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VEGETATION AREA ESTIMATION USING MICROWAVE C-BAND SIR-C SAR IMAGE

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Abstract: *The classification of Microwave Synthetic Aperture Radar (SAR) image has become a very important task after availability of data from satellites. In this paper Microwave C-band Dual Pole SIR-C SAR satellite dataset of Pinatubo, Philippines is used. Here unsupervised and supervised classification techniques applied on the dataset used. The unsupervised classification techniques include like H-alpha, Wishart H-alpha and Wishart H-A-alpha, whereas in supervised classification classes, made manually, using clustering process. The aim of this work finds the vegetation present in the selected SAR images using above mentioned classification techniques. This paper presents the comparison of the simulation results of both classification techniques for the analysis of area coverage by Vegetation. In supervised classification, the classified image is better than all unsupervised classification techniques.*

Keywords: *SAR, SIR-C, Unsupervised, Supervised Classification.*

1 INTRODUCTION

The microwave SAR is an active microwave imaging system, which has the capability to produce a very high-resolution image of the Earth. In this system, microwave pulses transmitted through an antenna towards the Earth surface and energy scattered back to the sensors are measured. It allows the observation during the day as well as on the night and as independent from weather

conditions [1]. The polarization characteristics of electromagnetic energy recorded by a remote sensing sensor represent an important variable, it be used in many Earth resource investigations [2-3]. In the present study, Microwave C-Band Dual Polarized SIR-C Satellite Image of Pinatubo, Philippines in MLC (Multi Look Complex) format used. The MLC data, based on an averaging of multiple look, and it consists of one file for each scene per frequency**,** which have been multilooked and usually resampled to a ground range projection [4]. The SIR-C data also had speckle noise and was not geocoded. Due to constructive and destructive interference of the return signal, which in turn gives, causes the speckle noise. Therefore, homogeneous regions will appear non-uniform and edges will lose their sharpness. Hence, such noise removed by using speckle noise filters [5-6].

In remote sensing classifying data is a very challenging task because of many factors, such as the selected study area, the complexity of the scene, accuracy assessment and the types of classification techniques used in image processing. In the present work, unsupervised classification techniques like H-alpha, Wishart H-alpha and Wishart H-A-alpha and supervised classification technique is used.

The objective of these works is to separate Vegetation by the polarimetry measurements from a random media into independent elements which can be associated with the various physical scattering mechanisms occurring on the ground using above classification techniques. This paper will provide comparative simulation model results for the analysis of Vegetation classification for microwave C-Band SIR-C image by using PolSARpro Ver. 5.0 and NEST Ver. 5.0.16 software.

2. Classification Techniques

The classification of SAR image is to identify the different spectral classes present in it and their relation to some specific ground cover type. The classification technique used in this study, based upon polarimetric decomposition classification parameters such as Entropy (H), Anisotropy (A) and Alpha (α) and this classification procedure carried out using decomposition theorem and the H/A/α set of the coherency matrix [7]. The information on the scattering degree of randomness provided by entropy (H). The anisotropy (A) provides information on the relative importance of secondary mechanisms and the alpha (α) parameter indicates the nature of the scattering single or double bounce reflection or scattering over anisotropic media. This parameter cannot be evaluate separately from the entropy. The result of classification based on the Wishart statistics of multilook coherency matrix. In the present work, Wishart H-alpha and Wishart H-A-alpha classification techniques are used. The eight classes resulted from Wishart H-alpha classification and sixteen classes resulted from the Wishart H-A-alpha classification are to be studied.

2.1 Unsupervised Classification

The classification of SAR image is to identify the different spectral classes present in it and their relation to some specific ground cover type. The result of classification based on H-alpha parameters and the Wishart classification based on the Wishart statistics of multilook coherency matrix. In the present work, the result of the H-alpha and Wishart H-alpha and Wishart H-A-alpha decomposition can be initialized as training sets of the unsupervised classifier is studied [8].

2.2 Supervised Classification

The supervised classification involved three basic steps, in the training stage, the analyst identifies the training areas and developed numerical description of the spectral attributes of each object on the Earth of interest in the scene. In the classification stage, each pixel in the dataset categorized into the specific class. The accuracy of creating class depends upon selecting the training area and identifying the same pixel from the dataset. The final stage classified output image, used for further analysis [9].

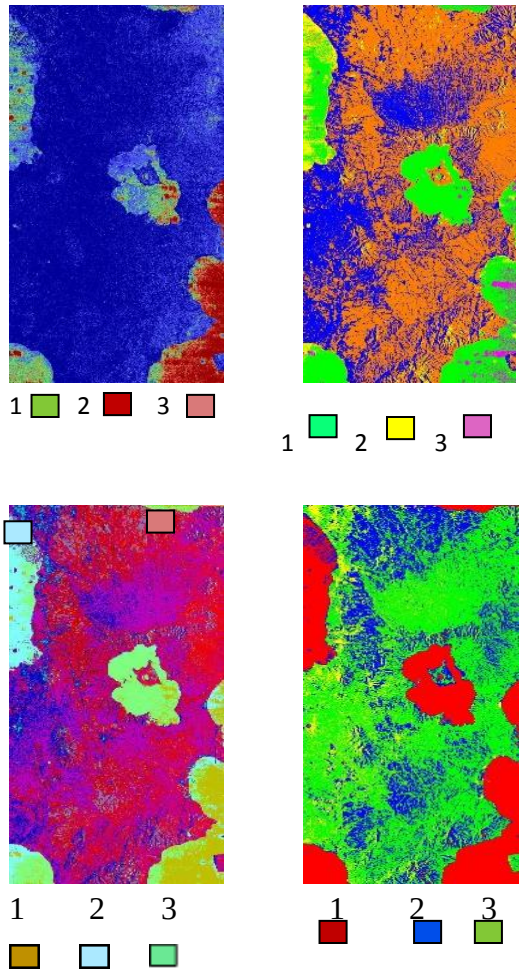
3. Study Area

The study area is located in Pinatubo, Philippines are having longitude $120^0$36'10.80''E to $121^0$31'37.20''E and latitude of $13^0$32'34.80''N to $14^0$34'01.20''N. The data is in MLC format and incident angle is 53.903. The C- Band SIR-C satellite image with the dual polarization (HH, HV) obtained on 04/14/1994 [10].

4. Result and Discussion

The microwave SIR-C SAR image was in MLC format; hence, initially the image converted into the ground range using a multilooking process after importing the data in PolSARpro 5.0 software. The Pauli RGB image also called the Pauli decomposition image. This image constructed with the odd bounce, even bounce and 45^0 tilled even bounce components in red, blue and green colours respectively representing all the polarimetric information of the matrix. Next, the data filtered because speckle noise degrades the quality of SAR image. Hence, this image filtered with 5x5-window size by using Lee Refined speckle filter. Then H-A-alpha decomposition parameters are generated the Entropy (H), Anisotropy (A) and Alpha (α) images.

Later, the images classified using H-alpha, Wishart H-alpha and Wishart H-A-alpha unsupervised and superclassifier. The results of unsupervised classified images are shown in the figure 3 (a), (b), (c) and supervised classified image in figure (d) respectively,



1. Water 2. Open Land 3. Vegetation

Figure 2. Unsupervised Vegetation Bodies (a) H-alpha (b) Wishart H-alpha (c) Wishart H-A-alpha (d) Supervised Classification

Here the major three classes *viz*, Water, Open land and Vegetation is studied. Generally the H alpha and Wishart H-alpha having a capacity to show 8 classes, whereas the Wishart H-A-alpha have the capability of 16 classes. In supervised the three classes defined. These classified images further analysed by using NEST software. From the above all, results the area covered in percentage of vegetation class is shown in Table 1,

Table 1. Unsupervised Vs. Supervised Classification of SIR-C PolSAR Image

Class	Unsupervised Classification			Supervised Classification
	H Alpha (%)	Wishart H Alpha (%)	Wishart H A Alpha (%)	(%)
Vegetation	65.86	49.08	32.19	**50.22**

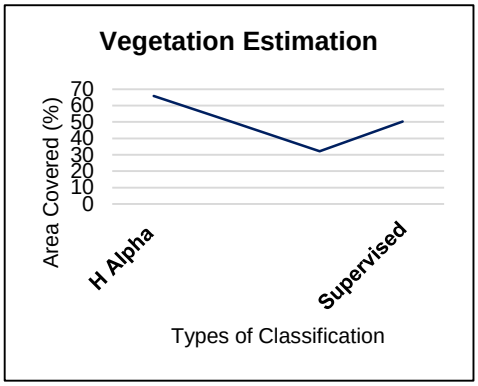


Figure 3. Graph for Unsupervised and Supervised Classification of Water Bodies

In unsupervised classification the H-alpha and Wishart H-alpha having, the same number of classes, but Wishart H-alpha shows more value than H-alpha. Whereas in Wishart H-A-alpha having less Vegetation area coverage than Wishart H-alpha, because of more number of classes found in

Wishart H-A-alpha. In the H Alpha classification, the result has mix classification; hence, it shows highest value as compared to other. Hence, in the comparison of unsupervised classification the Wishart H Alpha has a better result. The results of supervised classification have slightly larger value than Wishart H Alpha unsupervised classification. Hence, from the overall work, it is observe that the supervised classification results are much better than all the unsupervised classification.

5. CONCLUSION

The microwave C-Band SIR-C dual polarized MLC data using PolSARpro software are successfully classified. In the unsupervised classification the H-alpha, Wishart H-alpha and Wishart H-A-alpha techniques are used. Then in supervised classification manual 3 classes was defined out of that Vegetation class was measured. The classification results of both techniques for Vegetation present, compared and analyzed by using NEST software. The more accuracy found in the supervised classified image than the unsupervised classification. The reason for that is due to correct selection of a training area while creating the classes and the C-band frequency having a high-resolution dataset. Hence, from all these studies it is concluded that the for Vegetation analysis classification accuracy for supervised is better than unsupervised classification.

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[10] Microwave C-Band SIR-C Dataset Download from: http://earthexplorer.usgs.gov/