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A Review on Image enhancement using Histogram Equalization for Aerial images

Meenu Dailla[1], Prabhjot Kaur[2]

[1]M.Tech Student, ECE Department
AIMT, Karnal, Haryana, India
dailla.meenu@gmail.com
[2]Assistant Professor, ECE Department
AIMT, Karnal, Haryana, India
parbhjot004@gmail.com

Abstract: *Image Enhancement through De-noising is one of the most important applications of Digital Image Processing and is still a challenging problem. Images are often received in defective conditions due to usage of Poor image sensors, poor data acquisition process and transmission errors etc., which creates problems for the subsequent process to understand such images. The present paper gives the detail of various noise effects on the images and also discusses the methods to remove the noise by using Gaussian filter and to enhance the image quality using gamma correction technique. The Experimental results performed on a set of standard test images for a wide range of noise corruption levels. The present paper also discusses the enhancement of the text images. The work is implemented on the MATLAB environment. The various techniques have been reviewed.*

Keywords: - *RGB (red, green, blue), Image enhancement, noise, MATLAB, spatial domain etc.*

1. INTRODUCTION

Image De-noising and Enhancement are the key research fields in Image Processing as they are useful in several applications such as Feature Detection, Medical Image Processing, Remote Sensing, Machine vision etc., which improves the image clarity and visual perception of human beings. They modifies images to improve them (enhancement, restoration), extract information (analysis, recognition), and change their structure [6]. It improves the clarity of the Image for Human Perception. Edge Enhancement, Sharpen (create more contrast between neighboring pixels), Soften (blend the edges of neighboring pixels), Blur removing (blend together pixels of the image), Raising Contrast, Medical Imaging (CT scan and MRI images) are some of the Image Processing functions. Grayscale images are distinct from one-bit black-and white images, which in the context of computer imaging are images with only the two colors, black, and white (also called bi-level or binary images). Grayscale images have many shades of gray in between 0 and 255. A 640 x 480 grayscale image requires over 300 KB of storage. Linear and Non Linear Filtering Techniques are used for Image De-noising and Enhancement [4].

On the other hand, image denoising from natural and unnatural images is still a challenging problem in image processing. Indeed, wavelets transform based approaches have efficient noise reduction ability in photographic images and promising results are reported in these references. Recently, multiple wavelets basis image denoising methods are also reported with remarkable performance. However, still these approaches have problems on a heavy noisy network [1]. Additionally, wavelet based approaches are computationally expensive and are not suitable for non-natural images.

1.1 Different types of noises

There are several noises that may degrade the quality of an image

- Amplifier noise (Gaussian noise)
- Salt-and-pepper noise
- Quantization noise (uniform noise)

In our proposed work we have considered the effect of Gaussian noise and we have proposed a method to denoise the noisy image using Gaussian filter [3]. The proposed work also considers the enhancement of the image using bilateral filtering method [2].

2. RELATED WORK

Morphology is a set theory approach, developed by J.Serra and G. Matheron, process the digital image based on geometrical shape i.e. by applying a structuring element. It has various applications in bio-medical imaging, Geo-science, Remote sensing, Quality control, Document processing and Data analysis. The value of each pixel in the output image is based on a comparison of the corresponding pixel

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in the input image with its neighbors. The extraction and enhancement of shape information from images is one of the important tasks of mathematical morphology. Basic operations of morphology are dilation and erosion. More complicated morphological operators can be designed by means of combining Erosions and Dilations. Dilation adds pixels to the boundaries of objects in an image.

Monedero *et al* [7] proposed a spatially variant erosions/ dilations and openings/closings approach. Structuring elements (SE) can locally adapt their shape and orientation across the direction of the structures in the image. The process of extracting shape and orientation of the SE at each pixel from the image is under study. This method is useful in the enhancement of anisotropic features such as coherent, flow like structures. A general method based on fuzzy implication and inclusion grade operators have been discussed by Yee Yee Htun *et al*.

3. PROPOSED FORMULATION

For the purposes of image analysis and pattern recognition there is always a need to transform an image into another better represented form. During the past five decades image-processing techniques have been developed tremendously and mathematical histogram in particular has been continuously developing because it is receiving a great deal of attention because it provides a quantitative description of geometric structure and shape and also a mathematical description of algebra, topology, probability, and integral geometry. It is mathematical in the sense that the analysis is based on set theory, topology, lattice algebra, function, and so on.

3.1 Power Law Transformations

Power-law transformations have the basic equation

$$S = cr^{\gamma} \quad (1)$$

Where c and ´Y are the positive constants. Sometimes this equation is written as

$$S = c(r + \varepsilon)^{\gamma} \quad (2)$$

to account for an offset. However, offsets typically are an issue of display calibration and result they are normally ignored in (1). As in the case of the log transformation power-law curves with fraction values of gamma map a narrow range of dark input values into a wider range of output values. It has opposite being true for higher values of input levels. According to this, it will generate the curves with values of ´Y > 1 have exactly the opposite effect as those generated with values of ´Y < 1. Finally from (1) it reduces to the identity transformation when c = ´Y= 1. A variety of devices used for image capture, printing and display respond according to a power law. The exponent in the power law equation is referred to as gamma. The process is used to correct these power-law response phenomena is called gamma correction.

Gamma correction is important if it is displaying an image an image accurately on a computer screen is of concern [14]. Images that are not corrected properly can look either bleached out, or what is more likely too dark. It is trying to reproduce colors accurately also requires some knowledge of gamma correction because varying the value of gamma correction changes not only the brightness but also the ratios of red to green to blue. Basically in this method it utilizes for enhanced the dimmed images. In this method gamma is adjusted manually, according to this gamma value, the image will be enhanced [8]. So the main drawback of this method is to give the value of gamma manually, it does not optimize the value of gamma [11].

3.2 Gaussian Filtering De-Noising

The Gaussian filtering is an important space for the weighted mean filter. It is based on the shape of the Gaussian function to select the right value of linear smoothing filter[13]. It usually uses the Gaussian function of discrete two-dimensional by zero-mean to be smoothing filter. The following equation as below:

$$g(x,y) = \frac{1}{M}\sum f(x,y)\exp\left[-\left((x-i)^2+(y-j)^2\right)/2\sigma^2\right]$$

In our proposed work we have used Mathematical morphological operator for the manipulation of the images. We have considered the above said point in our approach to enhance the captured images. Further we have also considered the power law transformation technique for the result analysis.

4. HISTOGRAMS

- A graphical representation is similar to a bar chart that organizes a group of data points into user-specified ranges. The histogram condenses a data series into an easily interpreted visual by taking many data points and grouping them into logical ranges or bins[15].
- A Histogram is a graphical display of data using bars of different heights.
- The horizontal axis of the graph represents the color variations, while the vertical axis represents

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the number of pixels in that particular color.

- The histogram compresses a data series into an easily interpreted visual by taking many data points and grouping them into logical ranges.

It plots the number of pixels for each tonal value.

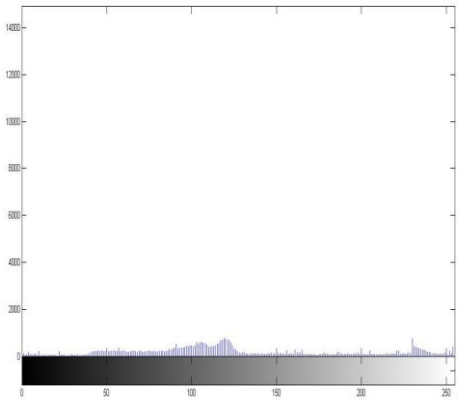

Figure 1: Histogram Appraoch

5. CONCLUSION AND FUTURE SCOPE

Most of the techniques are useful for altering the gray level values of individual pixels and hence the overall contrast of the entire image. But they usually enhance the whole image in a uniform manner which in many cases produces undesirable results. There are various techniques available which produce highly balanced and visually appealing results for a diversity of images with different qualities of contrast and edge information and it will produce satisfactory result. The captured images of aerial image always lead to an ambiguity which is the main concern of research. The presented paper gives the review of different techniques to improve the quality of an image. The image enhancement quality can be assessed by the Absolute Mean Brightness Error (AMBE), the Discrete Entropy (H) and PSNR to assess the enhancement quality between the dimmed input image and the enhanced image.

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