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Classification of RISAT data with BM3D algorithm 1V.Venkata Sai Krishna and 2Y. Sreedhar 1 M.Tech., URS Dept., IIRS, Dehradun, Uttarakhand. 2Associate Professor, Dept. of CSE, VBIT, Proddutur, AP, India

-- ABSTRACT: In this Paper, We Proposed a de-speckling method on Indian Synthetic-aperture radar (SAR) image with block matching 3D transformation and has been used for classification method. This block- matching 3D algorithm clearly explained how to generate de-speckling of SAR image for classification.

In this technique has been tested on RISAT-1 SAR image data set and practical results exhibit that this technique is the better in terms of de speckling quality image factors. The despeckled image has been fused with LANSAT-8 optical image. The resultant multi spectral and good resolution image has been classified using supervised classification.

KEY WORDS: Synthetic-aperture radar, de-speckling, block matching 3D algorithm.

--- 1. INTRODUCTION RISAT-1 is our national microwave imagery sensor.

Synthetic-aperture radar images are affected by the speckling noise at the time acquisition process [1-2]. Due to this effect, the images are not clearly seen and interpretation of images is very difficult. It is compulsory to eliminate the speckle noise as much as possible to get maximum information from the image.

So many techniques like filter based and transform domain based models have been proved in their quality parameters. Lee filter, khan filter, frost filter, Map filter, wiener filter are used in filter domain and wavelet, curvelet, Principal component analysis, non local mean algorithm are used in transform domain. But still there is scope for further denoising [3]. Actually Block Matching algorithms have been used since mid-80.

The algorithm is generally based on pixel grouping and group matching. This is the state-of-art algorithm in this denoising of images. We have studied the algorithm affect on our own satellite imagery. Lee filters are famous in denoising, but they cannot preserve the edges. For denoising purpose we used matlab software and for fusion and classification purpose we used ERDAS software. Finally accuracy calculations has to be performed.

The SAR image is a grey image and optical image is multispectral image. In fusion process both input images are having different resolutions and different frequency bands, but finally we will get better resolution with multi spectral image [4]. This algorithm can be applied at different applications like crop classification, land use and land cover classification. 2. PROCEDURE 1.

Take the SAR image in geotiff format. 2. Add speckle noise to SAR image. 3. Divide the SAR image to small blocks. 4. Calculate euclidean distance between blocks. 5. If the distance is less than or equal to a threshold then apply DWT. 6. Apply hard threshold to low frequency region. 7. Apply IDWT. 8. Apply DWT once again. 9. Apply wiener filter to low frequency region. 10. Apply IDWT. 11. Take the despeckled image and optical image to get fused image using PCA method. 12.

The fused image will be analyzed and obtain the supervised classified image. 13. Calculate the accuracy assessment. 14. Measure overall accuracy. 3. RESULTS AND ANALYSIS /// (a) (b) (c) Figure 1: a. Original image b. Speckling noise image c. Recovered image Figure 1 (a) is RISAT-1 Image and it is of Coarse Resolution Scan SAR Mode (CRS).

It provides 8 m slant resolution image over swath of 223 km in either single or dual polarization. Figure 1 (b) is speckle noisy image. Figure 1 (c) is a denoised image, denoised by using block matching method. The following table 1 gives the quality factors with our method like equivalent number of looks (ENL), speckle suppression index (SSI), correlation coefficient(CC), edge saving index(ESI), mean square error(MSE) and peak signal to noise ratio (PSNR). Table 1: Quality Factors ENL _6.368855 _ _SSI _0.532762 _ _CC _0.905894 _ _ESI _0.618134 _ _MSE _1278.2 _ _PSNR _17.06482 _ _ Figure 2 (a) shows SAR image of 36 meter resolution and figure 2 (b) shows LANDSAT-8 optical image with 30 meter resolution.

The fused image has been obtained using principal component fusion and it is shown figure (c). The fused image is having the features like better spatial resolution and spectral resolution. Figure 3(a) is classified image and figure 3(b) is a supervised classified image.

We took 4 classes like settlements, fallow land, agriculture type1 and agriculture type 2. /// (a) (b) (c) Figure 2: a. SAR image b. Optical image c. Fused image / / (a) (b) Figure 3: a. Classified Image b. Supervised Classified Image 4. CLASSIFICATION ACCURACY ASSESSMENT REPORT Table 2: ERROR MATRIX Classified data _Un-classified data _Class-1 _Class -2 _Class-3 _Class -4 _Row total _ _Un classified _0 _0 _0 _0 _0 _0 _ _Class-1 _0 _89 _0 _0 _11 _100 _ _Class-2 _0 _0 _4 _0 _0 _4 _ _Class-3 _0 _0 _0 _17 _3 _20 _ _Class-4 _0 _7 _0 _1 _124 _132 _ _Column total _0 _96 _4 _18 _138 _256 _ _ We have calculated accuracy of the obtained supervised classified image. We tested random 256 pixel values to get good results.

We calculated producers and user accuracy also. The overall classification accuracy for classified image is 91.41% and overall kappa statistics is 0.8492. It is a very good result in the field of microwave imagery. Table 2 gives the error matrix and table 3 gives accuracy assessment of our classified image. Table 3: Accuracy Totals Class name _Reference Totals _Classified totals _Number correct _Procedures accuracy _Users accuracy _ _Unclassified _0 _0 _0 _---- _---- _ _Class -1 _96 _100 _89 _92.71% _89.00% _ _Class -2 _4 _4 _4 _100% _100% _ _Class -3 _18 _20 _17 _94.44% _85.00% _ _Class-4 _138 _132 _124 _89.86% _93.94% _ _Totals _256 _256 _234 _ _ _ Overall Classification Accuracy = 91.41% Conditional kappa for each category are given as Table 4: Kappa values Class name _Kappa _ _Un-classified _0.0000 _ _Class-1 _0.8240 _ _Class-2 _1.0000 _ _Class-3 _0.8387 _ _Class-4 _0.8685 _ _REFERENCES 1. www.nrsc.gov.in 2. www.isro.gov.in 3. Y. S.

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