

STUDY OF NOISE MODEL AND FILTERING TECHNIQUES

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Abstract: In image processing, noise reduction and restoration of image is expected to improve the qualitative inspection of an image and the performance criteria of quantitative image analysis techniques. Digital image is inclined to a variety of noise which affects the quality of image. Different approaches for reduction of noise and image enhancement have been considered, each of which has their own limitation and advantages. Noise is always presents in digital images during image acquisition, coding, transmission, and processing steps. Noise is very difficult to remove it from the digital images without the prior knowledge of noise model.

Keywords: Introduction, Image and Images Types, Image Noise Model, Filters, Filters Techniques.

I. INTRODUCTION

Digital Image Processing is a component of digital signal processing. The area of digital image processing refers to dealing with digital images by means of a digital computer. Digital image processing has several advantages above analog image processing; it allows a considerably wider collection of algorithms to be apply to input data and can keep away from problems for instance the build-up of noise and signal deformation during processing. Digital Image Processing involves the modification of digital data for improving the image qualities with the aid of computer. The processing helps in maximize the clarity, sharpness of image and details of features of interest towards extraction of information & further analysis. Digital image processing is a very broad subject and it often involves the procedures which can be complex mathematically, but the central idea behind digital image processing is simple.

II. IMAGE RESTORATION

Compensate for noise, data errors, and the geometric distortions that is introduced while recording, scanning, and the playback operations.

- It restore the periodic line dropouts
- b. Used for restoring periodic line striping
- Good for filtering of random noise
- d. Enhance geometric distortions

III. IMAGE ENHANCEMENT

Processing an image so that the result is more suitable for a particular application. Such as sharpening or de-blurring an out of focus image, highlighting the edges of image, improving the contrast of image or increase the brightness level of an image, remove the noise from noisy image

- Used for Contrast Enhancement Freehand
- Intensity, saturation and hue transformations
- Edge enhancement d. Producing the synthetic stereo image

IV. IMAGE ANALYSIS:

Image analysis is concerned with making a quantitative measurement from an image to produce a description of image. Image analysis techniques extract the certain features that aid in the recognition of an object. Quantitative measurement of an object features allow description and classification of the image.

- Produce principal component image
- Producing the ratio images Producing the ratio images
- Multi-spectral classification

V. IMAGE AND ITS TYPES:-

A. TIFF (also known as TIF), file types ending in .tif

TIFF stands for Tagged Image File Format. TIFF images create very large file sizes. TIFF images are uncompressed and thus contain a lot of detailed image data (which is why the files are so big) TIFFs are also extremely flexible in terms of color (they can be grayscale, or CMYK for print, or RGB for web) and content (layers, image tags).

TIFF is the most common file type used in photo software (such as Photoshop), as well as page layout software (such as Quark and InDesign), again because a TIFF contains a lot of image data.

B. JPEG (also known as JPG), file types ending in .jpg

JPEG stands for Joint Photographic Experts Group, which created this standard for this type of image formatting. JPEG files are images that have been

compressed to store a lot of information in a small-size file. Most digital cameras store photos in JPEG format, because then you can take more photos on one camera card than you can with other formats.

C. GIF, file types ending in .gif

GIF stands for Graphic Interchange Format. This format compresses images but, as different from JPEG, the compression is lossless (no detail is lost in the compression, but the file can't be made as small as a JPEG). GIFs also have an extremely limited color range suitable for the web but not for printing. This format is never used for photography, because of the limited number of colors. GIFs can also be used for animations.

D. PNG, file types ending in .png

PNG stands for Portable Network Graphics. It was created as an open format to replace GIF, because the patent for GIF was owned by one company and nobody else wanted to pay licensing fees. It also allows for a full range of color and better compression.

E. Raw image files

Raw image files contain data from a digital camera (usually).

Raw files usually contain a vast amount of data that is uncompressed. Because of this, the size of a raw file is extremely large. Usually they are converted to TIFF before editing and color-correcting.

VI. NOISE MODEL GAUSSIAN NOISE

Principal sources of Gaussian noise in digital images arise during acquisition e.g. sensor noise caused by poor illumination and/or high temperature, and/or transmission e.g. electronic.

A typical model of image noise is Gaussian, additive, independent at each pixel, and independent of the signal intensity, caused primarily by Johnson-Nyquist noise. At higher exposures, however, image sensor noise is dominated by shot noise, which is not Gaussian and not independent of signal intensity.

Salt-and-pepper noise



A. Shot Noise

The dominant noise in the darker parts of an image from an image sensor is typically that caused by statistical quantum fluctuations, that is, variation in the number of photons sensed at a given exposure level. This noise is known as photon shot noise.

B. Quantization noise (uniform noise)

The noise caused by quantizing the pixels of a sensed image to a number of discrete levels is known as quantization noise. It has an approximately uniform distribution. Though it can be signal dependent, it will be signal independent if other noise sources are big enough to cause dithering, or if dithering is explicitly applied.

C. Anisotropic noise

Some noise sources show up with a significant orientation in images. For example, image sensors are sometimes subject to row noise or column noise.

In digital camera



Image on the left has exposure time of >10 seconds in low light. The image on the right has adequate lighting and 0.1 second exposure.

In low light, correct exposure requires the use of slow shutter speed (i.e. long exposure time), higher gain (ISO sensitivity), or both. On most cameras, slower shutter speeds lead to increased salt-and-pepper noise due to photodiode leakage currents.

VII. FILTERS

Filtering in an image processing is a basis function that is used to achieve many tasks such as noise reduction, interpolation, and re-sampling. Filtering image data is a standard process used in almost all image processing systems.

Filters can be described by different categories:--

A. Filtering without Detection

In this filtering there is a window mask which is moved across the observed image. This mask is usually of the size $(2N+1)/2$, in which N is a any positive integer. In this the centre element is the pixel of concern.

B. Detection followed by Filtering

This filtering involves two steps. In the first step it identifies the noisy pixels of image and in the second step it filters those pixels of image which contain noise. In this filtering also there is a mask which is moved across the image. It performs some arithmetic operations to detect the noisy pixels of image.

C. Hybrid Filtering

In hybrid filtering scheme, two or more filters are used to filter a corrupted location of a noisy image. The decision to apply a particular filter is based on the noise level of noisy image at the test pixel location and the performance of the filter which is used on a filtering mask.

D. Filter Description

$g(x, y)$ = Corrupted image $f(x, y)$ = Filtered image

E. Filtering Techniques Linear Filters

Linear filters are used to remove certain type of noise. Gaussian or Averaging filters are suitable for this purpose. These filters also tend to blur the sharp edges, destroy the lines and other fine details of image, and perform badly in the presence of signal dependent noise.

F. Non-Linear Filters

In recent years, a variety of non-linear median type filters such as rank conditioned, weighted median, relaxed median, rank selection have been developed to overcome the shortcoming of linear filter.

VIII. CONCLUSION

Enhancement of a noisy image is a necessary task in digital image processing. Filters are used best for removing noise from the images. In this paper we describe various types of noise models and filter techniques. Filter techniques are divided into two parts: linear and non-linear techniques. After studying linear and non-linear filters, each has its own limitations and advantages. In hybrid filtering schemes, there are two or more filters recommended to filter a corrupted location.

LITERARY SURVEY

[1]. **Rekha, C.K** stated that In image processing noise removal is a strenuous task. Noise removal forms one of the applications of segmentation. It is also the basic tool for the medical diagnosis.

[2]. **Fah, C.Y** stated that The definition of a 'good image' is subjective and depends on the requirements of a given application.

[3]. **Chen, D.G** stated that In time-domain or pulse-modulation (PM) imaging, the incident light intensity is not encoded in amounts of charge, voltage, or current as it is in conventional image sensors.

[4]. **Celik-Butler, Z** stated that The author reviews the recent results obtained on the low-frequency noise characteristics of deep-submicron metal-oxide-semiconductor field-effect transistors (MOSFETs).

[5]. **Priyanka Kamboj** stated that Digital Image Processing is a component of digital signal processing.

[6]. **Ashraf A. Aly** stated that Digital image processing is an important domain for many reasons. Actually Digital image processing is a recent subject in computer history.

[7]. **Manisha Bhardwaj** stated that Image processing refers to digital image processing. The producing of the input image in the place is referred to as imaging.

[8]. **Dr. Mehraj-Ud-Din Dar** stated that Traditionally, our main form of transmission & storage for information has been by paper documents.

[9]. **Leslie Stroebel** stated that Image noise is random (not present in the object imaged) variation of brightness or color information in images, and is usually an aspect of electronic noise.

[10]. **Ajay Kumar Boyat** stated that Noise is a random signal. It is used to destroy most of the part of image information. Image distortion is most pleasurable problems in image processing.

REFERENCES

- [1]. A. K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, First Edition, 1989.
- [2]. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing," Pearson Education, Second Edition, 2005.
- [3]. K. S. Srinivasan and D. Ebenezer, "A New Fast and Efficient Decision -Based Algorithm for Removal of High Density Impulse Noises," IEEE Signal Processing Letters Vol. 14, No. 3, March 2007.
- [4]. http://www.academia.edu/4948239/REVIEW_PAPER_ON_OVERVIEW_OF_IMAGE_PROCESSING_AND_IMAGE_SEGMENTATION.
- [5]. Ashraf A. Aly, Safaai Bin Deris, Nazar Zaki.

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Quartar of War.

[8]. <http://www.ivanexpert.com>
https://en.wikipedia.org/wiki/Image_noise.

[9]. Digital Image Processing, 3rd ed. R. C. Gonzalez & R.
E. Woods www.ImageProcessingPlace.com

[10]. www.hrwallingford.com

[11]. www.oup.com/us

[12]. www.comp.dit.ie/bmacnamee/

[13]. www.jgrcs.info/index.php/

[14]. www.imageprocessingplace.com/

[15]. <https://books.google.co.in>

