Colour Image Enhancement

Navneet Kumar
Vadodara Institute of Enginnering, Vadodara

Abstract- **This paper presents a new approach for color enhancement of the images that is based on the compressed domain technique. The proposed techniques simple but more effective than some of old existing techniques like AR, MCE and MCEDRC. In this proposed method we use the treatment of the chromatic components, while previous techniques treated only the luminance component. The proposed technique, computationally more efficient than the spatial domain based method, so it is provide better color enhancement compared to other compressed domain based approaches.**

Index Terms- **Image Enhancement, DCT, Colourfulness, color space, JPEG, Quality Metrics.**

I. INTRODUCTION

Image Enhancement is the performance which is most required in the field of Image Processing to develop the revelation. Enhancement constitutes a fundamental process of image processing that aims at improving image's visual appearance. The aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques. Since the resolution of images increased in the past few years, the requirements for large storage space and fast process, directly in the compressed domain, becomes essential. Many techniques of contrast enhancement have been listed in journalism but most of them operate the spatial domain pixel values. Spatial domain techniques include point to point mapping of pixel values between the original and the enhanced images; mask processing, histogram equalization etc. Since most of the spatial domain coefficients of an image have non-zero values the total number of computations to be performed is directly related to the image size.

However, in portable devices reducing the number of computations at the algorithmic level will result in important vigor savings. Many images are compressed using the Joint Photographic Experts Group (JPEG) standard which uses Discrete Cosine Transform (DCT) for image compression. Manipulating data in the DCT domain is an energy well-organized image enhancement technique since a large number of DCT coefficients are 0. The contrast enhancement technique used manipulates the DCT coefficients of a JPEG image to improve its quality. DCT and its inverse transform IDCT are performed on 8 x 8 blocks of pixels; any image processing algorithm implemented in the transform domain produces imperfections known as blocking artifacts. These artifacts are a direct result of the independent processing of blocks which does not take into account the .unit also tries to minimize these blocking artifacts as a result of processing in the compress domain.

II.PREVIOUS WORK

A majority of techniques advanced so far have focused on the enhancement of gray-level images in the spatial domain. These methods include adaptive histogram equalization, unsharp masking, constant variance enhancement, homomorphic filtering, high-pass, and low-pass filtering, etc. (see [1] and [2] and references therein). These methods have also been adapted for color image enhancement [1], [3]. However, later approaches for enhancing color images have taken into account also the chromatic information as well. In many such algorithms [3]–[11] the R-G-B color coordinates are transformed into a different space such as H-S-V , Y-Cb-Cr etc., where chromatic components are more uncorrelated from the achromatic component. This allowed the representation of the color in terms of hue, saturation, and intensity in closer agreement with the physiological models which describe the color processing of the human visual system [2], [12], [13]. There are also a few work reported in the R-G-B space.

III.PROPOSED ALGORITHM

The algorithm is designed in such a way that each block (of size 8 × 8) for all the components could be handled independently. This makes it more suitable for parallel implementation and efficient buffer management. Moreover, in a block DCT space, the algorithm attempts to exploit the advantage of having localized information from the DCT coefficients. The Type II DCT is more commonly used in image compression algorithms. In the case of 2-D image

{x(m,n), 0≤m≤N-1,0≤n≤N-1} it is given by

C(k,l)= (1)

Where α(p) is given by

α(p)= , (2)

The coefficient C(0,0) is the DC coefficient and the remaining are the AC coefficients for the block. The normalized transform coefficients ĉ(k,l) are defined as

$$\hat{c}(k,l) = C(k,l)/N \quad (3)$$

Let μ and σ denote the mean and standard deviation of an N × N image. Contrast (ζ) of an image is usually modeled with the Weber law ζ = (ΔL / L), where ΔL is the difference in luminance between a stimulus and its surround, whereas L is the luminance of the surround [26]. As μ provides a measure for surrounding luminance and σ is strongly correlated with ΔL, we redefine the contrast of an image as follows:

$$\zeta = \frac{\sigma}{\mu} \quad (4)$$

It may be emphasized here that the above definition is merely intuitive by drawing analogy from the Weber Law as mentioned before. It also reflects the local contrast measure and under the present context, we apply it to the individual blocks.

In the following theorem, we state how the contrast of an image is related to the scaling of its DCT coefficients.

Theorem 1: Let K_{dc} be the scale factor for the normalized DC coefficient and K_{ac} be the scale factor for the normalized AC coefficients of an image Y of size N × N . Let the DCT coefficients in the processed image Ỹ be given by

$$\tilde{Y}(i,j) = \begin{cases} k_{dc}Y(i,j), & for\ i = j = 0 \\ k_{ac}Y(i,j), & otherwise \end{cases} \quad (5)$$

The contrast of the processed image then becomes (K_{ac} / K_{dc}) times of the contrast of the original image. The overall algorithm is summarized below. As each block is independently processed, in the description processing with a single block is narrated. In our description we have also considered a block of general size (N × N).

In this algorithm, the scaling of the coefficients by a constant for each component is the major computational task. Figure 1 shows the steps involve in the proposed algorithm.

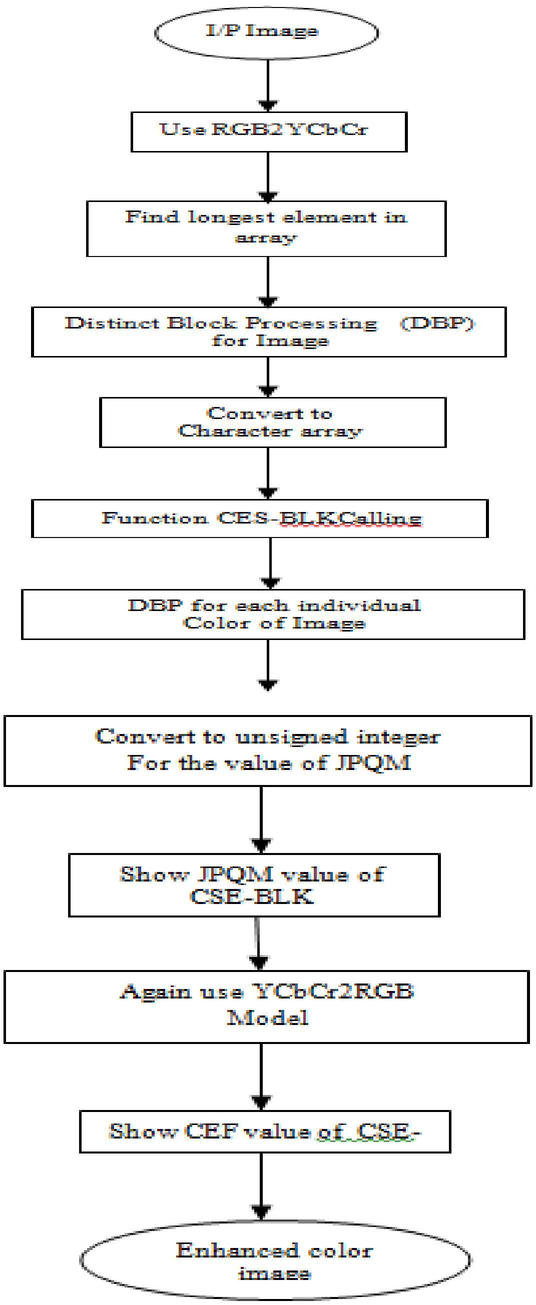

Figure:-1

III. EXPERIMENTAL RESULT

We have used three metrics of comparisons, namely the quality metric (called as QM) suggested in [17], JPEG quality metric (called as JPQM) [18] for measuring the quality in terms of blocking artefacts and blurring and the colourfulness metric (called as CM) [19]. The first one (QM) requires a reference image and its values lie in the interval [-1, 1]. Processed images with QM values closer to 1 are more similar in quality according to our visual perception. The JPQM value for an image with good visual quality should be close to 10. The last one (CM) is used for measuring the color enhancement factor (CEF) as a ratio of CM between enhanced image and its original. We have compared the performance of the proposed approach with that of three existing DCT domain color enhancement techniques, namely alpha-rooting (denoted as AR in this work) [14], multi-contrast enhancement [15] technique (referred as MCE), and multi-contrast enhancement coupled with dynamic range compression (referred as MCEDRC).

In this thesis we present typical enhancement results for a images. As we found the performance measures for CES-BLK are better in most cases (compared to all other techniques considered here), we demonstrate the enhanced images obtained from this algorithm.

(a)

(b)

Average Performances at Different Compression Levels

We have experimented with a color images. The average performance measures obtained from these enhanced images are listed in Table 1. From this table it can be seen that JPQM and CES-BLK provide the best performance indices in all three measures.

Table 1. Average Performance measures for image

Techniques	JPQM	CEF
AR	8.58	0.90
MCE	7.00	0.94
MCEDRC	7.92	0.97
CES-BLK	8.700	1.13

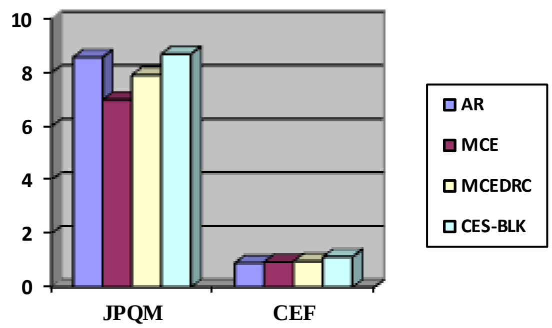

Figure.2 shows the Comparison of JPQM and CEF values between the techniques AR, MCE, MCEDRC and Proposed Algorithm CES-BLK.

IV.CONCULSION

In this paper, we have presented a simple approach for enhancing color images in the block DCT domain by scaling the transform coefficients.

1. The proposed technique is simple but more effective than some of old existing techniques like AR, MCE and MCEDCR.
2. The unique feature of this algorithm is that it also treats chromatic components in addition to the processing of the luminance component improving the visual quality of the images to a great extent.
3. The results of all previous techniques along with that of the proposed one are compared with respect to those obtained by applying a spatial domain color enhancement technique that appears to provide very good enhancement.
4. The proposed technique is computationally more efficient than the spatial domain based method, is found to provide better color enhancement compressed domain based approaches.
5. Proposed Algorithm is less complex and it outperforms in enhancing chromatic and luminance components equally well. The values

from JPQM and CEF metrics insist that quality after enhancement is improved.

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