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Modified Classical Unsharp Masking Algorithm

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Abstract: We propose a new generalized algorithm using the exploratory data model as unified frame work. Enhancement of contrast and sharpness of an image is required in many applications. In applications like Photoshop it is an anti blurring filter. By using unsharp masking algorithm for sharpness enhancement, the resultant image suffering with two problems, first one is a hallo is appear around the edges of an image, and second one is rescaling process is needed for the resultant image. The aim of this project is to enhance the contrast and sharpness of an image simultaneously and to solve the problems in the classical unshorn masking algorithm. In the proposed algorithm, we can adjust the two parameters the contrast and sharpness to produce the desired output. The proposed algorithm is designed to three issues:1) simultaneously enhancing contrast and sharpness by means of individual treatment and the residual,2)reducing the halo effect by means of an edge-preserving filter using Bilateral filter. Experimental results, which comparable to recent published results, shows that proposed algorithm is able to significantly improve the sharpness and contrast of an image. This makes the proposed algorithm practically used.

Index Terms: edge-preserving filter, Bilateral filter, exploratory data model, Image Enhancement, Unsharp Masking

I. INTRODUCTION

Enhancement of sharpness and cantrast of an image is required many application. Unsharp masking is classical tool for image enhancement it enhance the sharpness of an image but not contrast and histogram equalization is good method to enhance the contrast of an image, basically these two are the individual process, An image is defined as a two dimensional light intensity function $f(x, y)$, where x and y are spatial coordinates, and the value f at any pair of coordinates (x, y) is called intensity or grey level value of the image at that point. In this project a new algorithm, a generalized unsharp masking algorithm is proposed using exploratory data model as a unified framework. By the usage of linear smoothing filters in classical unsharp masking algorithm the hallo effect is arise due to the smoothening of the sharp edges. To prevent the hallo effect in classical unsharp masking algorithm, edge preserving filters are required instead of linear smoothing filters to avoiding smoothing of sharp edges in an image and deferent edge preserving filters are available. The log-ratio operations are required to solve the out of range problem, these log-ratio operations are developed based on generalized linear system.

A. Related works

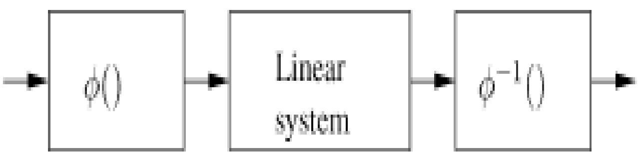
1 sharpness and contracts enhancement

The principal objective of sharpening is to highlight fine detail in an image or to enhance detail that has been blurred, either in error or as a natural effect of a particular method of image acquisition. Uses of image sharpening vary and include applications ranging from electronic printing and medical imaging to industrial inspection and autonomous guidance in military system. The classical unsharp masking algorithm can described by the v=y+γ(x-y) where x is the input image , y is the result of the linear low pass filter, γ is the gain .the signal d=x-y contain the 1.details of the image 2.noise 3.over-shoot and under-shoot

Contrast is a basic perceptual feature of an image .It is Difficult to see the details in a low contrast image. To improve the contrast or to enhance the contrast the adaptive histogram equalization is frequently used. To enhance the contrast recently some new advanced algorithms are developed, which is retinex based algorithms.

2 generalized linear system and log-ratio approach

Marr has pointed out that the development of an effective of computer vision technique three must consider
1. why the particular operations are used 2.how the signal is represented 3.what implementation structure are used
Block diagram of the generalized linear system



where $\phi()$ is usually a nonlinear function

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FIG:1

vehhrdThe generalized addition and scalar multiplications denoted by

$x \oplus y = \oplus \Phi[\Phi(x) + \Phi$ 1

$\alpha \otimes x = \Phi[\alpha \Phi(y)]$ 2

Where x and y are signals samples is real scaler The log ratio operation are studied by using generalized linear system

Log-ratio operation are used for to solve the out range problems since its operation are implicitly denoted by using 1 and 2 the property of thye log-ratio operation is that the gray scal set €(0,1) it is closed to the new operation so dung used to log-ratio operations for contest for image enhancement. cahill, deng, piloni compared log ratio operation with other generalized linear system-based image processing technique such as log-arithmetic image processing(LIP)

B. Motivation and Contributions This work is motivated by unsharp masking algorithm, an outstanding analysis of the halo effect, and the requirement of the rescaling process. In this project the tangent operations were defined, motivated by the graceful theory of the logarithmic image processing model. The major contribution and the organization of this paper are as follows. In Section 2, we first present a frame work for the generalized unsharp masking and we described about the proposed algorithm. We proposed a new approach to solve the out of range problem, which is tangent system it is presented in section 3. In Section 4, we describe the details of each building block of the proposed algorithm which includes the bilateral filter, the adaptive gain control, and the adaptive histogram equalization for contrast enhancement. In Section 5, we present simulation results which are compared existing unsharp masking algorithm results. And in Section 6 Conclusion and future work are presented

II . EXPLORATORY DATA MODEL AND GENERALIZED UNSHARP MASKING

II.1 .image model and Generalized Unsharp Masking

The idea behind the exploratory data analysis is to decompose a signal into two parts. One part fits a particular model, while the other part is residual. In simple way the data model is: "fit PLUS residuals". From this definition, the output of the filtering process, denoted as y=f(x) , can be regards as the part of the image that fits the model. Thus we can represent an image using the generalized operations as follows: $x = y + d$ (4) Where d is called the detail signal (the residual). The detail signal is defined as , where is the generalized subtraction operation. A generalized form of the unsharp masking algorithm can be written as $v = h(y) + g(d)$ (5) Where v is the output of the algorithm and both h(y) andg(d) could be linear or nonlinear functions. This model explicitly states that the part of the image being sharpened is the model residual. In addition, this method allows the contrast enhancement by means of a suitable processing function such as adaptive histogram equalization algorithm. In this way, the generalized algorithm can enhance the overall contrast and sharpness of the image.

III. The Proposed Algorithm The proposed algorithm, shown in is based upon the classical unsharp masking algorithm. Here we address the problem of the halo effect by using an edge-preserving filter which is the bilinear filter to generate the signal. The choice of the bilinear filter is due to its relative simplicity, advanced than median filter and well studied properties such as the root signals. Other more advanced edge preserving filters such as the cubic filter and wavelet-based denoising filter and nonlocal means filter can also be used. Here we address the problem of the need for a careful rescaling process by using new operations defined based on the tangent operations and new generalized linear system. From here the gray scale set is closed under these new operations, the out-of-range problem is clearly solved and no rescaling is needed.

DENG: A GENERALIZED UNSHARP MASKING ALGORITHM

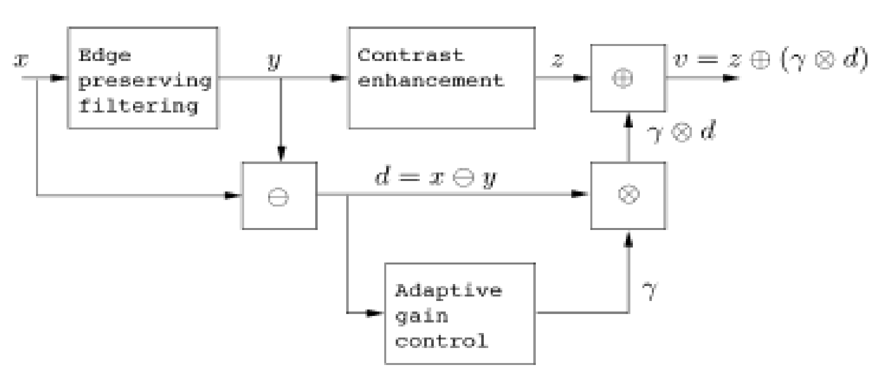

Fig. 2. Block diagram of the proposed generalized unsharp masking algorithm.

Block diagram of Generalized Unsharp Masking Algorithm Here we address the problem of the need for a careful rescaling process by using new operations defined based on the tangent operations and new generalized linear system. From here the gray scale set is closed under these new operations, the out-of-range problem is clearly solved and no rescaling is needed. Here we address the new concept of contrast enhancement and sharpening by using two different processes. The image is processed by AHE algorithm and the output is called h (y). The detail image is processed by whereG (d) is the adaptive gain and is a function of the amplitude of the detail signal . The final output of the algorithm is then given by $v = h(y) \oplus [\gamma(d) \otimes d]$ (7) We can see that the proposed algorithm is a generalization of the existing unsharp masking algorithm in several ways.

	y	d	$h(y)$	$g(d)$	output v	re-scale
UM	LPF	$x - y$	y	γd	$y + g(d)$	yes
GUM	EPF	$x \ominus y$	ACE	$\gamma(d) \otimes d$	$h(y) \oplus g(d)$	no

From above table explain following issue by using edge preserving halo effect is solved it as signal y and addition and multiplication used for generalized linear system and solved out of range problem .from table unsharp masking algorithm described mathematical equations and GUM is described generalised mathematical operations such as scalar multiplication.

IV. THE PROPOSED ALGORITHM

IV. 1 implementation of the proposed algorithm for color Images

In color image processing we use RGB color space images to processing. For this algorithm firstly we have to convert the color image from the RGB color space to the HSI or LAB color space. The chrominance components, such as the H and S components are not processed the luminance component I only processed. After the luminance component is processed, the inverse conversion is performed. An enhanced color image in its RGB color space is obtained. To avoid a possible problem of varying the white balance of the image when the RGB components are processed individually, we process luminance component I only.

V. ENHANCEMENT OF THE DETAIL SIGNAL

V.1. The Root Signal and the Detail Signal

The bilateral filtering operation can be denoted as a function
y =f (x) which maps the input x to the output y. Result image bilateral filter operation can be represented as root signal, which is y.

V.2 Edge preserving filter

A bilateral filter is an edge-preserving and noise reducing smoothing filter. The intensity value at each pixel in an image is replaced by a weighted average of intensity values from nearby pixels. This weight is based on a Gaussian distribution. Crucially the weights depend not only on Euclidean distance but also on the radiometric differences (differences in the range, e.g. color intensity or Z distance). This preserves sharp edges by systematically looping through each pixel and adjusting weights to the adjacent pixels accordingly. The basic idea underlying bilateral filtering is to do in the range of an image what traditional filters do in its domain. Two pixels can be close to one another, that is, occupy nearby spatial location, or they can be similar to one another, that is, have nearby values, possibly in a perceptually meaningful fashion. In addition, one can show that range filtering without domain filtering merely changes the color map of an image, and is therefore of little use. The appropriate solution is to combine domain and range filtering, thereby enforcing both geometric and photometric locality In smooth regions, pixel values in a small neighborhood are similar to each other, and the bilateral filter acts essentially as a standard domain filter, averaging away the small, weakly correlated differences between pixel values caused by noise. Consider now a sharp boundary between a dark and a bright region, good

TABLE IV

KEY COMPONENTS OF SOME GENERALIZED LINEAR SYSTEM MOTIVATED BY THE BREGMAN DIVERGENCE. THE DOMAIN OF THE LIP MODEL IS $(-\infty, M)$. IN THIS TABLE, IT IS NORMALIZED BY M TO SIMPLIFY NOTATION

	Domain	$D_F(x,y)$	$\phi(x)$	$x \oplus y$	$\alpha \otimes x, (\alpha \in R)$
Log-ratio	$(0,1)$	$-x \log \frac{x}{y} - (1-x) \log \frac{1-x}{1-y}$	$\log \frac{1-x}{x}$	$\frac{1}{1 + \frac{1-x}{x} \frac{1-y}{y}}$	$\frac{1}{1 + \left(\frac{1-x}{x}\right)^{\alpha}}$
LIP	$(-\infty,1)$	$(1-x) \log \frac{1-x}{1-y} - [(1-x) - (1-y)]$	$-\log(1-x)$	$x + y - xy$	$1 - (1-x)^{\alpha}$
MHS	$(0,\infty)$	$x \log \frac{x}{y} - (x-y)$	$-\log(x)$	xy	x^{α}
Tangent	$(-1,1)$	$\frac{1-xy}{\sqrt{1-y^2}} - \sqrt{1-x^2}$	$\frac{x}{\sqrt{1-x^2}}$	$\frac{\phi(x)+\phi(y)}{\sqrt{1+(\phi(x)+\phi(y))^2}}$	$\frac{\alpha\phi(x)}{\sqrt{1+(\alpha\phi(x))^2}}$

filtering behavior is achieved at the boundaries, thanks to the domain component of the filter, and crisp edges are preserved at the same time thanks to the range component.

VI. CONTRAST ENHANCEMENT OF THE ROOT SIGNAL

For contrast enhancement, we use adaptive histogram equalization implemented by Mat lab function in the image processing Toolbox. The function called "adapthiseq" has a parameter controlling the contrast. This parameter is determined by the user through experiments to obtain the most visually pleasing result. In our simulations, we use default values for other parameters of the function.

VII. ADAPTIVE GAIN CONTROL

In the enhancement of the detail signal we require gain factor to yield good results, it be must be greater than one. Using a same gain for the entire image does not lead to good results, because to enhance the small details a relatively large gain is required. This large gain can lead to the saturation of the detailed signal whose values are larger than a certain threshold. Saturation is undesirable because different amplitudes of the detail signal are mapped to the same amplitude of either -1 or 1. This leads to loss of information. Therefore, the gain must be controlled adaptively. We describe the following below gain control algorithm using tangent operations. To control the gain, we first perform a linear mapping of the detail signal to a new signal c, $c = 2d - 1$ Such that the dynamic range of is (-3,1) . A simple idea is to set the gain as a function of the signal and to gradually decrease the gain from its maximum value when to its minimum value when. More specifically, we propose the following adaptive gain control function:

$$\gamma(c) = \alpha + \beta \exp(-|c|^{\eta})$$

Where is a parameter that controls the rate of decreasing. The two parameters and are obtained by solving . so the two parameters the equations: and . For a fixed, we can easily determine the two parameters αand β obtain by solving following equations(0)=γmax and γmin for fixed ,η we can easily find out by two parameters

β =(γmax-γmin)/(1-$e - 1$)

α=γmax-β

γmaxnand γmin both are individual for image processing if γmin=1 the detailed signal is large. So it is not used for further purpose

VIII. RESULTS AND COMPARISON

Fig-7: this figure show the individual effect of constract enhancement and detailed image from left to right

Fig: this figur described results of the proposed algorithm using 3x3 mask with different shapes

Top left –square top right –diagnal botom left –harizantal-vertical and the results shown in the bottom right .the halo effects are marked by red ellipes

Fig-4: the following figur shown results of the proposed algorithm using log-ratio (miodle) and tanget operations(right).so there is no visible bitween midle and right

FIG: this figure described comparison of the other published results such as top left-original image, top right –proposed algorithm,bottamleft-farbman, bottaomright-meylan algorithm

VI CONCLUSION AND FURTHER WORK

In this paper, we developed generalized unsharp masking algorithm by using an exploratory data model as a unified frame work, it is very useful for highly texture images and which images having long distance objects to find the exact edges for that objects. By using the generalized unsharp masking algorithm we solved problems associated with existing unsharp masking algorithm, first one is the halo-effect is reduced by means of an edge-preserving filter that is bilateral filter, second one is rescaling process eliminated by using tangent operations and final one we introduced a new future that is simultaneously enhancing contrast and sharpness by means of individual treatment of the model component and the residual. Extensions of this work can be carried out in a number of directions. In this work, we only test the bilateral filter as a computationally inexpensive edge preserving filter. It is expected that other more advanced edge preserving filters such as non local means filter, the least squares filters and wavelet

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