A Review Paper on an Improved Histogram for Noisy Image Received by Satellite on Earth Station by using Innovative Filters

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Abstract— *in information age also known as computer age or digital age, visual knowledge and material is often transmitted in the form of digital images. Digital images plays very significant role in our daily routine like they are used in satellite television, Intelligent traffic monitoring, handwriting recognition on checks, signature validation, computer resonance imaging and in area of research and technology such as geographical information systems and astronomy. A digital image can be described as two-dimensional image as a finite set of discrete values, known as picture elements or pixels. Pixel ideals typically represent grey levels, colors, heights, opacities etc. Image processing is any form of signal processing for which the input is an image, such as photographs or frames of video and the output of image processing can be either an image or a set of characteristics or parameters related to the image.*

Keywords— Image Processing, Image Denoisng, Filter, Histogram

I. Introduction

In image processing system depends on its ability to detect the presence of noisy pixels in the image. Image Processing is the analysis of a picture using different techniques that can identify relationships, shades and colors that cannot be perceived by the human eye. Image processing is a way to change an image into digital form and implement some operations on it, in order to get an image with increased quality or to obtain some useful information from it. Significant works have been done in both hardware and software to improve the signal-to-noise ratio for images. In software, a denoising filter is used to remove noise from an image. Each pixel is represented by three scalar values representing the red, green, and blue chromatic intensities. At each pixel studied, a filter takes into account the surrounding pixels to derive a more accurate version of this pixel. By taking neighboring pixels into consideration extreme “noisy” pixels can be replaced. However, outlier pixels may represent in corrupted fine details, which may be lost due to the smoothing process.

Blurring as well as noise generates degradation due to electronic and photometric sources. Blurring is a form of bandwidth reduction of the image caused by the imperfect image formation process such as relative motion between the camera and the original scene or by an optical system that is out of focus so there may be several reasons due to which an image can reduce its quality or get corrupted are-motion between camera and object, improper opening of the shutter, atmospheric disturbances, misfocusing etc. Noise is addition of undesired components in the image that degrades the visual quality of an image. This undesired constituent needs to be removed before the process of retrieving the original image is to be start. The digital image acquisition process converts an optical image taken with an optical device into a continuous stream of electronic signals that is later sampled in the primary process by which noise appears in digital images. In some case when the images are sent by the sender, images get corrupted with undesirable noise & unwanted elements after transmission

A. Digital Image

A digital image a[m,n] described in a 2D discrete space is derived from an analog image a(x,y) in a 2D continuous space through a sampling process that is frequently referred to as digitization. The 2D continuous image a(x,y) is divided into N rows and M columns. The intersection of a row and a column is termed a pixel. The value assigned to the integer coordinates [m,n] with {m=0,1,2,...,M–1} and {n=0,1,2,...,N–1} is a[m,n]. In fact, in most cases a(x,y)—which we might consider to be the physical signal that impinges on the face of a 2D sensor—is actually a function of many variables including depth (z), color (λ) and time(t).

B. Denoising

Denoising is the pre-processing step in the Image Enhancement process. Denoising is necessary and first step to be taken before the image data is analyzed for further use. Because after introducing the noise in image, the important details and features of image are destroyed. It is necessary to apply efficient denoising technique to compensate for such data corruption. Image denoising is used to remove the noise while retaining as much as possible the important signal features. The purpose of image denoising is to estimate the original image from the noisy data. Image restoration or denoising is required, to make a visually high quality image, which includes the process of changing, correcting or moving of the image data to produce noise free image.

Denoising is more significant than any other tasks in image processing, analysis and applications. Preserving the details of an image and removing the random noise as far as possible is the goal of image denoising approaches. Besides the noisy image produces undesirable visual quality, it also lowers the visibility of low contrast objects. Hence noise removal is essential in digital imaging applications in order to enhance and recover fine details that are hidden in the data. In many occasions, noise in digital images is found to be additive in nature with uniform power in the whole bandwidth and with Gaussian probability distribution. Digital images are corrupted by noise during image acquisition or transmission process. There are different types of noises in digital images.

C. Thresholding

Thresholding is the simplest method of image segmentation. Segmentation involves separating an image into regions (or their contours) corresponding to objects. We usually try to segment regions by identifying common properties. Or, similarly, we identify contours by identifying differences between regions (edges).

The simplest property that pixels in a region can share is intensity. So, a natural way to segment such regions is through thresholding, the separation of light and dark regions.

D. Problems with Thresholding

The major problem with thresholding is that we consider only the intensity, not any relationships between the pixels. There is no guarantee that the pixels identified by the thresholding process are contiguous.

We can easily include extraneous pixels that aren't part of the desired region, and we can just as easily miss isolated pixels within the region (especially near the boundaries of the region). These effects get worse as the noise gets worse, simply because it's more likely that a pixel's intensity doesn't represent the normal intensity in the region.

When we use thresholding, we typically have to play with it, sometimes losing too much of the region and sometimes getting too many extraneous background pixels. (Shadows of objects in the image are also a real pain—not just where they fall across another object but where they mistakenly get included as part of a dark object on a light background.)

E. Histogram

Before discussing the use of Histograms in image processing, we will first look at what histogram is. In statistics, a histogram is a graphical representation of the distribution of data. It is an estimate of the probability distribution of a continuous variable and was first introduced by Karl Pearson. Histograms are used to plot the density of data, and often for density estimation: estimating the probability density function of the underlying variable. Histograms are a way of visualizing the predominate intensities of an image. A histogram is a graph that shows frequency of anything. Usually histogram has bars that represent frequency of occurring of data in the whole data set. A Histogram has two axis the x axis and the y axis.

– The x axis contains event whose frequency you have to count.
– The y axis contains frequency.

As a definition, image histograms are a count of the number of pixels that are at certain intensity. When represented as a plot, the x-axis is the intensity value, and the y-axis is the number of pixels with that intensity value. Let X be a gray scale (achromatic) image. A single pixel is denoted as Xs where s 2 S is a position in the lattice S. Generally, we will assume that Xs takes on the discrete values 0, ……L– 1 where typically L = 256. The histogram of the image X is then given by

$$H_{(i)} = \sum_{s \in S} \delta(Xs - i) \quad \ldots\ldots(1)$$

So $H_{(i)}$ computes the number of pixels that take on the value i.

II. Literature Review

This chapter deals with the survey of various research papers that have contributed in the denoising of images processing, in one way or other. There is a growing demand of image processing in diverse application areas, such as multimedia computing, secured image data communication, biomedical imaging, biometrics, remote sensing, texture understanding, pattern recognition, content-based image retrieval, compression and so on. And wavelet transform has been providing a major contribution in all the above mentioned areas since long time. But the quest of betterment never ends.

It is very essential to keep the useful data in the exact original form for further processing denoising being the latest technique that has proved its command over this issue. The following literature review discusses denoising techniques in a wide scenario, i.e. using a number of filtering and thresholding techniques for a wide variety of test images.

A. Problem Identification

It is essential to suppress noise from an image as far as possible. At the same time, its fine-details and edges are to be retained as much as practicable. The filtering with the Thresholding algorithms to be developed must be of low computational complexity so that they can filter noise in short time, and hence will find themselves suitable for online and real- time applications.

Thus, the problem taken for this thesis research work is to develop efficient filters with the Thresholding to suppress noise:

– With very high efficiency
– yielding extremely low distortion
– In wide range of noise densities
– With less computational complexity and low run- time overhead
– While retaining edges and fine details of an image

The thesis research work focuses mainly on salt & pepper noise, Gaussian noise and random noise; in addition some methods are developed to suppress noises.

Therefore the following problem is taken.

– Problem: to develop some novel efficient restoration algorithms for images corrupted with high density noises.

III. Methodology

Denoising techniques plays an increasingly important role in the signal analysis and image processing. Denoising analysis techniques has been applied to a wide of signals.

A. Denoising Technique

Image analysis is easy task after noise is filtered. An engineer working in signal processing has different meaning of the term filter which requires certain operations which tell us the area of interest in the image. Image filters may be used to highlight edges that is, parts of objects in images or boundaries between objects. Filters provide for, better visual interpretation of images, and can also be used as a predecessor to further digital processing, such as segmentation. Image Denoising is the process of obtaining the original image from the degraded image if value of the degrading factors is known. It is used to eliminate the noise from the corrupted image while retaining the edges and other major detail without hampering the visual information of image.

There are three most popular techniques for image denoising namely image filtering, wavelet analysis and multifractal analysis. Each technique has their own advantages and disadvantages. Filtration can be done in either linear or non-linear environment. Linear filter provides linear relationship between input and output, so we can plot a linear curve between input and output. For example mean filter, weiner filter etc. Nonlinear filters have quite different behavior compared to linear filters. For nonlinear filters, the filter output or response of the filter does not obey the principles outlined earlier, particularly scaling and shift invariance. Moreover, a nonlinear filter can produce results that vary in a non-intuitive manner.

In this thesis we will deal with different type of filters. Two types of filtering techniques are popular-linear and Non-linear filtering techniques are discussed below:

- Linear filters: The approach output values are linear function of the pixels in the original image. Linear methods are easy to analyze mathematically than the nonlinear Filters
- Non-linear filters: These filters have accurate results because they are able to reduce noise levels without blurring the edges.

IV. Conclusion

In this thesis, we have proposed a new threshold estimation technique in which a gray scale image in ‘bmp’ format is injected salt and pepper noise, Gaussian noise, Random noise. Further, the noised image is denoised by using different filtering and Thresholding techniques (“Brute Force Thresholding”). A particular algorithm is to be selected according to the noise present in the image. The proposed threshold mentioned in this thesis shows better performance over other techniques. Thus we can say that the proposed threshold may find applications in image recognition system, image compression, medical ultrasounds and a host of other applications.

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