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Image Processing

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Abstract— ***It is truly said "a picture is worth a thousand words, but an image is worth a thousand pictures". an image .Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or, a set of characteristics or parameters related to the image. It is the manipulation of numeric data contained in a digital image for the purpose of enhancing its visual appearance. Through image processing, faded pictures can be enhanced. Originally developed for space exploration and biomedicine, image processing and analysis are now used in a wide range of industrial, artistic, and educational applications. An image processing can be digital, optical or analog image processing.***

Index Terms—Image restoration, Spatial filters, Frequency domain filters, Geometric transform.

I. INTRODUCTION

The major topics within the field of image processing include: 1 image analysis, 2. Image restoration, 3.Image enhancement and Image compression. Image restoration is the process of taking an image of some known, or estimated, degradation and restoring it to its original appearance. In general, it is more of an art then a science. Techniques involved in Image restoration: 1. Spatial filters: spatial filters can be used to remove various types of noises in digital images. The two special categories for noise removing are order and mean filters.2. Frequency domain filters: frequency domain filtering operates by using the Fourier transform representation of images.3. Geometric transforms

II. SPATIAL FILTERS

Spatial filters can be used to remove various types of noise in digital images. The primary two categories of spatial filters for noise removal are order filters and mean filters. The order filters are implemented by arranging their neighborhood pixels in order from smallest to largest gray value level while the mean filters determine, in one sense or other, an average value. The mean filters work on Gaussian or uniform noise, and the order filters work best with salt-and-pepper, negative exponential or Rayleigh noise.

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A. Order Filters

Order filters are based upon specific type of image statistics called order statistics. Typically, these filters operate on small sub images, windows and replace the center pixel value (similar to convolution process). Order statistics is a technique that arranges all pixels in sequential order, based on gray level value. The placement of the pixel value can be ordered set is referred as the rank.

B. Median filter

The most useful of the order is the median filter. The median filter selects the middle pixel value from the order set. In the preceding example, the median filter selects the value 104 because there are 3 values above it and 4 below it. The median filtering operation is performed on an image by applying the sliding window is over laid on the upper left corner of the image and the median is determined.ths is put into the output image corresponding to the center location of the window. The window is then slid one pixel over, and the process is repeated. When the end of row is reached, the window is slid back to the left side of the image and down one row. This process continues until the entire image has been processed. The wasted rows and columns are padded with zeros.

C. Alpha- Trimmed Filter

The alpha trimmed mean is the average of the pixel values within the window but with some of the endpoint ranked values excluded. The alpha trimmed mean filter ranges from a mean to median filter depending on the value selected for the T parameter.

D. Midpoint filter

They are actually both mean and order filter because they rely on ordering the pixel values, but they are then calculated by an averaging process. The midpoint filter is an average of minimum and maximum filter within the window .The midpoint filter is used for Gaussian and uniform noise.

E. Minimum and maximum filters

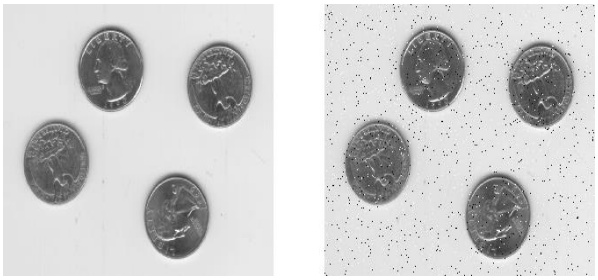

Figure. Image contaminated by salt and pepper noise

The minimum and maximum filter are two order filter that can be used for elimination of salt and pepper (impulse) noise. The maximum filter selects the maximum value within an ordered window of pixels, whereas the minimum filter selects the smallest value.
The minimum filter works best when the noise is primarily of the salt type (high values), and the maximum filters works best for pepper type noise (low values). These filters are excellent for minimal information loss.

F. Adaptive filter

Adaptive filter in the sense that their output depends on the underlying values. Adaptive filter alters its basic behavior as median filter on the other parts of the image is processed. It may act like a mean filter on some parts of the image and a median on the other parts of the image.

III. FREQUENCY DOMAIN FILTER

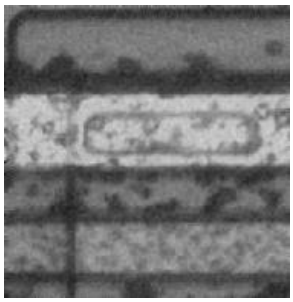

Figure. original picture

Figure. degraded image

It operates by using the Fourier transform representation of images. The Fourier transform is performed on three spatial domain functions: 1) the degraded image, the degradation function, the noise model, next the frequency domain filter is applied to Fourier transform out puts, The output of the filter operation undergoes an inverse Fourier transform to give the restored image. Another name for degradation function is the point spread function (PSF). The PSF describes what happens to a point of light when it passes through a system.PSF helps to find out degradation function of the system.

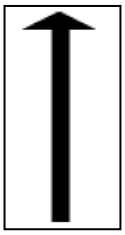

Figure.One impulse signals

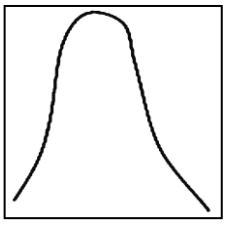

Figure. Blurred output

A. Inverse filter

Inverse filter uses assumptions that no additive is mixed with the image. To find the original image, we take inverse Laplace Fourier transform the image.

Figure. distorted image

Figure. Original image

B. Notch filter

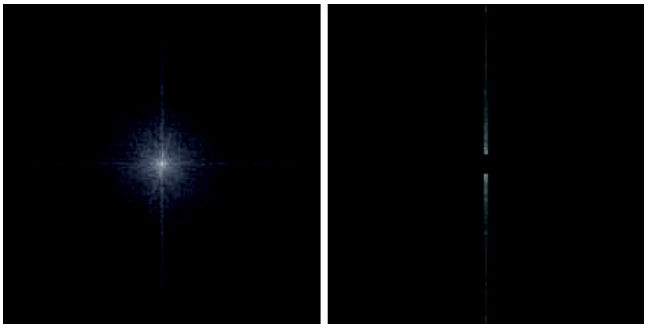

Figure. Recovered image using notch filter

It is a special type of band reject filter instead of eliminating entire ring of frequencies it only notches out selected frequencies. This type of filter is most useful for an image that has been corrupted with a sinusoidal pattern. This pattern is often seen in poor broadcast television images and also in common artifacts.

IV. CONCLUSION.

Image restoration can be a powerful tool to restore image reality if used properly. The big enemy to a good restoration is random image noise. Some filters are easy to use, while others require a great deal of technical knowledge. Its Applications includes satellite imaging, computed tomography, desktop publishing, manufacturing inspection, and atomic physics.

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