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Adaptive Feature Analysis Based SAR Image Classification

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ABSTRACT

SAR Image Classification is the progression of unscrambling or grouping an image into different parts. The effective part of detection algorithms based on the feature of classified image. The main act of detection algorithms based on the quality of classified image. A significant problem in SAR image application is truthful classification. Adaptive Feature Analysis Based logic is one of prominent unsupervised clustering methods, which can be used for Synthetic Aperture Radar (SAR) image classification. In this paper, we consider the problem of SAR image Classification by adaptive Thresholding. Hear two different Thresholding techniques on SAR images that minimize two different objective functions for merging different region to get the classified SAR images.

Keyword: SAR, Adaptive Thresholding, Correlation Coefficient, skewness.

1. INTRODUCTION

Synthetic Aperture Radar (SAR) contributing such a facility. SAR systems receive gain of the extended range proliferation characteristics of radar signals and the multifarious data processing potential of contemporary digital electronics to supply better imagery. Synthetic Aperture Radar (SAR) image classification is becoming more and more increasingly important in military or scientific research. Under some severe conditions of improper illumination and unexpected disturbances, the blurring images make it more difficult for target recognition, which results in the necessity of classification. Color based classification of image is a decisive operation in image analysis and in many computer vision, image elucidation, and pattern recognition system, with applications in scientific and industrial field(s) such as medicine, Remote Sensing, content based image and video repossession, document analysis, industrial automation and quality control. The performance of SAR Image Classification may significantly affect the quality of an image understanding system.

2. SAR CLASSIFICATION

After segmentation of the given SAR image, the numbers of classes are derived out by developing some novel classification algorithms using the sixteen features, extracted from the developed segmentation algorithms. These sixteen features are: Mean, Correlation Coefficient, Standard deviation, Entropy, Covariance, Median, Mode, 1st order skewness, 2nd order skewness, 1st order moment, 2nd order moment, 3rd order moment, 4th order moment, Beta - coefficients, Gama-coefficients and Kurtosis. The test image data sets, used in this dissertation are Image1- NILNOD, Image2- SUNSU Island, and Image3- LUN Fun Island forms Italian Space Agency, 2008. Table 1 shows the respective values of sixteen features, evaluated from the above three image data set. Based on above sixteen features, classification methodology, namely: Adaptive Thresholding (AT), has been developed. Further classification algorithm has been compared with

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Table 1
Feature Table of different SAR images.

Index	Features	Image1	Image2	Image3
1	Mean	106.220	105.1209	104.6448
2	correlation coefficient	0.9714	0.9199	0.9954
3	Standard deviation	36.6332	34.2693	73.2734
4	Entropy	6.9004	6.6587	6.2737
5	Covariance	34.4881	32.5999	70.0210
6	Median	103	96	107
7	Mode	43	37	46
8	1st order skewness	7	7	6
9	2nd order skewness	20	20	17
10	1st Order moment	106.220	109.1664	104.6448
11	2nd Order moment	254.9789	239.1487	194.2979
12	3rd Order moment	254.9994	246.5168	196.7852
13	4th Order moment	255.000	247.8853	198.1756
14	Beta -coefficients	0.0039	0.0043	0.0052
15	Gama-coefficients	0.0626	0.0658	0.0725
16	Kurtosis	-2.9999	-2.9998	-3

existing classifiers: Bayes classifier, Support Vector Machine (SVM), K-Nearest Neighbor (KNN). In addition to this, some existing methodologies like: Gray Level Co-occurrence Matrix (GLCM), Gabor filters, Gaussian Markov Random Field (GMRF) and Gray histogram are also compared with the developed algorithms based on the statistical parameter, Kappa Coefficient, whose value gives a measure of the performance of any algorithms.

3. FLOW OF WORK

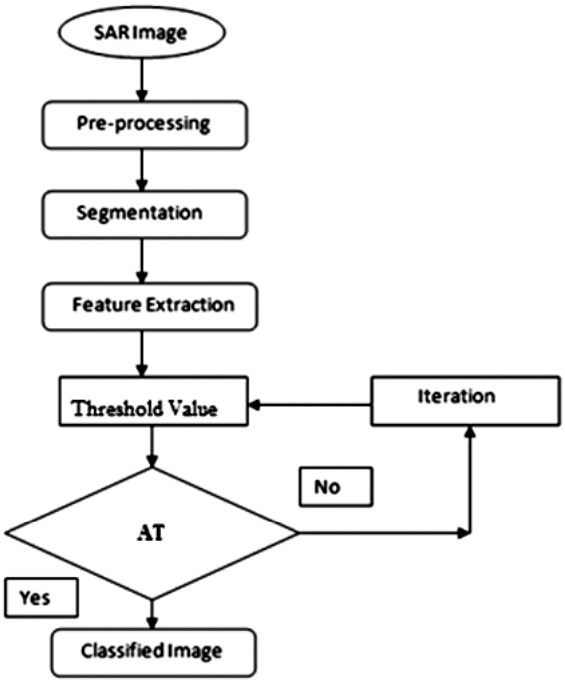

Figure 1: SAR Image Classification's Methodology

4. ADAPTIVE THRESHOLDING (AT)

The steps are given below:

- Input SAR image.
- Select the training samples i.e. mean value for every region in the SAR image, calculated in segmentation.
- Calculating the variance using 5×5 mask of SAR image.
- The Group threshold, called as Adaptive threshold, of each pixel has been evaluated by sum of the mean and standard deviation.
- convolve the 5×5 mask on the given SAR image and replacing the central pixel value, calculated by the following expression mask coefficient of SAR image
- If the pixel value of the SAR image is greater than or equal to the Group threshold, calculated in steps 4, then the pixel is treated as a class otherwise it is discarded.
- Steps 4, 5, 6 are repeated until and unless entire region is covered.

The qualitative performance of the AT has been compared with the existing methods in terms of number of class, shown in Table 2. From the Table-2 it is noted that the number of classes are more, in this case 3, in the developed algorithm compared to the existing one. Table -3 shows the quantitative performance of the developed algorithm with the existing one using the Kappa Coefficient. Figure 16 shows the performance graph of the different algorithms. From the Table-3 and Figure-2, it is clear that the Kappa Coefficient value is higher in the developed algorithm which shows the improvement of the existing algorithms.

Table 2
Quantitative Performance

Technique		No. Of Classes
Existing Methods	Gray Level Co-Occurrence Matrix (GLCM)	3
	Gabor filters	3
	Gaussian Markov Random Field (GMRF)	3
	Content-Based Regional-Matching (CBRM)	2
	Multilevel Local Pattern Histogram (MLPH)	2
	K-Nearest Neighbors (KNN)	2
Developed Method	***Adaptive Thresholding (AT)***	***3***

Table 3
Quantitative Performance

Technique		Kappa Coefficient
Existing Technique	Gray Level Co-Occurrence Matrix (GLCM)	0.895
	Gabor filters	0.901
	Gaussian Markov Random Field (GMRF)	0.892
	Content-Based Regional-Matching (CBRM)	0.923
	Multilevel Local Pattern Histogram (MLPH)	0.910
	K-Nearest Neighbors (KNN)	0.916
Developed Technique	***Adaptive Thresholding (AT)***	***0.927***

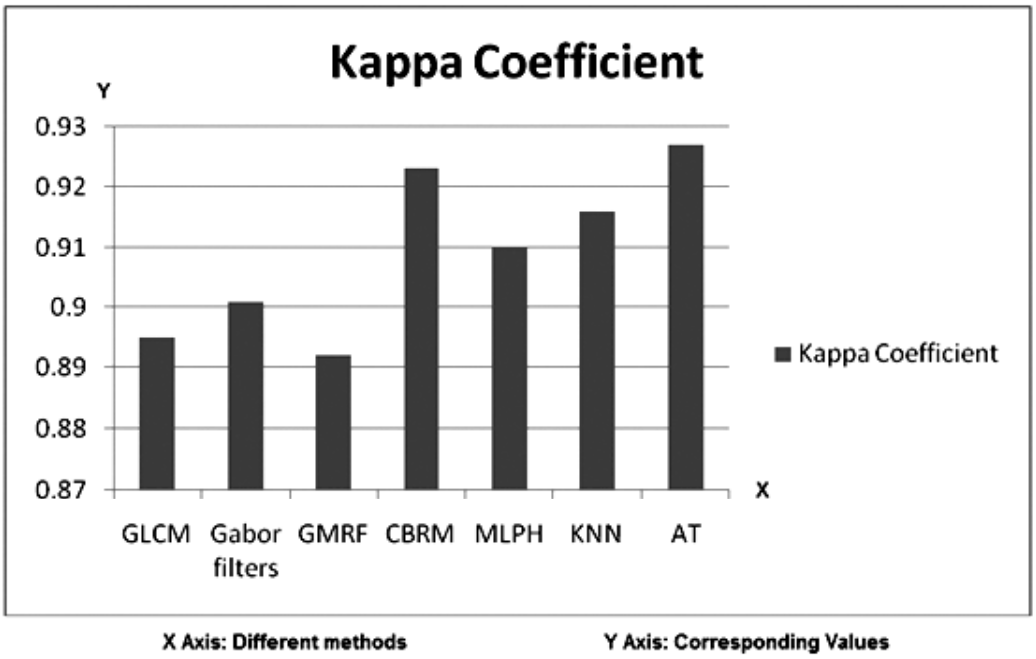

Figure 2: Quantitative Performance graph

5. EXPERIMENT RESULT

We ignore these pixels and their neighbors both in training and testing. We randomly select 20% pixels of the Wuhan image as training data and adopt the entire SAR image as test data. All reported results represent averages over ten train–test partitions. Two sets of experiments are performed in this study. The first set compares the performances of the AT under various parameter configurations. The second set compares the AT to three other widely used texture descriptors and to a gray histogram. The qualitative performance of the AT has been compared with the existing methods in terms of number of class, shown in Table 2.In this thesis work, we have considered synthetic aperture radar images. The SAR images are classified by using Adaptive Feature Analysis technique.

6. CONCLUSION

In this paper, a novel algorithm based on adaptive feature analysis based for classification of SAR images is proposed. This technique is based on considering a 3X3 window and calculates successively the corresponding First, mean and variance of the SAR Images. Then store the color feature using Thresholding value of same SAR image for better result. The proposed algorithm gives better result compared with other classification of SAR images.

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