An Analysis of a Block Matching Method on Single Chrome Images

Y. Murali Mohan Babu, K. Radhika and G.Kameswari

Abstract: ***In microwave frequency image formation and processing, a speckle noise is generally added. This noise is added for the imaging systems like radar image capturing, medical image capturing, etc. De-speckling methods are used to remove the available speckle noise. An un-decimated block matching 3D (BM3D) method is a state of art technique in de-speckling area. In this paper, a comparison analysis has made on different layers of satellite images with proposed method. Different quality parameters are evaluated and compared for different speckle noise variances. This paper analyses the importance of denoising of different sub layers rather than grey image of the original optical image.***

Index Terms: BM3D, colour band, de-speckling, monochrome image, and optical image.

I. INTRODUCTION

Microwave images are popular in taking the images at any environmental situations throughout the day. In this capturing of images or image formation, a common noise maybe generally added called as speckle noise. Always contaminated image is different from original. To get back the original image of the scene, a good de-speckling method [1] has to be used on noised images. In this process, spatial domain filters like lee, map and wiener filters and frequency domain filters like Lee, G-mean, wavelet, ridgelet, BM3D, PCA, NLM, curvelet, bandlet, and contourlet are generally used [2-3].

II. PROPOSED METHOD

A BM3D method is good for de-noising of satellite images. In BM3D, wavelet decomposition and reconstruction are used. A 512*512 image is converted into 256*256 image in decomposition of sub bands and 256*256 image is converted into 512*512 image in reconstruction. In this process of reconstruction the originality is missed, it is because of compatibility of the sizes of images. This can be avoided by using un-decimated BM3D method [4]. This method has given very good results for de-speckling analysis. In the figure 1, it is clearly shown the process of the method of image de-speckling. This method is used for speckled image. Haar wavelet is used in the wavelets [5]. Different sub bands of wavelet are having different visual information. Threshold in these sub bands play the most important role. Block size of 32 is considered. Wavelet theory is used two times in the technique. Wiener filter is used in filter section. A bunch of blocks of size 32 is arranged in one dimension and finally forms a 3 dimensional image. Actually this is not a 3 dimensional, but this blocks arrangement process looks like 3 dimension. That's the reason it is said to be 3D algorithm. By having un-decimation along with 3 dimensional arrangements, it is named as un-decimated 3D algorithm [6-8].

Different quality parameters like equivalent number of looks (ENL), speckle suppression index (SSI), speckle suppression and mean preservation index (SMPI), correlation coefficient (CC), edge saving index in horizontal (ESIH), edge saving index in vertical (ESIV), mean square error (MSE), peak signal to noise ratio (PSNR), overall edge preserving index (EPI) or edge saving index (ESI) and computational time (CT) are calculated and compared for two speckle noise variances. These values play a vital role in de-speckling process. These de-speckled images can be used for classification purpose and validation can be done for accuracy and kappa calculations.

The differences in the optical images or radar images can't be understood with naked eye. It can be possible with statistical approach. This de-speckling method can be used at the time of image formation and it is possible at initial levels of image formation. Now, this method has been tested at last level of image of geo tiff format of the image. This method can be done for the sizes of 256*256, 512*512 and 1024*1024. This method is tested on regular mono chromo images like red, green and blue sub bands of 11 bands of sentinel image. This can also be used for adjacent sub bands of above said bands.

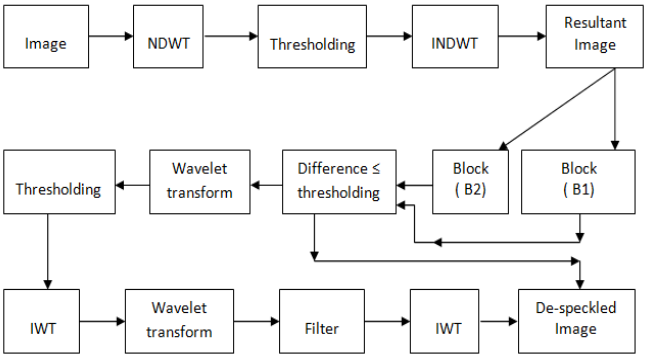

Figure 1: Proposed method

III. RESULTS AND DISCUSSIONS

The de-speckling method has been verified with different variances (0.25 & 0.1) for monochrome images. The monochrome images that considered are red colour band, green colour band, blue colour band and grey colour image of original optical image. Environment for Visualizing Images (ENVI) software is

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used for sub band division and addition and matrix laboratory (MATLAB) software is used for de-speckling technique. The satellite or optical image is having 7585*7591 pixels in its representation. MATLAB can't run that big sized image, ENVI can.

Different quality parameters like ENL, SSI, SMPI, CC, ESIH, ESIV, MSE, PSNR, EPI and CT are calculated for two set of images. Each set contains de-speckling of red colour band de-speckling, green colour band de-speckling, blue colour band de-speckling and grey colour image de-speckling of original optical image. It is given the statistical approach to analyse the de-speckling of the bands with given de-speckling method. ENL is more in green band de-speckling. Because this band contains very less visual information, it is good to use for next steps. SSI and SMPI are related to speckle reduction measurements. SSI and SMPI values are more for red and blue bands. More visual information is available in these bands and better to have high value at these bands. Good effort in this issue. The obtained CC values are really appreciated. CC value is more for red and blue bands. More visual information is available in these bands and better to have high value at these bands. ESIH is high and same in all the bands and better than ESIV. Generally horizontal information is more important to human eyes than vertical information. Good effort in this issue. MSE and PSNR values are reasonably good and same in all the bands. The obtained PSNR values are really prised. EPI values are not good in number. It may be due less resolution image. CT is more and almost all same for all the bands. De-speckling is not meant for colour images. So, grey colour image of RGB colour image has been tested. Grey colour image has given almost all average of all the three bands.

IV. CONCLUSION

This explains the importance of analyzing sub bands of satellite images rather than total image or grey converted image. It is a trail and error analysis. It may be true for the images or all satellites or all the noises or all the noise variance values. It has been considered the noise variance as 0.5, 0.25, 0.1 and 0.05 for speckling purpose. This method was tested and worked on monocrome image like microwave image. That is base reason to have this idea on other monocrome images like sub bands. The experimental results gave the conclusion that the proposed method (Undecimated BM3D) can also be used for sub bands of general satellite images. The mono chromatic sub band images of optical image like red, green and blue bands and grey converted colour images have been tested for de-speckling.

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Table 1: Comparison of different quality parameters of de-speckling method for different monochrome images (V=0.5)

	RED	GREEN	BLUE	GRAY
ENL	1.213460	9.961071	1.265884	10.56566
SSI	0.066192	0.036346	0.063138	0.038047
SMPI	0.815408	0.332268	0.827202	0.353342
CC	0.984545	0.960317	0.988859	0.962290
ESIH	0.694483	0.692101	0.694305	0.683658
ESIV	0.420869	0.438305	0.418537	0.482057
MSE	67.34639	101.23866	68.83743	90.72620
PSNR	29.83515	28.07982	29.752915	28.523360
EPI	0.173256	0.459474	0.921316	0.582118
CT	412.837371	410.232966	419.566321	437.506615

Table 2: Comparison of different quality parameters of de-speckling method for different monochrome images (V=0.25)

	RED	GREEN	BLUE	GRAY
ENL	1.213160	9.961071	1.265484	10.56566
SSI	0.066192	0.036346	0.065138	0.039047
SMPI	0.813408	0.332568	0.827002	0.356342
CC	0.986545	0.960317	0.988259	0.963290
ESIH	0.694283	0.690101	0.694205	0.689658
ESIV	0.420569	0.430305	0.418537	0.430057
MSE	67.34639	101.23666	68.81743	90.72620
PSNR	29.84515	28.07982	29.752915	28.553360
EPI	0.170256	0.459474	0.921316	0.586118
CT	412.817371	410.252966	419.566321	437.506615

Table 3: Comparison of different quality parameters of de-speckling method for different monochrome images (V=0.1)

	RED	GREEN	BLUE	GRAY
ENL	0.887557	7.843664	0.897557	6.299499
SSI	0.065164	0.033450	0.065164	0.037298
SMPI	0.871737	0.392845	0.870737	0.376141
CC	0.993161	0.974125	0.993161	0.976964
ESIH	0.705200	0.698264	0.705300	0.699422
ESIV	0.403735	0.417117	0.403735	0.421141
MSE	45.510267	58.874695	45.510267	49.879395
PSNR	31.559709	30.431516	31.547909	31.152591
EPI	0.416910	0.604721	0.416910	0.575319
CT	399.600407	406.332070	435.619231	408.400028

Table 4: Comparison of different quality parameters of de-speckling method for different monochrome images (V=0.05)

	RED	GREEN	BLUE	GRAY
ENL	0.837557	7.843664	0.897557	6.299499
SSI	0.075164	0.033450	0.065164	0.047298
SMPI	0.875737	0.392845	0.850737	0.376441
CC	0.9926161	0.974125	0.983161	0.976464
ESIH	0.705600	0.698264	0.705600	0.699422
ESIV	0.412335	0.415117	0.403535	0.441141
MSE	45.510267	58.872195	45.510267	49.839395
PSNR	31.559709	30.4341516	31.547909	31.152591
EPI	0.416910	0.604721	0.456910	0.574319
CT	399.600207	406.334070	435.619231	408.404028