Using adaptive filter for satellite image to hur al dalmach

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Abstract:

In this paper by using the adaptive filter on subset satellite image from landsat 7 (ETM+).This image taken on March27_2006 that included hur aldalmach by using erdas 8.4 and envi4.3 programs softwares for making filter and statistical (min,max and mean value). This study shows that combination image after filtering clearer than same image before filtering.

Keywords: adaptive filter, satellite image , mean value ,combination image.

استخدام المرشح التكيفي لصورة فضائية لهور الدلمج

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الخلاصة:

تم في هذا البحث استخدام المرشح التكيفي على مقطع من صورة فضائية للقمر الصناعي لاندسات . هذه الصورة اخذت في ٢٧ اذار ٢٠٠٦ المتضمنة هور الدلمج واستخدم برنامجي ايرداس واينفاي لعمل الترشيح والاحصاء (القيمة الصغرى ،القيمة العليا، معدل القيمة) . من خلال هذه الدراسة تبين ان الصورة الممزوجة بعد الترشيح تكون اكثر وضوحا من نفس الصورة قبل الترشيح.

الكلمات المفتاحية: المرشح التكيفي ،صورة فضائية، معدل القيمة، الصورة الممزوجة.

1. Introduction

The Lee and Kuan filters have the same formation, although the signal model assumptions and the derivations are different.Essentially, both the Lee and Kuan filters form an output image by computing a linear combination of the center pixel intensity in a filter window with the average intensity of the window. So, the filter achieves a balance between straightforward averaging (in homogeneous regions) and the identity filter (where edges and point features exist). This balance depends on the coefficient of variation inside the moving window.

The Frost filter also strikes a balance between averaging and the all-pass filter.

In this case, the balance is achieved by forming an exponentially shaped filter kernel that can vary from a basic average filter to an identity filter on a point wise, adaptive basis. the response of the filter varies locally with the coefficient of variation. In case of low coefficient of variation, the filter is more average-like, and in cases of high coefficient of variation. The filter attempts to preserve sharp features by not averaging [1]. Although the existing despeckle filters are termed as "edge preserving" and "feature preserving," there exist major limitations of the filtering approach. First, the filters are sensitive to the size and shape of the filter window. Given a filter window that is too large (compared to the scale of interest),over-smoothing will occur and edges will be blurred. A small window will decrease the smoothing capability of the filter and will leave speckle. In terms of window shape, a square window (as is typically applied) will lead to corner rounding of rectangular features that are not oriented at perfect 90 rotations, for example. Second, the existing filters do not enhance the existing filters do not enhance edges—they only inhibit smoothing near edges. When any portion of the filter window contains an edge, the coefficient of variation will be high and smoothing will be inhibited. Therefore, noise/speckle in the neighborhood of an edge (or in the neighborhood of a point feature with high contrast) will remain after filtering. Third, the despeckle filters are not directional[2]. In the vicinity of an edge, all smoothing is precluded, instead of inhibiting smoothing in directions perpendicular to the edge and encouraging smoothing in directions parallel to the edge. Last,the thresholds used in the enhanced filtersedges—they only inhibit smoothing near edges.[1].

a. Adaptive Speckle Filters

They briefly describe the speckle reducing filters:the Lee filter and the Frost filter. Then, they examine the relationship between the speckle filters and the diffusion technique.The Lee filter is designed to eliminate speckle noise while preserving edges and point features in radar imagery.

Based on a linear speckle noise model and the minimum mean square error (MMSE) design approach, the filter produces the enhanced data according to
$\hat{I}_s = \bar{I}_s + k_s(I_s - \bar{I}_s)$……..(1)

where $\mathbf{I_s}$: is the mean value of the intensity within the filter window k_s ,η_s

is the adaptive filter coefficient determined by

$k_s = 1 - c_u^2 / c_s^2$…….(2)

and $\mathbf{c_u^2}$:is a constant for a given image and can be determined

here:

$c_s^2 = (1/|\eta_s|)\Sigma_{p\varepsilon\eta} (I_p - \bar{I}_s)^2/(I_p - \bar{I}_s)^2$…..(3)

by either $c_u^2 = 1/ENL$…….(4)

where **ENL** is the effective number of looks of the noisy image

b. Speckle filters

The most primitive filter is the mean filter. But a better version of mean filter is the multi-look processing of Synthetic-aperture radar (SAR) data, whereby the full bandwidth of the signal is divided into overlapping smaller bandwidth spectrums, and incoherently summed to reduce the speckle noise. This is effective in reducing noise, but at the cost of degraded spatial resolution. Other speckle filters involve both adaptive as well as non adaptive filters. The other type of non adaptive filter is the median. This is better than mean in terms of preserving edges. But still these are not adaptive to the noise in edges, and in regions of sudden jumps and changes. Hence, the non adaptive methods such as Lee, Frost, Gamma-map, Kuan, simulated annealing types of filtering have been resorted to, in order to take care of speckle [3].

The two main approaches for training multi-spectral remote sensing data classifiers are supervised and unsupervised learning. Supervised learning involves training the classifier with a learning set of pixels whose landuse label is known. Typically, the training set is assembled either by an on-site survey or by a human photo-interpreter using aerial and/or satellite photographs and maps. Assessment of the performance of the classifier can be done by classifying a separate test data set of pixels with known landuse labels. It is generally considered good practice to take the testing and training pixels from different areas in the image. Unsupervised learning on the other hand does not require labelled training pixels. Instead, this method tries to identify natural clusters in the data. The method however, does require the setting of parameters such as expected number of clusters, maximum cluster variance, etc. It is the task of the data analyst to afterwards identify the natural clusters in terms of landcover classes or class combinations. The main advantages of the unsupervised clustering scheme is that it does not force multimodal clusters into a unimodal distribution (such as can be the case for maximum likelihood if no precautions are taken), and that it is a more economic procedure since it does not require a training set. Supervised classification on the other hand has the advantage of classifying the images with labels that are meaningful for the end-users. As an additional advantage, it enables an assessment of the accuracy of the classification. However, accumulating the training set, e.g. by an on-site survey, can be very expensive[4].

density function of the scene is required before the filter can be applied. The scene reflectivity is assumed to be a Gamma distribution instead of a Gaussian distribution and the filtering process is controlled by setting two thresholds. [5]. Reduction of speckle noise is one of the most important processes to increase the quality of radar coherent images. Image variances or speckle is a granular noise that inherently exists in and degrades the quality of the active radar and SAR images. Before using

active radar and SAR imageries, the very first step is to reduce the effect of Speckle noise. Most of speckle reduction techniques have been studied by researchers; however, there is no comprehensive method that takes all the constraints into consideration.

Filtering is one of the common methods which is used to reduce the speckle noises. This paper compares six different speckle reduction filters quantitatively using both simulated and

real imageries. The results have been presented by filtered images, statistical tables and diagrams. Finally, the best filter has been recommended based on the statistical and experimental results [6]. speckle, a form of multiplicative, locally correlated noise, plagues imaging applications such as medical ultrasound image interpretation. For images that contain speckle, a goal

of enhancement is to remove the speckle without destroying important image features. In certain applications, however, the removal of speckle may be counterproductive. Examples in which speckle preservation is important include feature tracking in ultrasonic imaging [7]. They have developed a nonlinear anisotropic diffusion technique, speckle reducing anisotropic diffusion, for removing multiplicative noise in imagery. Unlike other existing diffusion techniques [8].

2. Data and Method

The adaptive filter has been applied on subset satellite image from landsat 7(ETM+) . This image taken on march 27_2006 that included hur al dalmach by using erdas8.4 program for made. filtering and using envi4.3 program for statically (min ,max,and mean value). Figure (1) represents steps of this work:

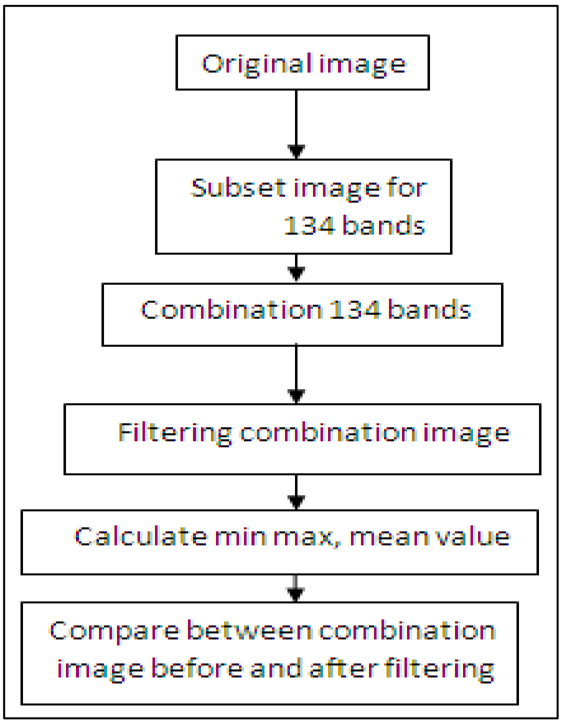


Figure (1): steps of this work

3. Result and Discussion:

The second figure is the subset image for bands1,3 and4 before and after filtering, like figure (2) , that shows study area of hur aldalmach .The third figure is about images to same study area before and after filtering ,like figure(3). The mean values after filtering were lower than theses before filtering like figure (4)and tables (1),(2).These results show that the combination image after filtering clearer than same image before filtering.

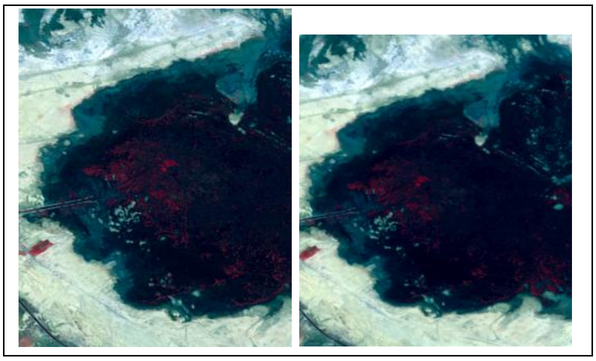


Image134 after filtering	Image 134 before filtering

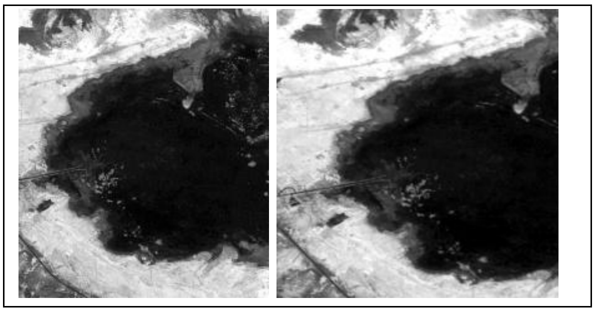
Figure (3): combination 1,3,4 bands before and after filtering

Table(1): min,max, mean value for image before filtering

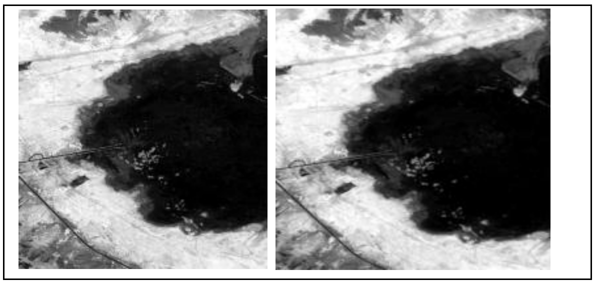
Min	Max	Mean
0	163	75.65
0	215	89.15
0	174	86.11

Table(2): min,max, mean value for image after filtering

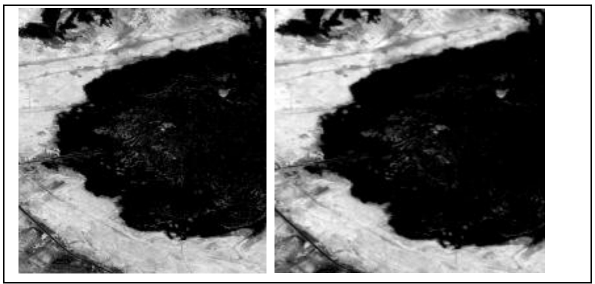
Min	Max	Mean
0	218	75.24
-5	248	88.76
-8	212	85.71



Filter band 1	band 1

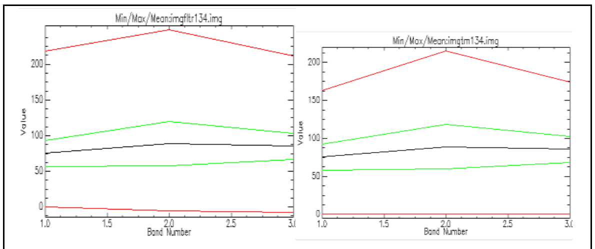


Filter band 3	band 3



Filter band 4	band 4

Figure (2) :bands 1,3,4 before and after filtering



Mean value for image after filtering	Mean value for image before filtering

Figure(4):mean value for image before and after filtering

4. Reference

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