International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 11 (2015) pp. 28185-28194

http://www.ripublication.com

Novel Implementation of Image Restoration Schema Using Band Reject Filter Processing Techniques

A. Shakul Hamid*
Research scholar M.S.University
Dr. S. P. Victor
HOD-CS, St. Xaviers College, Tirunelveli

Abstract

In the digital media communication restoring an image plays a vital role in Image processing domain which provides the systematic way of novel implementation towards real-time data with different level of implications. Our experimental setup initially focuses with images with periodic noises. This paper perform a detailed study of band rejection filter schema towards variant effect of periodic noisy image in the field of image processing which can be carried out with expected optimal output strategies. We will implement our experimental image restoration techniques with real time implementation of object representation in the motive of Personal profile Domains such as an image clarity required for a profile image. We will also perform algorithmic procedural strategies for the successful implementation of our proposed research technique in several sampling domains with a maximum level of improvements. In near future we will implement the Optimal Image Restoration techniques for the de noising structure of images domain.

Introduction

Image restoration is to restore a degraded image back to the original image while image enhancement is to manipulate the image so that it is suitable for a specific application.

The image degradation model is descrobed by using the formula,

$$g(x,y) = f(x,y) * h(x,y) + \eta(x,y)$$

where $h(x,y)$ is a system that causes image distortion and $h(x,y)$ is noise.

Band Reject Filter

A Band Reject filter is used to eliminate some frequency components.The basic types are ideal, butter worth and gaussian which filters the specific bands based on their defined intensive values.

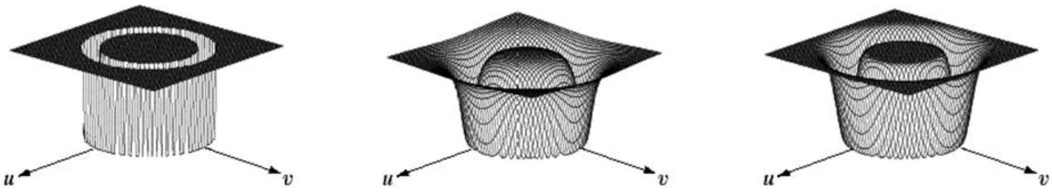

Figure 1: Ideal, Butter Worth and Gaussian Band Reject Filter Schema

The image method of filter design determines the properties of filter sections by calculating the properties they have in an infinite chain of such sections. In this, the analysis parallels transmission line theory on which it is based. Filters designed by this method are called *image parameter filters*, or just *image filters*. An important parameter of image filters is their image impedance, the impedance of an infinite chain of identical sections.

The basic sections are arranged into a ladder network of several sections, the number of sections required is mostly determined by the amount of stop band rejection required. In its simplest form, the filter can consist entirely of identical sections. However, it is more usual to use a composite filter of two or three different types of section to improve different parameters best addressed by a particular type. The most frequent parameters considered are stopband rejection, steepness of the filter skirt (transition band) and impedance matching to the filter terminations.

Image filters are linear filters and are invariably also passive in implementation.

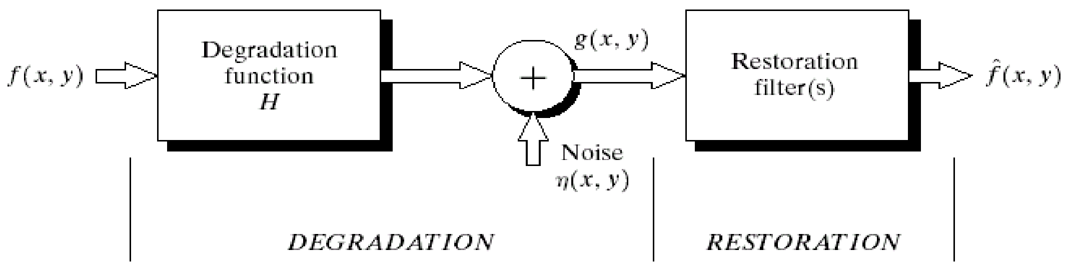

Figure 2: Image Restoration Schema

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. It can be produced by the sensor and circuitry of ascanner or digital camera. Image noise can also originate in film grain and in the unavoidable shot noise of an ideal photon detector. Image noise is an undesirable by-product of image capture that adds spurious and extraneous information.

The original meaning of "noise" was and remains "unwanted signal"; unwanted electrical fluctuations in signals received by AM radios caused audible acoustic noise ("static"). By analogy unwanted electrical fluctuations themselves came to be known as "noise".[1] Image noise is, of course, inaudible.

The magnitude of image noise can range from almost imperceptible specks on a digital photograph taken in good light, to optical and radio astronomical images that are almost entirely noise, from which a small amount of information can be derived by sophisticated processing (a noise level that would be totally unacceptable in a photograph since it would be impossible to determine even what the subject was).

An image is a picture, photograph or any other form of 2D representation of any scene.[20] Most algorithms for converting image sensor data to an image, whether in-camera or on a computer, involve some form of noise reduction. There are many procedures for this, but all attempt to determine whether the actual differences in pixel values constitute noise or real photographic detail, and average out the former while attempting to preserve the latter. However, no algorithm can make this judgment perfectly, so there is often a tradeoff made between noise removal and preservation of fine, low-contrast detail that may have characteristics similar to noise. Many cameras have settings to control the aggressiveness of the in-camera noise reduction.

A simplified example of the impossibility of unambiguous noise reduction: an area of uniform red in an image might have a very small black part. If this is a single pixel, it is likely (but not certain) to be spurious and noise; if it covers a few pixels in an absolutely regular shape, it may be a defect in a group of pixels in the image-taking sensor (spurious and unwanted, but not strictly noise); if it is irregular, it may be more likely to be a true feature of the image. But a definitive answer is not available.

This decision can be assisted by knowing the characteristics of the source image and of human vision. Most noise reduction algorithms perform much more aggressive chroma noise reduction, since there is little important fine chroma detail that one risks losing. Furthermore, many people find luminance noise less objectionable to the eye, since its textured appearance mimics the appearance of film grain.

The high sensitivity image quality of a given camera (or RAW development workflow) may depend greatly on the quality of the algorithm used for noise reduction. Since noise levels increase as ISO sensitivity is increased, most camera manufacturers increase the noise reduction aggressiveness automatically at higher sensitivities. This leads to a breakdown of image quality at higher sensitivities in two ways: noise levels increase and fine detail is smoothed out by the more aggressive noise reduction.

In cases of extreme noise, such as astronomical images of very distant objects, it is not so much a matter of noise reduction as of extracting a little information buried in a lot of noise; techniques are different, seeking small regularities in massively random data.

Image processing usually refers to digital image processing, but optical and analog image processing also are possible[3] This article is about general techniques that apply to all of them. The *acquisition* of images (producing the input image in the first place) is referred to as imaging[4].

Closely related to image processing are computer graphics and computer vision. In computer graphics, images are manually *made* from physical models of objects, environments, and lighting, instead of being acquired (via imaging devices such as cameras) from *natural* scenes, as in most animated movies. Computer vision, on the other hand, is often considered *high-level* image processing out of which a machine/computer/software intends to decipher the physical contents of an image or a sequence of images (e.g., videos or 3D full-body magnetic resonance scans)[5].

Image restoration is the operation of taking a corrupted/noisy image and estimating the clean original image. Corruption may come in many forms such as motion blur, noise, and camera misfocus. Image restoration is different from image enhancement in that the latter is designed to emphasize features of the image that make the image more pleasing to the observer [7], but not necessarily to produce realistic data from a scientific point of view. Image enhancement techniques (like contrast stretching or de-blurring by a nearest neighbor procedure) provided by "Imaging packages" use no a priori model of the process that created the image [8].

Proposed Methodology-The Imaging Model

Removing periodic noise form an image involves removing a particular range of frequencies from that image. Band reject filters can be used for this purpose.An ideal band reject filter is as follows:

$$H(u,v)=\begin{cases}1 & if\ D(u,v)<D_0-\frac{W}{2}\\ 0 & if\ D_0-\frac{W}{2}\le D(u,v)\le D_0+\frac{W}{2}\\ 1 & if\ D(u,v)>D_0+\frac{W}{2}\end{cases} \qquad \text{------------------------------------(1)}$$

(1) Ideal: frequencies within the given range are passed through without attenuation and frequencies outside of the given range are completely removed.
The butter worth band rejection filter is as follows,

$$H(u,v)=\frac{1}{1+\left[\frac{D(u,v)W}{D^2(u,v)-D_0^2}\right]^{2n}} \qquad \text{-----------------------------------(2)}$$

(2) Butter worth frequencies at the center of the frequency band are unattenuated and frequencies at the edge of the band are attenuated by a fraction of the maximum value.
The Gaussian band rejection filter is as follows,

$$H(u,v)=1-e^{-\frac{1}{2}\left[\frac{D^2(u,v)-D_0^2}{D(u,v)W}\right]} \qquad \text{-------------------------------------(3)}$$

(3) Gaussian: the transition between unfiltered and filtered frequencies is very smooth.

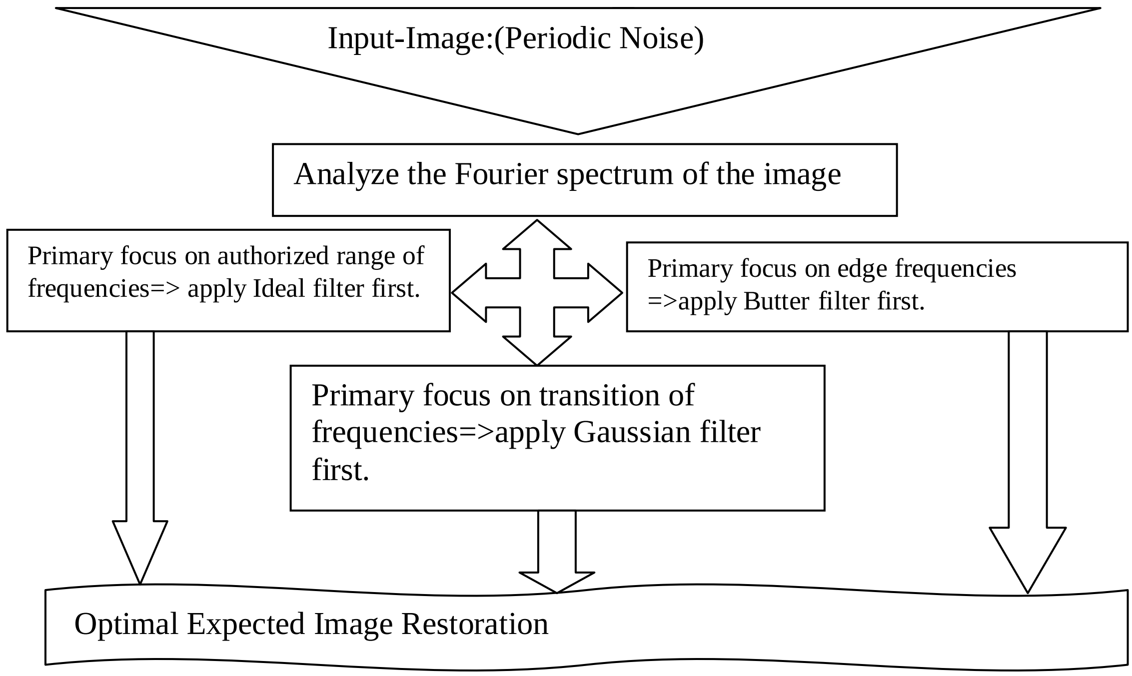

Figure 3: Proposed Image restoration Procedure

Implementation

The Matlab code for the implementation of Band reject filter filter strategical technique is as follows,

```
 ; Read in the file
 file = FILEPATH('spvictor.png', SUBDIR=['examples',' data'])
image Original = READ_PNG(file)
; Generate some periodic noise.
x Coords = LINDGEN(300,300) MOD 300
y Coords = TRANSPOSE(x Coords)
noise = -SIN(xCoords*1.5)-SIN(y Coords*1.5)
imageNoise = imageOriginal + 50*noise
; Filter the noise with a band reject filter
imageFiltered = BANDREJECT_FILTER(imageNoise, 0.28, 0.38)
; Find the image dimensions so we can display three of them
; in an iImage iTool
dims = [(SIZE(imageOriginal))[1]*3, $
(SIZE(imageOriginal))[2]*1+120]
; Display the original, noise-added, and filtered images
IIMAGE, image Original, VIEW_GRID=[3,1], $
VIEW_TITLE='Original Image', $
DIMENSIONS=dims, WINDOW_TITLE='BANDREJECT_FILTER Example', $
```

```
/NO_SAVEPROMPT
IIMAGE, imageNoise, /VIEW_NEXT, VIEW_TITLE='Added Noise'
IIMAGE, imageFiltered, /VIEW_NEXT, $
VIEW_TITLE='Using BANDREJECT_FILTER'
; Increase the text size
ISETPROPERTY, 'text*', FONT_SIZE=36
```

Now implementing the proposed restoration technique the input image can be restored as follows,

Figure 4: Input Image

Figure 5: Applying the Ideal filter

Figure 6: Applying the Butter worth filters

Figure 7: Applying the Gaussian filter

Table 1: Image Restoration Levels

Sl. No	Image Restore-Level	Noise level	Image restoration level
1	Original Image	80%	20%
2	Ideal Filter	20%	80%
3	Butterworth Filter	12%	92%
4	Gaussian Filter	07%	99%

Results and Discussions

The following graph illustrates the restoration improvent for implementing the proposed methodology.

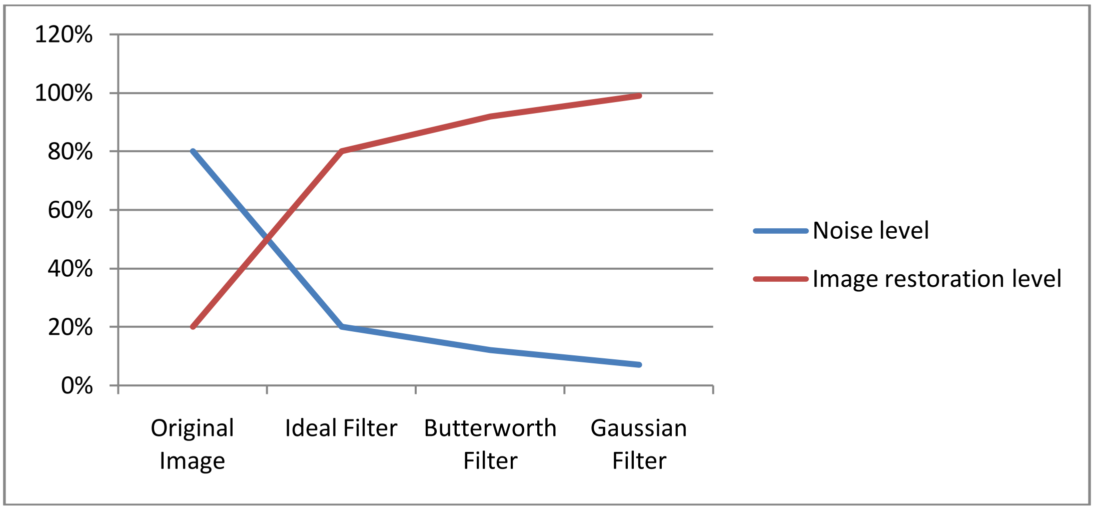

Figure 8: Image Restoration process Graph

The setting of the filter schema plays the vital role in our procedural approach which must satisfy the following

Bandreject_Filter (Imagenoise, X,Y)
X and Y will be a positive integer in the range of 0 to 1. The pivotal value of X and Y is, the faster the image filter will converge. However, picking too large of X and Y may also make the blank level of the image increases rapidly wrt the reduced periodic noise degradation level. Imagine that the two different atrtributes of indirect proportional strategies without any proper combination will yield the inappropriate results. Taking large steps will ensure that we will get there fast but we'd probably first. Taking small will ensure that we get there without falling off but it could take an infinite amount of time. So the compromise would be to take big steps at the start and decrease our step size as we get close to our destination.

The following is the optimal expected image after the proper combinations of X and Y which starts off at 0.1 and increases by 10% every individual sampling.

Figure 8: Optimal output Image

Conclusion

Image restoration is a combination of mathematical statistics with the image processing techniques of image filters. Restoring images in an optimal or an expected form is a highly technical process to implement in an efficient way. The selection of image and the proper utilization of image processing tool is a scientific methodology to implement. Our proposed methodology make it as an easy process by the novel view of periodic noise level combinations, further focusing of their mutual proportion along with variational effects we achieved an restoration process with 99 % efficiency.. For a given image size, we are limited in the periodic noise resolutions. For multiple degraded images, we may be limited by how many combinations we can obtain. So we are limited in both cases by how many combinations we can average over, and this profoundly affects our estimations. This is one of the main drawbacks that we found in the combination sector of periodic noisy image restoration techniques.

In near future this research will focus on an optimal algorithmic identification of Universal Combination of Image restoration process.

References

[1] M. R. Banham and A. K. Katsaggelos, "Digital Image Restoration," *IEEE Signal Processing Magazine*, vol. 14, no. 2, pp. 24-41, March 1997.

[2] D. Kundur and D. Hatzinakos, "Blind Image Deconvolution," *IEEE Signal Processing Magazine*,pp. 43-64, May 1997.

[3] N. P. Galatsanos and A. K. Katsaggelos, "Methods for Choosing the Regularization Parameter and Estimating the Noise Variance in Image Restoration and their Relation," *IEEE Trans. on Image Processing*, Vol. 1, No. 3, pp. 322-336, July 1992.

[4] Y. Yang, N. P. Galatsanos, and H. Stark, "Projection Based Blind Deconvolution," *Journal of the Optical Society of America-A,* Vol. 11, No. 9, pp. 2401-2409, September 1994.

[5] A. Likas, and N. M Galatsanos, "Variational Methods for Bayesian Blind Deconvolution",*Proceedings of the IEEE International Conference on Image Processing* (*ICIP-03*), September Barcelona, Spain 2003.

[6] "Moving Theory into Practice: Digital Imaging Tutorial", URL: http://www.library.cornell.edu/preservation/tutorial/contents.html

[7] "Image quality", URL: http://en.wikipedia.org/wiki/Image_quality

[8] C. Solomon and T. Breckon, 'Fundamentals of Digital Image Processing,' John Wiley & Sons, Ltd, 2011.

[9] V. Roth and P. Cattin, "Biomedical Image Analysis: Homomorphic Filtering and Applications for PET", Lecture Notes, Universität Basel.

[10] L. Yang and J. Ren, "Remote sensing image restoration using estimated point spread function", 2010 International Conference on Information, Networking and Automation (ICINA), IEEE, 2010.