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A Novel Concept of Image Enhancement Using Scalable DCT and Color Mapping

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Abstract: *In this paper a technique for converting a grey scale image into color image and enhancing the color mapped image by scaling the DCT coefficients is proposed. Color mapping technique converts the entire grey scale image to the color image by matching luminance and texture information between the images. It considers only chromatic information and retains the original luminance values of the grey-scale image. Further, this color mapped image is enhanced by scaling the DCT coefficients .The novelty in this case lies in the treatment of the chromatic components, while all other previous techniques treated only the luminance component. The proposed technique which is computationally more efficient than the spatial domain based method is found to provide better enhancement compared to other compressed domain based approaches. Standard deviation is computed as image quality assessment It is Defined as a measure that is used to quantify the amount of variation of a set data values.*

Keywords: Color mapping, Image Enhancement, YCbCr, DCT coefficients, standard deviation

1. INTRODUCTION

The advantages of color over grey scale image is that the objects can be easily identified and also thousands of color shades and intensities can be discerned by the human compared to about only two dozen shades of gray.
Full-color and pseudo color processing are two major areas in color image processing. In the full color processing the images are acquired with a full-color sensor, such as a color television. In pseudo color processing, a color is assigned to a particular monochrome intensity or range of intensities.

In order to distinguish one color from another, the characteristics brightness, hue and saturation are generally used. Saturation and hue together are referred to as chromaticity which is useful for color mixing. In order to increase the visual appeal of images, color can be added to grey scale images. To color grey scale images, RGB values must be assigned to an image which varies only along luminance value. As different colors have same luminance value but vary in chromaticity, the problem of coloring grey scale image has no correct solution. As a result of these ambiguities in coloring process, human interaction usually plays a key role [3].

Image enhancement deals with improvement of image contrast. The main objective of enhancement is to process an image in a way such that the result is brighter than the original image. Image enhancement algorithms usually used are frequency and spatial domain.
Image enhancement is done for grey scale as well as color images [2].Most of the advanced techniques concentrate on spatial domain methods for grey level image enhancement. Some of the techniques are un sharp masking, histogram equalization, constant variance enhancement, high pass filtering, Homomorphic filtering and low pass filtering etc., (refer [8] and [9]).Same methods are used for color image enhancement. Grey scale enhanced image doesn't preserve detailed information since textures and noise features exist in same area. So different approaches or techniques are used for image enhancement depending on the type of application.
Color image enhancement is done by using various spatial domain enhancement methods. The latter approaches for enhancing images used chromatic information. In such cases, RGB color coordinates are transformed into different color spaces such as L*a*b*,YCbCr etc., As a result the color is represented in terms of hue, saturation and intensity in closer agreement with the physical models that describe the color processing human visual system.

2. PROPOSED WORK

Color mapping function is used to map colors of one (source) image to the colors of other (target) Image [1]. color mapping is also known as color transfer When grey scale images are involved, it is known as brightness transfer function (BTF). Color mapping algorithms are based on statistics of the color of two image and pixel Correspondence between two images [5].
In Adaptive image processing algorithms are applied on image data so that the values are changed to generate particular effects. The image visual effect can be determined by two factors, i.e. pixel value and other is color map, it assigns color display for each intensity covering the whole range, then the image enhancement can be achieved by pseudo color processing without affecting image data. In the case of pseudo coloring processing automatically the luminance values are mapped to color values [11] this is determined by human.
The quality of reconstructed color map images is decreased by many factors. Firstly geometric model, in this model the color map is done by data acquired is noisy and inaccurate. Secondly the source images (camera captured) that are

mapped to the input images are again acquired from noisy data just as imprecise. Thirdly the color cameras and shutters of depth are not synchronized perfectly in consumer devices. Therefore misalignment of projected images increases. Fourthly the color images which are obtained from consumer RGB-D cameras consist of optical distortions.

2.1 Image Enhancement by scaling DCT coefficients

Image enhancement by scaling DCT coefficients is done in three steps. First the background illumination is adjusted. Next the local contrast and colors of the image are preserved [4].

To adjust the local background illumination, the DCT coefficients of a block are used .The adjustment is performed by mapping the brightness values to a value in desired range.

To preserve the local contrast of the block, the enhancement factor for a block during the adjustment of its luminance is defined. It is given as

$$K=\frac{\overline{Y}(0,0)}{Y(0,0)} \qquad \text{---------- (1)}$$

Where $\overline{Y}(0,0)$ is the mapped DC coefficient and Y (0, 0) is the original DC coefficient [6]

As DCT is a linear transform, all the coefficients of 'Y' multiplied by 'K' results in the multiplication of the pixel values in the block by the same factor. To preserve the colors of the image, scaling operation is performed on it according to the equation (2) and (3)

$$\overline{U}=\begin{cases} N\left(k\left(\frac{U(i,j)}{N}-128\right)+128\right), i=j=0 \\ kU(i,j), \quad otherwise \end{cases} \text{---------(2)}$$

$$\overline{Y}=\begin{cases} N\left(k\left(\frac{V(i,j)}{N}-128\right)+128\right), i=j=0 \\ kV(i,j), \quad otherwise \end{cases} \text{----------(3)}$$

The Y-Cb-Cr color space is related to the R-G-B color space as follows:

Y =0.502G+0.098B+0.256R

Cb=-0.290G+0.438B-0.148R+128

Cr=-0.366G-0.071B+0.438R+128

2.2 Flow chart

The procedure involved in this paper is as shown in fig

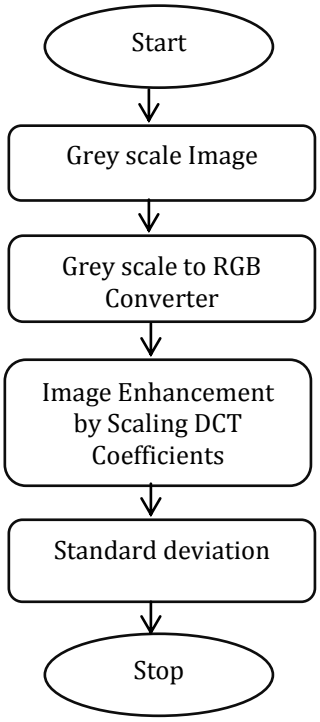


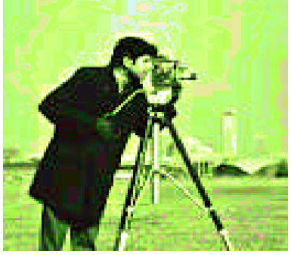
Fig.1: Flow chart for Color mapped Image Enhancement

3. RESULTS

a) Input greyscale image

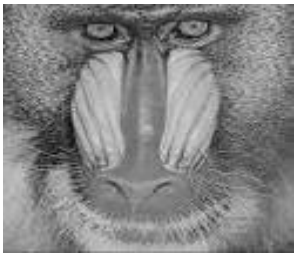
b) Sample color

c) Color mapped image



d) Enhanced Output Image

Fig. 2: Image Enhancement of Color mapped Camera man Image.


a) Input greyscale image


b) Sample color


c)Color mapped image

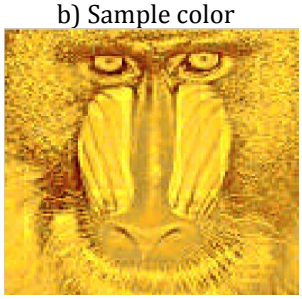

d) Enhanced output Image

Fig. 3: Image Enhancement of Color mapped Baboon Image.

Name of the Image	Standard deviation	
	ColorMapped Image	Enhanced Image
Camera man Image	64.1922	84.8153
Baboon Image	67.5461	83.5395

Tabel 1: Comparison of standard deviation

Image enhancement is done by scaling the DCT coefficients. From the above figures it can be observed that the enhanced image is brighter than the Color mapped image [7].

Image quality assessment is done by computing standard deviation for enhanced output images. As the standard deviation for enhanced image is more than color mapped image, contrast of the enhanced image is more.

4 CONCLUSION

The work has focused on enhancement of color mapped image by scaling DCT coefficients. This is done by converting grey scale image to RGB image by using sample color image and that color mapped image is enhanced by scaling the DCT coefficients. From the table it is observed that the standard deviation is more for enhanced image which means that the contrast of the enhanced image scaled by DCT coefficients is more.

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