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Content-Aware Dark Image Enhancement in Image Fusion Techniques

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ABSTRACT: In this paper is to produce a contrast enhancement technique to recover an image within a given area, from a blurred and darkness specimen, also improve visual quality of it. Our technique consists of two steps unsharp masking step and contrast enhancement step. We applied unsharp masking step to the image to sharpen edges and bring out hidden details. In contrast enhancement step 3x3 slider map window was applied to the image to determine if the corresponding pixel will be remapped or not. The new value of remapped pixel based on a sigmoid map function. We provide experimental results from the application of our technique to real images, which are hard to be contrasted by other conventional techniques. Good and satisfying results were obtained.

Key words: Digital image, sigmoid function, contrast enhancement, image processing and un-sharp masking.

I. INTRODUCTION

The world is filled with images, which are representations of objects and scenes in the real world. Images are represented by an array of pixels, which can represent the gray levels or colors of the image. There are many aspects of images that are ambiguous and uncertain. Examples of these vague aspects include determining the border of a blurred object and determining which gray values of pixels are bright and which are dark [1]. Sometimes an image may be too dark contains blurriness and therefore difficult to recognize the different objects or scenery contained in the image. Image enhancement algorithms are applied to remotely sensed data to improve the appearance of an image for human visual analysis or occasionally for subsequent machine analysis [2]. The objective of image enhancement is dependent on the application context; criteria for enhancement is often subjective or too complex to be easily converted to useful objective measures. Image enhancement techniques are widely used in many fields, where the subjective quality of images is important. Many algorithms for achieving contrast enhancement have been developed. Those enhancement algorithms can be classified into two types point operations, which are global, and spatial neighborhood techniques, which are local. Recently several algorithms for carrying out contrast enhancement have been developed among them histogram modification techniques, which are attractive due to their simplicity. Histogram equalization is a technique that generates a gray map which changes the histogram of an image and redistributing all pixels values to be as close as possible to a user-specified desired histogram [3-4]. Adaptive contrast and edge enhancement techniques are common contrast enhancement methods [5-7].

Sigmoid Function: Sigmoid function is a continuous nonlinear activation function. The name, sigmoid, obtained from the fact that the function is "S" shaped. Statisticians call this function the logistic function, Using f *(x)* for input, and with *a* as a gain term, the sigmoid function is:

$$f(x) = \frac{1}{(1 + e^{-ax})}$$

The sigmoid function has the characteristics that it is a smooth continuous function, the function outputs within the range 0 to 1, mathematically the function is easy to deal with; it goes up smoothly and kindly. For better details about this function, refer to [8].

In this paper we develop a robust approach for contrast enhancement of dark blurred image. The proposed technique holds two steps. The first step is applying un sharp masking to the raw image to obtain sharper and more detailed image. Second step is contrast enhancement step that based on a sigmoid mapping function. In the following section we describe our approach. This is followed by application of the technique on synthetic and real data. The results of applying our approach to real images are presented in section 3. Finally we conclude with directions for further work in contrast enhancement.

II. ALGORITHM IMPLEMENTATION

The steps of our enhancement technique are as following: 1 Un sharp masking step: Enhances small structures and bring out the hidden details in the image by using un sharp masking. It only sharpens the areas, which have edges or lots of details. Un sharp masking performed by generating a blurred copy of the original image by using laplacian filter [9], subtracting it from the original image.

$$I\ (i,j) = I_O(i,j) - I_b(i,j)$$

Where:

$I\ (i,j)$ unsharp masking im

$I_O(i,j)$ original image

$I_b(i,j)$ blurred copy

Multiply the un sharp masking image by a fractional value, and adding it to the original image to get the image that will be contrasted. In this step, the large features are not changed by much, but the small ones are enhanced. The result is a sharper, more detailed image.

$$g\ (i,j) = I_O(i.j) + k\, I\ (i,j)$$

Where:

g (i, j) is output image, k is scaling constant.

Logical values for *k* vary between 0.2 and 0.7. Recently there was an attempt to perform the sharpening by local analysis of Gradients. Contrast enhancement step: For a grey scale images A sliding 3x3 map window moves from the left side to the right side of original image horizontally in steps starting from the image's upper right corner.

A pixel value in the enhanced widow dependents only on its value that's mean if the interest pixel exceeds a certain value (threshold) its value remain unchanged if the value of the pixel is under the threshold then it will be remapped .The process can be described with the mapping function O =*M* (i), where O and i are the new and old pixel values, respectively. The form of the mapping function *M* that determines the effect of the operation is:

$$M = i * \frac{c}{1 + e^{-i}}$$

According to above mapping function the new value of Corresponding pixel will be:

$$O = \begin{cases} i & \text{if } i > t \\ i + (i * (\frac{c}{1 + e^{-i}}) & \text{if } i < t \end{cases}$$

Where c is a contrast factor determines the degree of the needed contrast. After map window reaches the right side, it returns to the left side and moves down a step. The process is repeated until the sliding window reaches the right-bottom corner of the image. For color images, before applying the slider map window the pixels with the lowest values map to 0 and the highest values to 255 other pixels value calculated based on a weighted average of the RGB values. Then apply the slider map window as Demonstrated above.

III. AND DISCUSSION

We selected two groups of images to simulate, and compared the simulation results. There is tabulation with comparison in many parameters such as, PSNR, Encode Time, Decode Time, and Compressed Size etc. The all Result showing in Table is the unique result and it is the best performance With respect to our base thesis and previous results.

A. Comparative Result Analysis

The techniques implemented in this investigation were applied to the following images. The test results along with the respective histograms are as shown in the following figures. The test image data set was carefully chosen to include images that have different ranges of contrast as well as challenging conditions.

Images with normal, low and high contrast were chosen along with the images that have details in shadow. These Figures are a medium contrast test image with a lot of details and objects that are enhanced after the implementation of the contrast enhancement techniques.

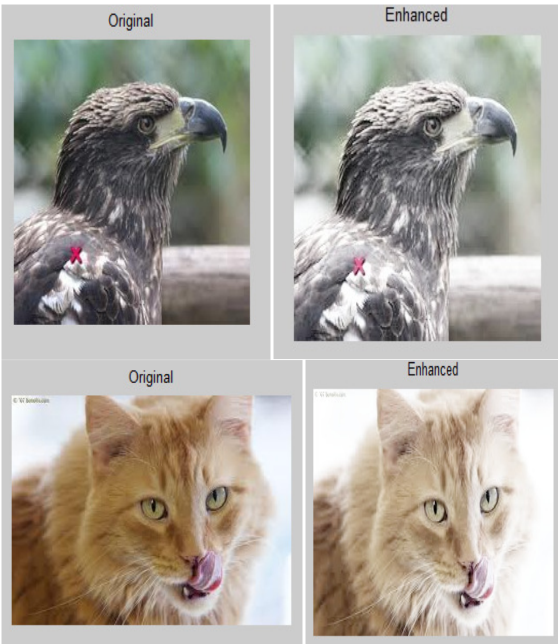
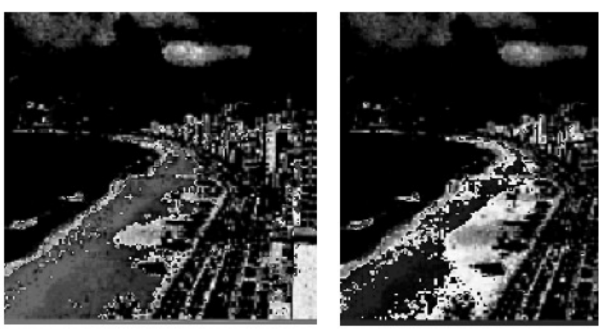


Fig. 1. Comparative Result of simulations.



(2c) output image, c =3 (2d) output image, c=4

Fig. 2. Illustrates the result of applying the proposed contrast Enhancement approach on a dark grey scale seaside image, (2a)
original image, (2b), (2c), (2d) output images with different values of c.

Fig. 3. Illustrates the result of applying the proposed contrast Enhancement approach on a dark color flower image, (3a) original dark blurred image, (3b),(3c),(3d) output images with different values of c.

IV. CONCLUSIONS

We have proposed a robust method for contrast enhancement of dark blurred images. The technique is based on the pixels of sharpened version of original image. The sharpened version is obtained by using unsharp masking. Then a 3x3-sliding window passes over the sharpened version, every pixel in that area will be examined to determine if is it exceeds a threshold value or not. All pixels values go over the threshold remain unchanged, other pixels will remapped according to a specific equation. The results from applying our approach on grey scale; color and medical images show that the technique is robust and able to recover even too dark images from blurring and darkness.

There are several advantages of using this method, including the ability to enhance the performance of any still image regardless of its construction, and to provide enhancements that are physically impossible to achieve, beside its ideal for enhancement of all types of photography, from snapshots to medical images. We suggest applying the technique in an iterative manner and show the results on real remote sensing panchromatic images. Further investigations have to be carried out to dynamically determine the appropriate scale parameter for use in the contrast enhancement step.

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