example, in a typical digital camera, the CCD or CMOS array receives the photons passing through lens and then the charge levels are transformed to the original image. Today, contrast enhancement process plays an important role in enhancing medical images' quality. Several previous studies proved that contrast enhancement techniques capable to clean up the unwanted noises and enhance the images' brightness and contrast. The resulting enhanced medical images provided clearer images for better and easier disease screening process by doctor.

II. METHODOLOGY

Existing scheme

Despite of the abundant literature on image enhancement, including representatives on literature survey, two challenging problems for image enhancement are still not solved. First how to achieve contrast enhancement while preserving a good tone. Second how to theoretically relate different types of enhancement algorithms to each other.

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Fig 1: photo in a bus

Fig 2: Building

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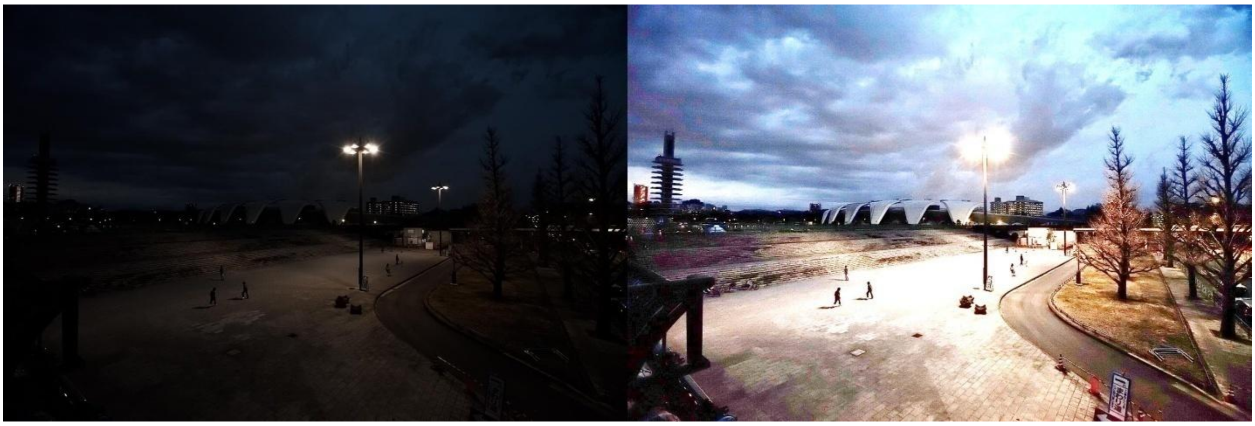

Fig 3: Street light

Fig 4: Person sitting on chair

Fig 5: Scene from a movie

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From the above shown examples of 1,2,3& 4, the existing system of image enhancement using the basic histogram and gamma correction results with presence of noise. So in order to overcome the drawback of image it is important to remove the irregularity of the image.
When we go for the video enhancing the method has to be changed and design a better one.

III. PROPOSED SCHEME

Image Quality and Preserving Colorspace for Human Visual System

The bilog transform smoothly modifies the gradient of the transformation so that in the region near zero it remains finite. A single constant C is provided to tune this behavior, so as to adjust the meaning of ―region near zero‖. The default value of this constant is 1/ ln(10); this gives a unity transfer function at zero but other values can be applied as wished, to focus into the region near zero or not. The modified logarithmic transformation called Bilog transform can be both one-sided and symmetric, and thus can transform negative data to scaled negative data. It can be applied to both the X and Y data, when it becomes a bi-symmetric log transform. Applying log transformation to an image will expand its low valued pixels to a higher level and has little effect on higher valued pixels so in other words it enhances image in such a way that it highlights minor details of an image

Uses

1. Used to expand the values of dark pixels in an image while compressing the higher values
2. It compresses the dynamic range of images with large variations in pixel values

Proposed Design

Propose a generalized equalization model for image & video enhancement; Based on our analysis on the relationships between image histogram and contrast enhancement/ white balancing, we first establish a generalized equalization model integrating contrast enhancement and white balancing into a unified framework of convex programming of image histogram.

The enhanced system flow is shown below.

The processes carried out here are

1) RGP Panel Splitting
2) White Balancing
3) FFT & IFT
4) Bi-log Transform
5) RGP restoration and
6) NTSC

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White Balancing

White balance (WB) is the process of removing unrealistic color casts, so that objects which appear white in person are rendered white in your photo. Proper camera white balance has to take into account the "color temperature" of a light source, which refers to the relative warmth or coolness of white light. Our eyes are very good at judging what is white under different light sources, but digital cameras often have great difficulty with auto white balance (AWB), and can create unsightly blue, orange, or even green color casts.

Understanding digital white balance can help you avoid these color casts, thereby improving your photos under a wider range of lighting conditions.

FFT

The Fourier transform is a representation of an image as a sum of complex exponentials of varying magnitudes, frequencies, and phases. The Fourier transform plays a critical role in a broad range of image processing applications, including enhancement, analysis, restoration, and compression.

The Fourier transform can also be used to perform correlation, which is closely related to convolution. Correlation can be used to locate features within an image; in this context correlation is often called template matching.

The Fourier Transform is an important image processing tool, which is used to decompose an image into its sine and cosine components. The output of the transformation represents the image in Fourier or frequency domain. In the Fourier domain image each point represents a particular frequency contained in spatial domain image.

The FT is used in a wide range of application, such as image analysis, image filtering, image reconstruction and image compression. The FT is used if we want to access the geometric characteristics of a spatial domain image. It is easy to examine or process certain frequency of the image in Fourier domain. In most implementations Fourier image is shifted in such a way that the DC-value F(0,0) is displayed in centre of the image. The further away from the center an image point is the higher is its corresponding frequency.

Bilog Transformation

Still there may be some presence of negative frequency components (zero frequency components). Bilog transformation is made use of here to perform action on low frequency information. The region near zeros are to be highlighted for the enhancement and brightness preservation. Hence, after the application of this transform, the region around zeros are enhanced. This is followed by grouping of pixels, where clustering is done to increase the high resolution pixels. At this stage, the image pixels are converted back to RGB color model and pixels highlighted to a certain level

Property

- The bilog transform smoothly modifies the gradient of the transformation so that in the region near zero it remains finite. A single constant C is provided to tune this behavior, so as to adjust the meaning of ―region near zero‖.

- The default value of this constant is 1/ ln(10); this gives a unity transfer function at zero but other values can be applied as wished, to focus into the region near zero or not.

- The modified logarithmic transformation called Bilog transform can be both one-sided and symmetric, and thus can transform negative data to scaled negative data.
- It can be applied to both the X and Y data, when it becomes a bi-symmetric log transform. Applying log

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transformation to an image will expand its low valued pixels to a higher level and has little effect on higher valued pixels so in other words it enhances image in such a way that it highlights minor details of an image.

Architecture And Module Design

The architecture gives the clear explanation about the process of image enhancement. The first stage is to split the obtained well defined input image into R,G,B panels. The white balance automatically adjusts the colors of the active layer by stretching the Red, Green and Blue channels separately. To perform this action, it discards pixel colors at each end of the Red, Green and Blue histograms which are used by only 0.05% of the pixels in the image and stretches the remaining range as much as possible. The HSV color space is a related representation of points in an RGB color space, which attempts to describe perceptual color relationships more accurately than RGB. HSV stands for hue, saturation, value and it describes colors as points in a cone.

Histogram equalization is a common technique for enhancing the appearance of images. Suppose if an image which is predominantly dark, then its histogram would be skewed towards the lower end of the grey scale and all the image detail is compressed into the dark end of the histogram. Hue saturation is used for histogram analysis. If the image can `stretch out' the grey levels at the dark end to produce a more uniformly distributed histogram then the image would become much clearer. By applying gamma correction, the brightness and contrast of the display are enhanced, making the images appear brighter and more natural looking. After processing, the image is sent for color space evaluation. The evaluation is done with the processed image. The processed image is splitted into R, G, B panels for performing FFT transform.

The Fourier transform is used to decompose an image into its sine and cosine components. The output of the transformation represents the image in the Fourier or frequency domain, while the input image is the spatial domain equivalent. In bilog-transformation after applying an inverse transformation to an image after doing FFT transform then logarithm is applied to inverse transformed image then difference of both the logarithmic of inverse image and original red panel image values is calculated to get the bilog-transformation of an original image which preserves the lightness and enhances the details and preserves the naturalness of an image.

The algorithm steps are as follows

STEP 1: Read image from the file and display the image. Split the color image into R,G,B panels.

STEP 2: Convert RGB panels to HSV i.e., to binary images.

STEP 3: Based on the Values derived histogram is created. The intensity value ranges from 0 to 1.

STEP 4: The weighted distribution is applied to the regions with high probability should not get over enhanced and regions with less probability should not be less enhanced.

STEP 5: Gamma Value is based on the cumulative histogram. White Balancing process is carried out in image to equalize the brightness in it.

STEP 6: The enhanced image is compared with the input image.

STEP 7: Read the enhanced image and convert RGB color panels to HSV panels.

STEP 8: Initialize the image matrix and other variables and rewrite the values of matrix by comparing it with the original image matrix.

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STEP 9: FFT filter is used to filter the pixels based on intensity i.e., low resolution pixels and high resolution pixels.

STEP 10: Low resolution pixels is converted into high resolution pixels. Perform Inverse FFT wherever needed to reconstruct the image.

STEP 11: Perform BILOG TRANSFORM as image does not contain same pixels some might be very large or small and regroup pixels using envelope check function to increase high resolution pixels in image.

STEP 12: Further enhance the image using NTSC format. Cost function performs the NTSC color space enhancement.

STEP 13: Enhance the image and convert back HSV into RGB image to view image in RGB color model.

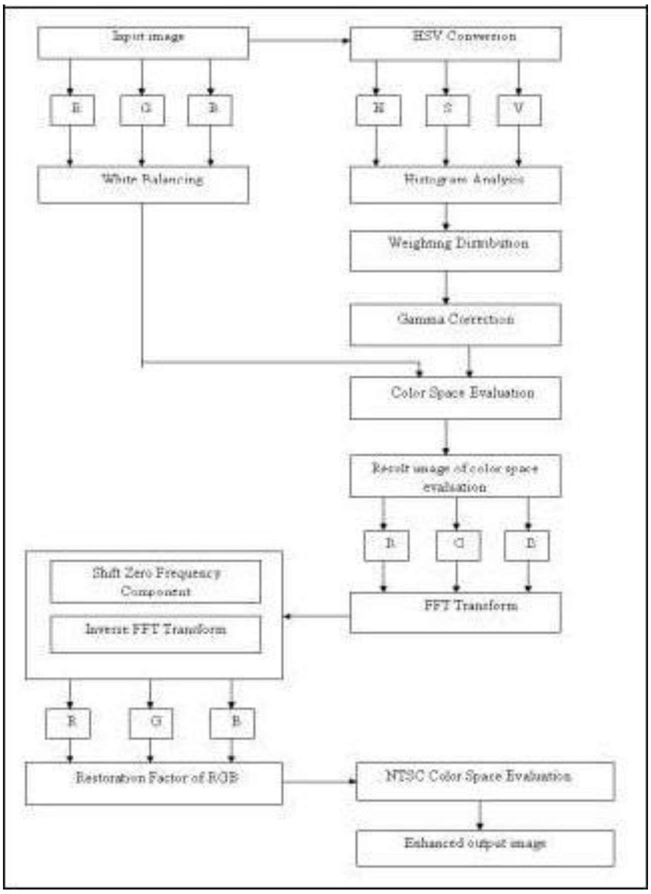

Fig 12: Architecture design

NTSC

At the end process the NTSC technique is operated on the pre-processed input image and video to ensure the colouring effect on both. The NTSC is specially for the video signal by means of using the YIQ model.

Some of the operated image and their results are shown bellow.

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Fig 6: Tree

Fig 7: Dark street

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Fig 8: Birds in forest

Fig 9: Image of decoration

Fig 10: Scenary

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Fig 11: Bridge

IV. RESULTS

In the existing system there are many techniques that are used for image enhancement. Those image enhancement techniques failed to preserve the natural look of the image. Based on this analysis a generalized equalization model is established integrating contrast enhancement and white balancing into a unique framework of image histogram. Using the properties of histogram transform namely contrast gain and nonlinearity, the model parameters for different enhancement applications are optimized.In the proposed method the difference of both the logarithmic of inverse image and original red panel image values is calculated to get the bilog transformation of an original image which preserves the lightness and enhances

V. CONCLUSION

This Project is aimed to quality of an image / video which is taken without the presence of proper lighting source by means of using FFT and bilog transform. Here with I obtained the output of the image which are better than the existing, using the above mentioned technique as shown as bellow.In the upcoming enhancement the performance of the image and the video frame quality are improved by using the technique of white balancing and the Bi-log transformation. This technique improves the performance by reducing the noise content present in the output shown.

VI. FUTURE WORK

In the future, besides global image enhancement, we expect to unify more local video enhancement methods into the model through local image feature analysis. Further to improve the performance by means of live capturing of the video and generating the direct output.

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