International Journal of Computer Science
Oddity...Probe...Reviste...
http://www.ijcsjournal.com Volume 1, Issue 2, No 4, 2013. ISSN: 2348-6600
Reference ID: IJCS-025 PAGE NO: 132-135

A Comparative Study of Noise Removal in Remote Sensing Images

D.NAPOLEON
Assistant Professor
Department of Computer Science
Bharathiar University
mekaranapoleon@yahoo.co.in

M.PRANEESH
Assistant Professor
Department of Computer Science
Sankara College of Science and Commerce
raja.praneesh@gmail.com

ABSTRACT
Noise reduction is a prerequisite step prior to many information extraction attempts from remote sensing images. Reducing noise in remote sensing image restoration problem in that it endeavour to recover on original perfect image from a corrupted copy. This problem is intractable unless one makes assumptions about actual structure of the perfect image. Various noise filters make various assumptions depending on the type of image and the goals of the restoration. This paper presents kalman filter for gray scale images contaminated by noise. Remote sensing images are affected by different types of noise like Gaussian noise, Speckle noise and impulse noise. These noises are introduced into the Remote Sensing image during acquisition or transmission process. In this paper wiener filter and kalman filter is used for reduce the noise rate, when compare to this filters, kalman gives better results.

Key words
Remote sensing image, wiener filter, kalman filter, gaussion noise.

I. INTRODUCTION

Remote sensing[1] usually refers to the instrument based technology of acquiring information about the earth's surface (land and ocean) and atmosphere, using sensors onboard airborne (aircraft, balloons) or space-borne (Satellites, space shuttles) platforms. Noise can be systematically introduced into images during acquisition and transmission process. There are several ways through which noise can be introduced into an image depending on how the image is created. Satellite image containing the noise signals and lead to a distorted image and not able to understand and study it properly. Noise reduction helps the possibility of better interpretation of the content of the image. Noise can be defined as any disturbance that changes the original signal information. Image noise is a random, usually unwanted variation in brightness or colour information in an image [2]. Image data recorded by sensors on a satellite or aircraft contain errors related to geometry and brightness values of the pixels. The errors are corrected using suitable(filters) mathematical models. There are so many filters can be used to reduce noise 1) Weighted Median Filter 2) Standard Median Filter 3)Adaptive Median filter, 4)Wiener Filter and 5)Kalman filter. Weighted Median Filter(WMF) selectively gives the multi preserving the image structure than a median filter. Weighted Median Filter(WMF) is a natural extension of the median filter and has the same advantage of the median filter. Median filter is a simple and powerful non-linear filter, based order statistics and easy to implement method of smoothing image. That is reducing the amount of intensity variation between one pixel and the next. It is often used to reduce noise in images[3]. Standard Median Filter(SMF) is a non-linear, low pass filtering method which can be used to remove speckle noise from an image. Standard Median Filter(SMF) is a simple rank selection filter that attempts to remove noise from image by changing the luminance values of the center pixel of the filtering window[4]. Adaptive Median Filter(AMF) has been applied widely as an advance method compared with standard median filter. Adaptive Median Filter perform spatial processing to determine which pixels in an image have been applied by impulse noise. Adaptive Median Filter classifies pixels as noise by comparing each pixel in the image to its surrounding neighbour pixel. The size of the neighborhood is adjustable as well as the threshold for the comparison[5]. Adaptive Median Filter(AMF) is designed to eliminate the problems faced by the standard median filter. In this paper kalman filter and wiener filter is used for reduce the noise rate, when compare to this two filter, kalman filter gives the better result.

Published by SK Research Group of Companies (SKRGC).

International Journal of Computer Science
Oddity...Probe...Reviste...
http://www.ijcsjournal.com Volume 1, Issue 2, No 4, 2013. ISSN: 2348-6600
Reference ID: IJCS-025 PAGE NO: 132-135

II. METHODOLOGY

Noise removal is one of the techniques in image processing. Here our proposed work is represented the architecture shown the fig-1.

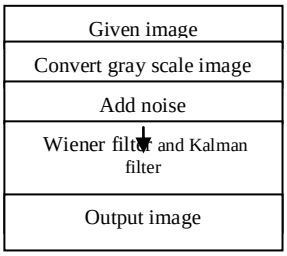

Fig-1 system

There are various types of noise in image that can corrupt images. Some of the noise are gaussian noise, speckle noise and salt and pepper.

A. GAUSSIAN NOISE

This type of noise is also called the normal noise is randomly occurs as white intensity values. Gaussian distribution noise can be expressed by

P(x) = 1/ (σ) * /2

When P(x) is the Gaussian distribution noise in image, μ and σ is the mean and standard deviation respectively.

B. SPECKLE NOISE

Speckle noise is a ubiquitous that limits the interpretation of optical coherence of remote sensing image. The noise can be expressed by

$$J = I + n*I$$

Where J is the distributed speckle noise image, I is the input image and n is the uniform image.

C. SALT & PEPPER NOISE

This type of noise contains random occurrences of both black & white intensity values, and often caused by threshold of noise image. Salt & Pepper distribution noise can be expressed by

P(x) =

Where P_1, P_2 are the Probabilities Density Function (PDF) p(x) is distribution salt and pepper noise in image and A, B are the array size image. In this paper salt & pepper noise in image is randomly occurred in white and black pixels of an image [6]. The main challenge in removing salt & pepper noise from image is due to the fact that image data as well as the noise, share the same small set of values, which complicates the process of detecting and removing the noise.

III. WIENER FILTER

Wiener filter is one of the earliest and best known approaches to linear image restoration. The most important technique for removal of noise in an image is due to the linear motion in the Wiener filter. Each pixel in a digital representation of an image should represent the intensity of a single stationary point in front of the camera. Its main advantage is the short computational time it takes to find a solution [10]. Its purpose is to reduce the amount of noise in an image. A wiener filter seeks an estimate that minimize the statistical error function.

$$e^2 = E\left\{(f - \hat{f})^2\right\}$$

Where E is the expected value operator and is the undegraded image. The solution to this expression in the frequency domain is

$$\hat{f}(u,v) = \left[\frac{1}{H(u,v)}\frac{|H(u,v)|^2}{|H(u,v)|^2 + S_n(u,v) + S_f(u,v)}G(u,v)\right]$$

Where = the degradation function

=

= the complex conjugate of

= the power spectrum of the noise

= the power spectrum of the undegraded image.

V. KALMAN FILTER

The Kalman filter is a mathematical method named after Rudolf E Kalman. Its purpose is used to measure the noise and other inaccuracies, and produce values that tend to be closer to the true values of the measurements and their associated calculated values. The kalman filter has many applications in technology, and is an essential part of space and military technology development [11]. It is an algorithm which makes optimal use of imprecise data on a linear (or nearly linear) system with Gaussian errors to continuously update the best estimate of the system's current state [12]. The image is considered to spatially depend on the current pixel and the surrounding pixels for and is represented by the following model:

$$x(m,n) = \sum_{(p,q)\in N}\sum a_{p,q}\, x(m-p)(n-q) + u($$

Where N denotes the range of pixels surrounding used in the linear sum, and denotes the coordinate centred on the current pixel indicates derived noise and is considered to be white noise having a zero mean when a large N is selected. The noise reduction is improved in the reconstruction of an image, including additive noise and blurred noise. The original image model is given by

$$x(k) =$$

Where $X(k) = [X_0(k), X_1($ denotes the state variable at time .

VI. DATASET DESCRIPTION

Remote sensing image is defined as an image produced by a recording device that is not in physical or intimate contact with the

Published by SK Research Group of Companies (SKRGC).

International Journal of Computer Science
Oddity...Probe...Reviste...
http://www.ijcsjournal.com Volume 1, Issue 2, No 4, 2013. ISSN: 2348-6600
Reference ID: IJCS-025 PAGE NO: 132-135

object under study. Remote sensing image is used to obtained information about a target or an area or phenomenon through the analysis of certain information which obtain by the remote sensing imagery generally require correction of undesirable sensor characteristics and other disturbing effects before performing data analysis. Images obtained by satellite are useful in many environmental applications such as tracking of earth resources, geographical mapping, prediction of agriculture crops, urban growth, weather, flood and fire control etc. When capturing image using sensors, the resulting image may contain noise from dirtiness on the image data acquisition process. So in this paper, we are analysing a remote sensing images. It should be downloaded from www. Google.com.

VII. RESULTS

The figure 1 shows the experimental results of the proposed work. The test image has very high frequency components, so the wiener filter and kalman filter leaves lots of residual noise. Kalman filter produce a better intensity level when compared to wiener filter which is shown in fig 1. The proposed work is done using MATLAB. 2010version.

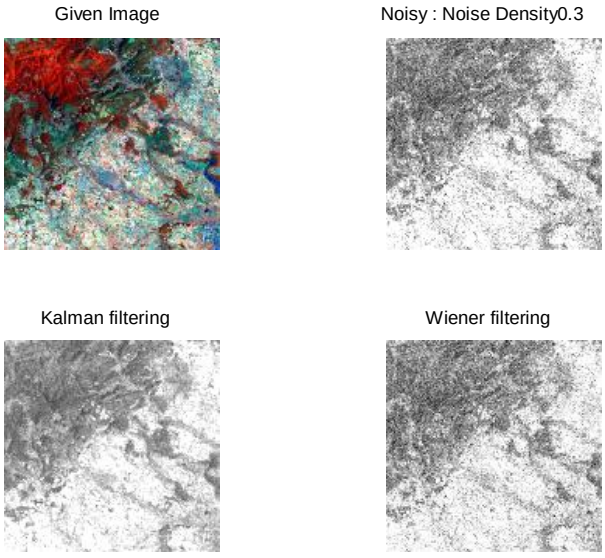

Fig 1: Intensity level of various filters

VIII. CONCLUSION

for Uppressing Impulsive Noise in Images", IJRRAS, Vol,1, Issue.3, December 2009.

Filters for removing noise in remote sensing images are proposed. The image captured by the sensor undergoes filtering by different smoothing filters and the resultant image is fused to attain high quality image. This paper has described a new principle of noise reduction while preserving the image structure. While capturing the Remote Sensing image it usually have a Gaussian noise, speckle noise and salt & pepper noise. Kalman filter works well at reducing noise while preserving the underlying structure of an image although it does have difficulty in certain situation. Kalman performed large amount of noise, it completely to reduce either small or large amount of "Gaussian" noise.

IX. REFERENCES

[1] Ranganath R., Navalgund, V. Jayaraman and P. S. Roy "Remote sensing applications: An overview" Special Section: Indian Space of technology.

[2]Mr. Salem Saleh Al-amir, Dr. N.V. Kalyankar and Dr. S. D. Khamitkar, "A Comparitive Study of Removal Noise from Remote Sensing Image", IJCSI, Vol. 7, Issue. 1,No.1, January 2010

[3]S. K. Satpathy, S. Panda, K. K. Nagwanshi, S.K. Nayak and c. Ardil, "Adaptive Non-Linear Filtering Technique for Image Restoration", IJECE 5:1 2010.

[4]Mrs. V. Radhika and Dr. G. Padmavathi, "Performance of Various Order Statistics Filters in Impulse and Mixed Noise Removal for RS Images", SIPIJ, Vol,1, No.2, December 2010.

[11]Jaako Astola, and Yrjo Neuvo, "Optimal Weighted Median Filtering Under Structural Constrains",IEEE, Vol, 43, No,3, March 1995.

[12]Eong-Seok Yu, Joon-Yeop Lee and Jun-Dong Senior Member, "A Fast Sorting Algorithm for General Purpose Standard Median Filters in VLSI implementation", IEEE
Behrooz Ghandeharian, Hadi Sadoghi Yazdi and Faranak Homayouni, "Modified Adaptive Centre Eighted Median Filter for Uppressing Impulsive Noise in Images", IJRRAS, Vol,1, Issue.3, December 2009.

Published by SK Research Group of Companies (SKRGC).

International Journal of Computer Science
Oddity...Probe...Reviste...
http://www.ijcsjournal.com Volume 1, Issue 2, No 4, 2013. ISSN: 2348-6600
Reference ID: IJCS-025 PAGE NO: 132-135

[5]Rafael C. Gonzalez, Richard Eugene Woods, Steven L. Eddins , "Digital Image processing", 2004

[6]Masayoshi Tsuchida,* Miki Haseyama, and Hideo Kitajima, "A Kalman Filter Using Texture for Noise Reduction in SAR Images", Electronics and Communications in Japan, Part 1, Vol. 86, No. 10, 2003

[7]Dan Simon, "Kalman Filtering", Embedded Systems Programming, June, 2001.

[8]M. Prema Kumar, P.H.S.Tejo Murthy and Dr.P.Rajesh Kumar, "Performance Evaluation of Different Image Filtering Algorithms Using Image Quality Assessment", IJCA, Vol. 18, No.6, March 2011.

[9]J. Astola and P. Kuosmanen, Fundamentals of Nonlinear Digital Filtering, Boca Raton, FL: CRC, 1997.

[10]Andrew A. Green, Mark Berman, Paul Switzer and Maurice D. Graig, "A Transform for Ordering Multispectral Data in terms of Image Quality with Implications for noise removal", IEEE, Vol. 26, No.1 January 1988

Published by SK Research Group of Companies (SKRGC).