DIFFERENT FILTERING METHOD FOR SUPPRESSING ARTIFACT FROM COLOR AND CONTRAST MODIFICATION

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ABSTRACT

This work is concerned with the modification of the gray level or color distribution of digital images. A common draw-back of classical methods is that it allows large number of artifacts or the attenuation of details and textures. In this work, we propose a generic filtering method enabling, given the original image and the radio metrically corrected one, to suppress artifacts while preserving details. The approach relies on the key observation that artifacts correspond to spatial irregularity of the so called transportation map, defined as the difference between the original and the corrected image.

In this paper, Adaptive Histogram equalization are applied on digital image which leads to some visual artifacts. Then Transportation map which is the difference between original image and transformed image is calculated, then a generic filtering method also called TMR filter which draws on the nonlocal Yaroslavsky filter is used to regularize the transportation map so that artifacts are suppressed .The results are compared with related approaches such as mean, median and wiener filtering of transformed images.

Keywords: Color and Contrast Modifications, Histogram Equalization, Adaptive Histogram Equalization, Transportation Map, TMR Filter, Color Transfer, Contrast Adjustment, Contrast Equalization,

I. INTRODUCTION

Applying contrast changes to digital images is one of the most essential tools for image enhancement. Such changes may be obtained by applying a prescribed function to the gray values of images, as in contrast stretching or Gamma correction, or by prescribing the histogram of the resulting image, as in histogram equalization or specification from an example image [1]. Such operations are characterized by the way they affect the histogram of an image and may be seen as Modifications of their gray-level distribution. These techniques extend to color images by considering a luminance channel, as in Gamma correction, or by working on each color channel separately. The prescription of the 3-D color distribution is more satisfying because it avoids the creation of false colors, but is also more involved.

Applications of contrast or color changes are of course extremely numerous. With the popularization of digital photography, these techniques have become immensely popular through the use of various “curves” in image editing software. Early uses of contrast equalization are the enhancement of medical images [2] and the normalization of texture for analysis purposes. In a related direction, the construction of *midway* histograms [3], [4] is useful for the comparison of two images of the same scene. More recently, extensive campaigns of old movies digitization have claimed for the development of contrast modification techniques to correct flicker [5], [6]. Similar techniques are commonly used in the postproduction industry [7], [8]. Another field of increasing industrial interest in which contrast changes play a central role is the one of imaging in bad climatic conditions, see, e.g., [9]. Color modification or transfer is also useful for a wide range of applications, such as aquatic robot inspection, space image colorization, and enhancement of painting images.

The drawback of color and contrast modification techniques and compression techniques is to create visual artifacts such as noise enhancement, detail loss, texture washing, color proportion inconsistencies and compression artifacts. Several methods have been proposed in last few years to remove artifacts from color and contrast modification .The simplest one is proposed in [10] in the context of local histogram modifications and amounts to limit the modification depending on gradient values. While improving the results in some cases, this approach let most artifacts untouched. In [11], it is proposed to correct color transfer artifacts by using a variation regularization after the transfer. Still in a variation framework, the authors of [12] propose a unified formulation containing both color transfer and regularity constraints in a single energy minimization. For the problem of color proportion, a possible approach is to transfer color after having identified some homogeneous regions, as proposed in [13] and [14]. A related class of works takes interest in the avoidance of compression artifacts, usually using the properties of the compression scheme [15].

In this paper TMR filter is proposed as a universal approach to remove all visual artefacts.TMR filter is a variant of yaroslavsky filter. In this paper, the original image is preprocessed and firstly, color and contrast modifications techniques applied over preprocessed image to convert into transformed image –I. Secondly, both color and contrast modification techniques and image compression and decompression techniques are applied over preprocessed image to convert in to transformed image-II .Then some visual artifacts are introduced into transformed image along with the actual requirement. Then mean, median, wiener filters are applied over transformed images one after another to remove those visual artifacts. Finally TMR filter is applied on transformed images to remove visual artifacts. TMR filter gives better results compared to mean, median and wiener filters.

II. LITERATURE REVIEW

Color alteration is an active research area in the communities of image processing and computer graphics. There searches much related with this work in the area of color alteration include color transfer, color correction, colorization of gray scale and reverse processing. Applications of this work range from post processing on images to improve their appearance to more dramatic alterations, such as converting a daylight image into a night scene.

First, they convert pixel values in RGB color space to Ruderman et al's perception-based color space l α β in1998. Then, they calculate the mean and standard deviations along each of the three axes, and then scale and shift each pixel in the input image. Last, they transform pixel values to return to RGB space. While this method has produced some very believable results.

Their approach is qualitatively and quantitatively superior to the conventional color correction. Another color correction method has been developed by Schechner and Karpel for underwater imaging and great improvement of scene contrast and color correction are obtained in 2004.Jiaetal propose a color correction approach based on a Bayesian framework tore cover a high quality image by exploiting the tradeoff between exposure etimeand motion blur in 2004.

Colorization is a term that is now used generically to describe any technique for adding color to monochrome still sand footage. Welshetal introduce a general technique for colorizing grey scale images by transferring color between a source, color image and a destination, grey scale image in 2002. Their method transfers then tire color mood of the source to the target image by matching luminance and texture information between the images and allows user interaction.

Levin presents a simple colorization method that requires neither precise image segmentation, nor accurate region tracking in 2004. This method is based on a simple premise: neighboring pixel sinspace-time that have similar intensities should have similar colors. In 2011 Julien Rabin, Julie Delon, and Yann Gousseau removes artifact from color and contrast modification in digital image by using TMR filter.

There are different approaches have been proposed to suppress artifacts due to contrast or color modification. The simplest one is proposed in [15] in the context of local histogram modifications and amounts to limit the modification depending on gradient values. While improving the results in some cases, this approach let most artifacts untouched. In [16], it is proposed to correct color transfer artifacts by using a variational regularization after the transfer. Still in a variational framework, the authors of [17] propose a unified formulation containing both color transfer and regularity constraints in a single energy minimization. For the problem of color proportion, a possible approach is to transfer color after having identified some homogeneous regions, as proposed in [18] and [19]. A related class of works takes interest in the avoidance of compression artefacts, usually using the properties of the compression scheme, see, e.g., [20].

III. PROBLEM STATEMENT & MOTIVATION

A common drawback of most method in modification of the contrast or color content in images is visual artifacts. When increasing the contrast, parasite structures that were barely visible become prominent. Most noticeable is the enhancement of noise and compression scheme patterns, such as “block effect” due to the JPEG standard. In the other direction, contrast reduction or color transfer may yield detail loss and texture washing. A last artifact is particularly noticeable in the case of color transfer and appear when the proportions of colors are very different between images.

In this paper TMR filter is proposed as a universal approach to remove all visual artefacts.TMR filter is a variant of yaroslavsky filter. In this paper, the original image is preprocessed and firstly, color and contrast modifications techniques applied over preprocessed image to convert into transformed image –I. Secondly, both color and contrast modification techniques and image compression and decompression techniques are applied over preprocessed image to convert in to transformed image-II .Then some visual artifacts are introduced into transformed image along with the actual requirement.

IV. DESIGN METHODOLOGY

The input image is preprocessed that is color image is separated into three planes and size will be changed to 256x256 image. Adaptive histogram equalization method is used to change contrast of an input image. Adaptive Histogram Equalization method is an extension to traditional Histogram Equalization technique. It enhances the contrast of images by transforming the values in the intensity image.

The main steps of the methodology for removal of artifacts are shown in Fig I and include the following: read the input image, preprocessing of image, transformation of image, filtering of image by different methods, comparing performance measures for all filter outputs.

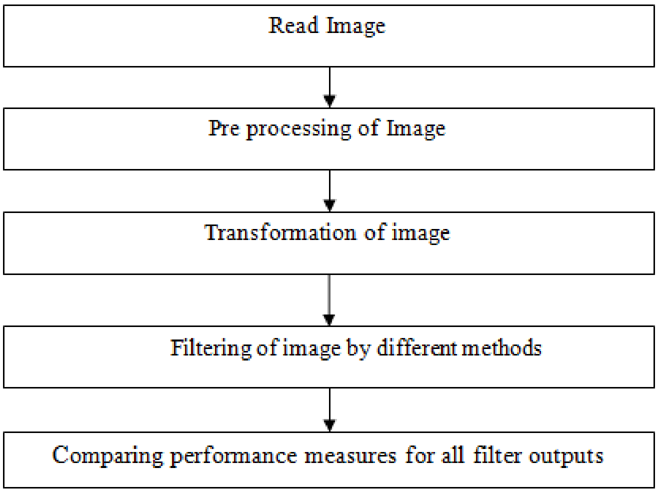


Figure1. Main Steps in Removal of Artifacts

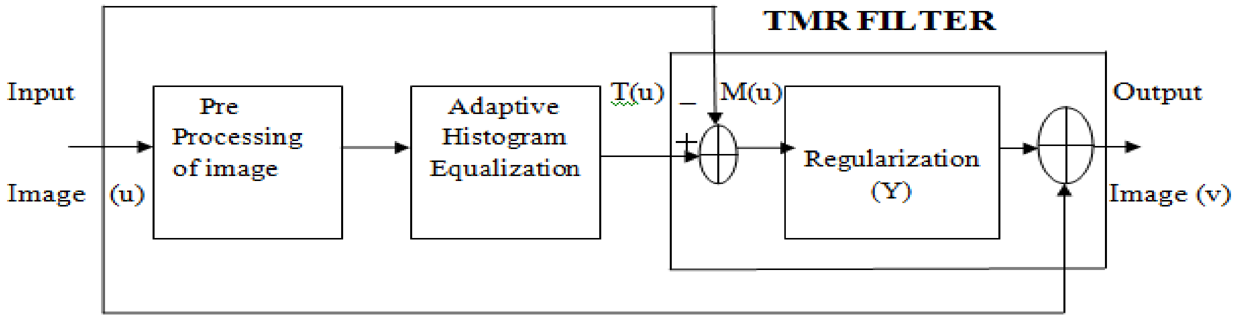


Figure 2. Block Diagram for Removing Artifacts from AHE Image Using TMR Filter

In Fig II, the input image is preprocessed that is color image divided into three planes, after that Adaptive Histogram Equalization method is applied to change the contrast. Visual artifacts such as Noise enhancement, detail loss, color proportion inconsistencies are introduced. TMR filtering is applied to remove those artifacts. The input image is preprocessed that is color image divided into three planes, then Adaptive Histogram Equalization method is applied to change the contrast and then JPEG Encoding& Decoding Technique is applied for compressing and decompressing. Visual artifacts such as Noise enhancement, detail loss, color proportion inconsistencies, compression artifacts are introduced.

V. TMR FILTER

The block diagram for TMR Filter is shown in Fig VI. The transportation map M (u) which is the difference between transformed image and original image is applied to TMR Filter. In this, weighted factor is computed, Regularization term is evaluated, finally stopping criterion is found out regularization process convergence. Then enhanced image will be obtained by combining the regularized image with original image (u).

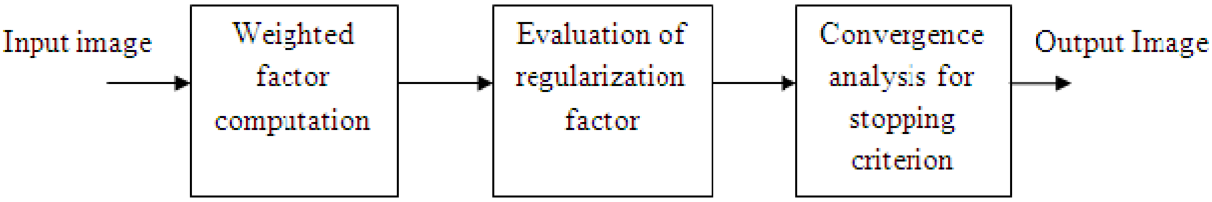


Figure 3: Block diagram of TMR Filter

All the artifacts mentioned above are removed by regularizing the *transportation map*, which is defined as the image of the differences between the original image and the one after contrast or color modification. All these artifacts may be interpreted as spatial irregularities of this transportation map. In order to regularize this map without introducing blur in the final image, inspiration is taken from nonlocal methods that have been proposed for image de-noising and more precisely from the Yaroslavsky filter.

The transportation map is filtered by averaging pixel values using weights that are computed on the original image, therefore adapting to the geometry of this initial image. It will be shown that artifacts are progressively suppressed by iterating this filtering stage.

We calculate the transportation map which gives the difference between original image and transformed one. Yu is the operator , a weighted average with weights depending on the similarity of pixels in the original image u. We calculate the weights for each and every pixel leaving the first pixel; we start from second pixel .we take 8 neighbor hoods of each pixel. Where ||.|| stands for the Euclidean distance in Rn, where, N(x) = x + N(0) ⊂ Ω with N(0) a spatial neighborhood of 0, where σ is a tuning parameter C(x) of the method and is the normalization constant.

We will add all the weights which are calculated for each and every pixels. Observe that if we apply to the image u , we obtain the Yaroslavsky filter. If the weights also decrease as a function of the distance to x, Yu, becomes similar to the cross bilateral filter introduced in [19] for flash photographic enhancement. The regularization of the image T(u), referred to as transportation map regularization (TMR), is then defined as TMR u(T(u)) : = u + Yu M(u). Now, observe that this formulation can be divided in two terms as of image TMR u(T(u)) = Yu(T(u)) + u - Yu(u)

First, the image T(u) is filtered by a nonlocal operator Yu, following the regularity of the image . This operation attenuates noise, compression, and color proportion artifacts but also the details of the image T(u). The second operation performed by the TMR filter consists in adding the quantity details =: u – Yu(u).

VI. TRANSPORTATION MAP REGULARIZATION

Recall that $T(u)$ is the image after color or contrast modifica-tion. In what follows, we write $\mathcal{M}(u) := T(u) - u$ for the trans-portation map of image u. We propose to regularize it thanks to the operator Y_u, a weighted average with weights depending on the similarity of pixels in the original image u. The effect of this operator on an image $v : \Omega \to \mathbb{R}^n$ with $n \geq 1$ is defined as

$$\mathbf{Y}_u(v) : x \in \Omega \mapsto \frac{1}{C(x)} \int_{y \in \mathcal{N}(x)} v(y) \cdot w_u(x,y) dy$$

$\|u(x)-u(y)\|^2$

σ^2

The regularization of image t(u) is defined as Transportation map. $\mathrm{TMR}_u(T(u)) = u + \mathrm{Y}_u \mathcal{M}(u)$. Now, observe that this formulation can be divided in two terms as

$$\mathrm{TMR}_u\,(T(u)) = \underbrace{\mathbf{Y}_u\,(T(u))} + \underbrace{u - \mathbf{Y}_u(u)}_{\text{image detail}}.$$

First, the image $T(u)$ is filtered by a nonlocal operator Y_u, following the regularity of the image u. This operation attenuates noise, compression, and color proportion artifacts but also the details of the image $T(u)$. The second operation performed by the TMR filter consists in adding the quantity $u_{\mathrm{details}} = u - \mathrm{Y}_u(u)$, which can be considered as details of the original image (e.g., texture and fine structures).

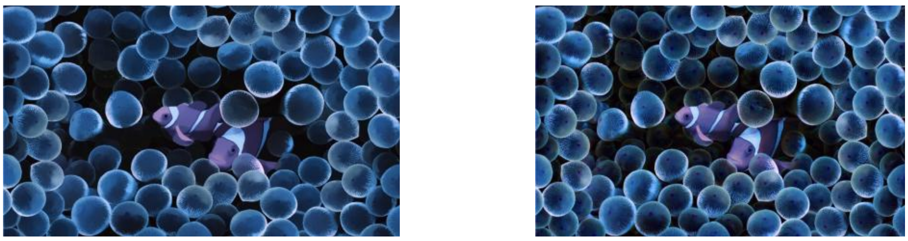
VII. RESULT

The images after applying various filters on transformed image-I are shown in Fig IV. The Fig IVI(f) has less artifacts and much similar to original image as the mean square error for transformed image-I after applying TMR filter is less and the PSNR of transformed image-I after applying TMR filter is more compared to the same after applying another filters such as mean, median, wiener filters. We can say TMR filter is giving better results compared to mean, median and wiener filters for transformed image

VIII. CONCLUSION

In this paper, we have introduced a generic filtering procedure in order to remove the different kinds of artifacts created by radiometric or color modifications. The ability of the proposed TMR filter to deal these artifacts while restoring the fine details of images has been demonstrated on various examples.

(a) Original image. (b) Target color distribution. (c) Raw color transfer



(d) Filtering of image (f) Regularization of image with iterated TMR filter.

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