Image Enhancement and its Techniques

Prof. Trima Piedade Fernandes e Fizardo[1] Gagan Sawant[2] Sarvesh Naik[3] Sahil Parab[4] Brijkishor D Singh[5]
[1]Guide
[1,2,3,4,5]Department of Electronics & Telecommunication
[1,2,3,4,5]Don Bosco College of Engineering, Fatorda, Goa, India

Abstract— Today applications need numerous varieties of pictures as sources of knowledge for interpretation and examination. Image improvement is the methodology of applying completely different alterations to an input image to form the resultant image additional pleasing or to produce a higher rework presentation for future machine-driven image process techniques. Several pictures like medical pictures, pictures of satellites, and even world pictures suffer from poor sharpness and wheezy effects. This is crucial to reinforce the distinction and take away the noise to extend image normally. One is presenting a review of numerous image improvement techniques for sharpening improvement. However, these techniques are ready to bring noticeable changes within the pictures and generally conjointly produces unwanted artefacts in several cases. These issues ought to be resolved in order that higher improvement is also performed in future work. This paper proposes a brand new work for improvement by mistreatment computer science schemes.

Key words: Image Enhancement

I. INTRODUCTION

Digital image processing is the field which is used for large scale experimental work by using different techniques and algorithms. In digital image processing, wide variety of algorithms can be applied to the input image and output image can be made more pleasing for viewers by using image processing techniques. Image enhancement is the one part of image processing. [1] Image enhancement allows the techniques for upgrading the quality of image to make the resultant image more effective than the original image. The basis of image enhancement is to highlight the hidden details in an image and increase the contrast in a low contrast image. Image enhancement is one of the basic and most promising field of digital image processing. Fundamentally, the key idea behind the enhancement techniques is to show out the details that are not visible to viewers. Enhancement is primarily done to restore an image that was deteriorated while converting it from one form to other.[1] The main objective of image enhancement depends on the application context and the norms for image enhancement are very cumbersome to be easily changed to meet objective measures, image enhancement algorithms must be easy to understand and qualitative. However, in any application one algorithm which is performing well for one class of the images may not perform as well for some other classes. The techniques are of two types that are spatial domain techniques and transform domain techniques. Under the heading of basic enhancement, we include all those image attributes that may be thought of as the digital surrogates in the translation from classical Analog-tone and colour- reproduction theory. These represent all aspects of the image relationship to the original scene in terms of its perceived brightness across all regions of the image, likewise the colour reproduction, and the tone or contrast associated with each brightness region of the image. This area of image enhancement that we label here as „basic" now has the special further assumed property whereby all image manipulations within this domain are obtained within the rule of determinate pixel mapping. In other words, only enhancements are assumed permissible which operate in a predetermined manner on each pixel, independent of the state of any adjoining pixel, or groups of pixels. The classification of these techniques as "Basic Enhancement". Image enhancement plays a fundamental role in many image processing applications where human beings (the experts) make decisions depended on the image information. But some problems arise in the interface between the observer and the machine. In the image processing, we usually use some objective quality criteria to ascertain the goodness of the results.

A. Histogram Effort

For a given image X, the probability density function p (Xm) is defined as

$$p(X_m) = \frac{n_m}{n}$$

For m = 0, 1, …, L – 1, where nm represents the number of times that the level Xm appears in the input image X and n is the total number of samples in the input image. Note that p (Xm) is associated with the histogram of the input image which represents the number of pixels that have a specific intensity Xm. In fact, a plot of nm vs. Xm is known histogram of X. Based on the probability density function; the cumulative density function is defined as

$$c(x) = \sum_{j=0}^{m} p(X_j)$$

Where Xm = x, for m = 0, 1… L – 1. Note that c (XL-1) = 1 by definition. HE is a scheme that maps the input image into the entire dynamic range, (X0, XL-1), by using the cumulative density function as a transform function. Let "s define a transform function f(x) based on the cumulative density function as

$$f(x) = X_0 + (X_{L-1} - X_0)c(x)$$

Then the output image of the HE, Y = {Y (i, j)}, can be expressed as

$$\mathbf{Y} = f(\mathbf{X}) = \{f(X(i,j) \mid \forall X(i,j) \in X\}$$

The high performance of the HE in enhancing the contrast of an image as a consequence of the dynamic range expansion, besides, HE also flattens a histogram. Based on information theory, entropy of message source will get the maximum value when the message has uniform distribution property.

II. IMAGE IMPROVEMENT TECHNIQUES

Image improvement is outlined as input image is given having inferiority like low distinction and noise and that we ought to improve it for higher output for several helpful applications. Basically, these are classified into 2 styles of abstraction domain and frequency domain techniques that are explained in the following section

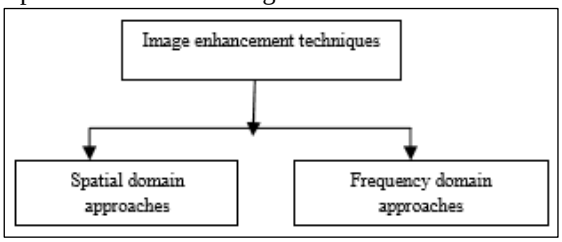


Fig. 2: Image enhancement techniques

A. Abstraction Domain Techniques

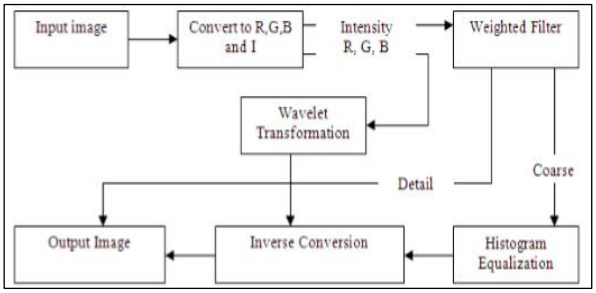
Spatial domain techniques are operated on pixels. The values of pixels are changed to induce the meant improvement. It involves the techniques like log transformations, power-law (gamma) transformations, bar graph effort and Matching (Specification) that are hooked in to the direct operation on the pixels within the image. [3]These are essentially used for the direct alteration of the gray values of the pixels separately and conjointly for the sharpness of the image. However, the matter in it's generally it conjointly generates the unacceptable results as a result of it works in an exceedingly uniform approach within the whole image that was taken.

B. Frequency domain techniques

It appropriate for the pictures that are supported frequency elements and works on the orthogonal transformation of the image instead of the image itself. The principle of these techniques consists of second separate unitary transformation, for illustration of 2-D separate Fourier rework that replaces the coefficients by the operator and so performs the inverse method. Its 2 elements particularly magnitude and section. Magnitude consists of the frequency part and section is for restoring the image back to the abstraction domain. These are simple techniques. Firstly, the Fourier rework of the image is computed that is to be computed and also the result increased by a filter and inverse rework is taken to get the output image. In low pass filtering, high-frequency elements of the image are eliminated and as a result, the image would be blurred related to noise. A perfect filter conjointly has 2 issues: the blurring of image and ringing of the image.

III. PLANNED ALGORITHMIC PROGRAM

The contributions of the paper for enhancing the high-contrast digital photos mechanically, which reinforces the brightness and distinction of pictures whereas conserving detail. it's supported a separate the colours of the image by rotten the image into the colour image and also the intensity image, two-scale decomposition of the image into a base layer, cryptography a rough or large-scale image, and a detail layer. The bottom layer is obtained mistreatment an edge-preserving filter. This filter is just a weighted average of the native neighbourhood samples, wherever the weights are computed supported temporal and radiometric distances between the centre sample and also the neighbour samples. The bar graph effort methodology is employed to enhance the brightness and distinction of the bottom layer image. The wave transformation is employed to reinforce the colour info. Finally, we tend to restore the small print back. The flowchart of the planned methodology is shown in Figure below.



A. Colour and Intensity Separation

[2]The first step of our methodology is rotten the image into the colour image and also the intensity image. We tend to calculate the intensity of the initial image and separate the colour info by wherever R, G, B are the intensity price of R, G, and B channels, I is that the intensity image and B G R is that the separated colour image. In the second step, we tend to acquire the two-scale decomposition of the image into a base layer, cryptography coarse or large-scale, and a detail layer by mistreatment the weighted filter and wave rework. [5]The coarse image and also the detail pictures are shown in Figure five. Since the human sensory system is curious about the detail image, solely the bottom layer image is increased by mistreatment bar graph effort to enhance the world brightness and distinction, thereby the small print are preserved.

Fig. 5: Source Image, Coarse Image and Detail Image Respectively

1) Histogram effort:

[4]For adjusting the image distinction and brightness, we tend to propose to use bar graph effort to get the optimum coarse image. It's the final tendency of spreading the bar graph of the input image in order that the degree of the

histogram-equalized image span a fuller vary of the grayscale. The bar graph distribution of the image before and once the bar graph effort is shown in Figure six and conjointly shows the results of the bottom layer image increased by the bar graph effort. One in every one of the helpful benefits of bar graph effort is that it's absolutely automatic. It's obvious that the dark space is lightened.

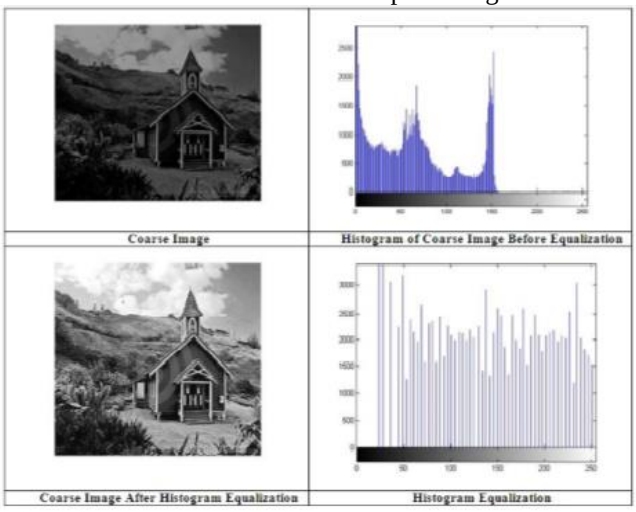


Fig. 6: The Base Layer Image Before and After Histogram Equalization

Then the colour information is enhanced by using the wavelet transform and Haar transform as shown in figure 7.

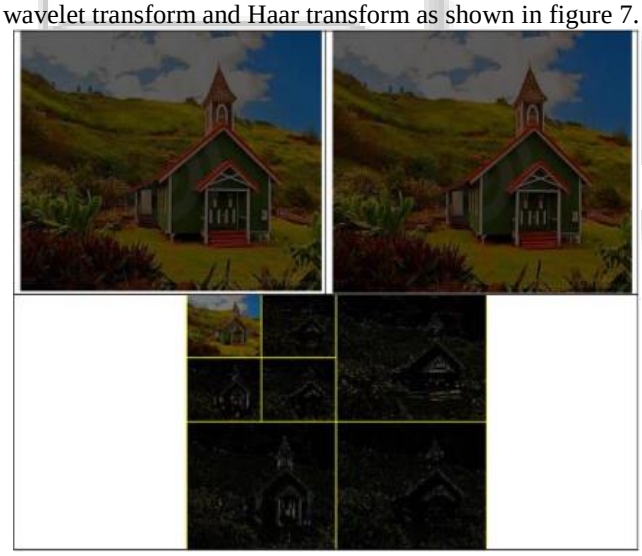


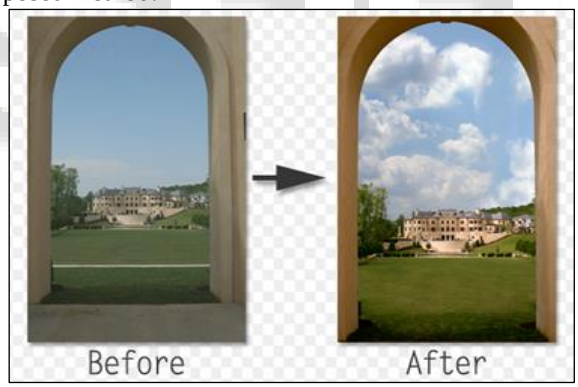
Fig. 7: The Result after Applying Wavelet, Synthesized Image, De-noise Image and Decomposition at Level 2

Finally, we tend to mix the detail image and colour info back, it achieves the goal of adjusting overall brightness and distinction of a picture mechanically and preserves the small print. Figure eight shows the ultimate results of the planned algorithmic program.

Fig. 8: The Final Result

IV. RESULT AND DISCUSSION

Figure 8 shows the final result enhanced automatically by the proposed algorithm. It is clear that the proposed method gets an excellent result, it not only lightens the darker area on the red areas, the trees are visible clearly, but also preserves the details of the light area, the sky and clouds are retained. Compared with the result by using the automatic enhancement function in Adobe Photoshop, we found that the proposed method performs better than the auto-level function in the commercial image-editing software. Figure 9 shows another example of high-contrast photo and the result enhanced automatically by the proposed method. Obviously, the details in the dark area are brightened while the details in highlight area are preserved and not washed out. They demonstrate the powerfulness and effectiveness of the proposed method.



V. CONCLUSION

In follow, the automated improvement operates within the business image is written material software package like Adobe Photoshop obtains poor results for the photos with high distinction or high dynamic vary. In this paper, we tend to gift a picture improvement algorithmic program supported the weighted filter, bar graph effort and wave transformation to unravel this drawback. The experimental results show that the planned approach will enhance the high-contrast pictures effectively; it not solely improves the world brightness and distinction of pictures however conjointly preserves details and take away noise. The opposite advantage of the planned methodology is that it's absolutely automatic and needs no parameter settings. Therefore, it's helpful and appropriate for many camera users.

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