A Region based Classification of SAR Images using IMA Algorithm

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***Abstract*— Classification is one of the major research area of image mining. The classification is basically to categorize the related images in similar groups. In this paper, the image classification for the satellite images is performed. The complete work is the hybrid approach that will use the concept of moment analysis along with histogram analysis to perform the image classification. Finally the segment detection will be performed by using the improved moment analysis (IMA) algorithm. The work is divided in two phases, the histogram analysis phase will improve the efficiency and the moment based analysis will improve the accuracy of the work. Finally a new technique to polarimetric SAR image classification is introduced & obtained results are compared with other competitive classifiers result.**

***Keywords*— SAR image, high resolution image (HRI), feature parameter, classification, low resolution image (LRI), Improved moment analysis (IMA).**

I. INTRODUCTION

Image classification means to classify images into different groups. Image classification is a difficult task and affected by many factors. Classification process comprises image sensors, image preprocessing, object detection, feature extraction, object segmentation, and object classification. Classification system consists of database of predefined patterns that compares with detected object to classify in to proper category. There are different methods [1] of image classification based on the intensity value, including a simple thresholding, quantization of the image, etc. Image classification is an important and challenging task in various application domains, including vehicle navigation, biomedical imaging, industrial visual inspection, biometry, robot navigation. Some more applications of image classification [8] are monitoring global land usage using satellite images, target recognition, matching stereo images to recover shape for navigation. During the past years, for classification of synthetic aperture radar (SAR) images different techniques were in use, based on fuzzy methods[2] , based on the Maximum Likelihood[5], based on artificial Neural Networks (NN)[3,4], or other approaches. And the wavelet-based texture feature sets for classification of multi frequency polar metric SAR images is proposed by Fukuda and Hirosawa [7]. So the accuracy of Classification depends on quality of features and the employed classification algorithm.
The presented work is the hybrid approach of two major pixel intensity based analysis schemes. These approaches are based on histogram analysis and the moment analysis. Based on peak value analysis number of different regions are identified using the first method and the second approach will perform the region identification and the colorization of the work. The stages of the work are given as under:

1. Collection of Data from Some Secondary source
The images required here should be high resolution images so that classification can be done effectively. These kinds of images can retrieved from the references mentioned in earlier papers.

2. Preprocessing
The preprocessing stage is about the conversion of an image to a normalize image form. Here the normalization includes the intensity, color model of the image, adjustment of size etc.

3. Find the Number of Regions
To estimate the number of regions over the image, the histogram based analysis will be performed. The peak value analysis of the regions in histogram is based on this kind of analysis. Number of Peak Mountains in the histogram will represents the number of regions over the image. The region identification will improve the efficiency of the approach.

4. Classify the Image
Once the numbers of regions are identified, to identify and classify the different regions over the image a moment based analysis will be performed over the image.

5. Colorization
The color mask will be implemented to perform the colorization to separate these regions.

6. Comparative analysis
Comparative analysis of the proposed approach will be performed in the form of graphs.

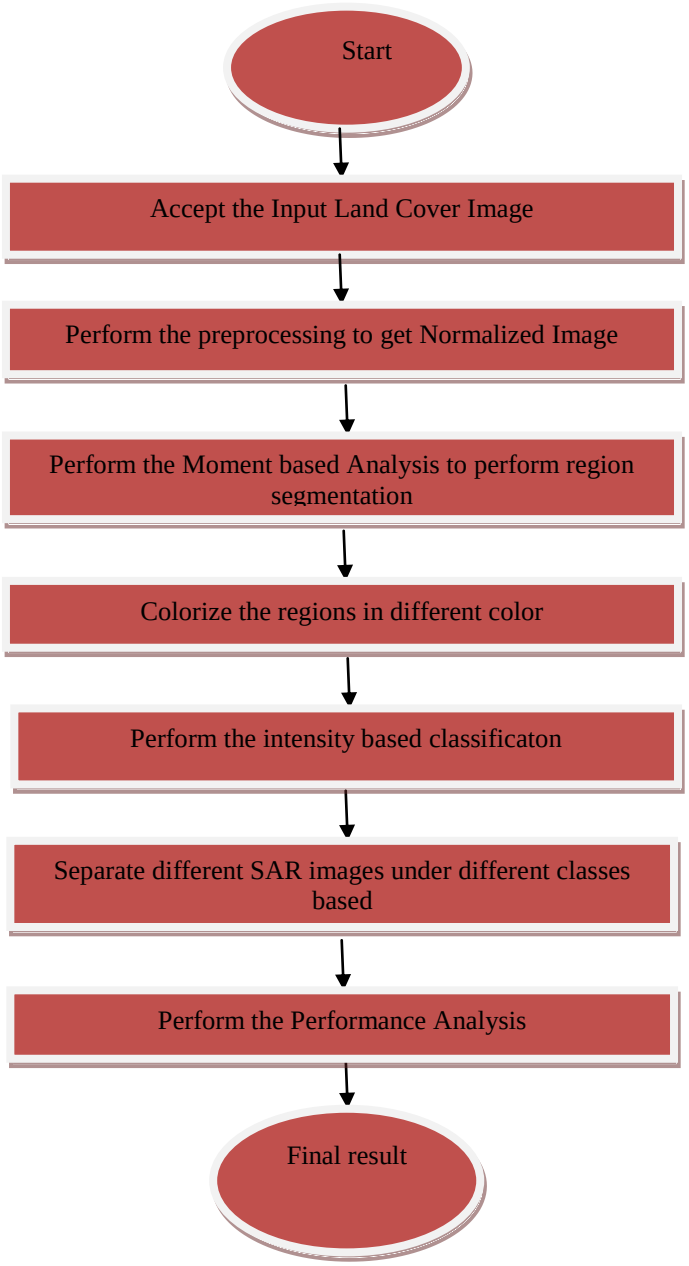
II. LITERATURE REVIEW

For the image classification, initially, worldwide features like histograms of color, texture and edge information were used to express and classify images [9, 10, 11]. The major drawback of this approach was that it captured not only the interesting target but also the noisy background. To avoid this problem, there were several works on subdividing an image into smaller blocks to exploit locality properties of image data [12, 14, 13]. They still got a problem that the schemes using fixed sized blocks were not robust on location translation which is common in real image classification applications. The simplest way to describe an image is to use histograms of color, texture and edge information as global features. Many papers have

been published in this direction. M.Szummer [11] studied binary image classification via color histograms using k-NN classifier. A.Vailaya [9] proposed using histograms of colors and edge directions together with Bayesian classifiers for multiple class classification. O.Chapelle [10] used color histogram features with SVM classifier for object classification. [11] Used color information to construct a classification tree. The major drawback of those methods is that a global histogram representation could not discriminate between the interesting target and the background noises. To avoid the problems of global histogram representations, Y. Chen [12] have been proposed subimage-based methods which divided an image into several rectangular blocks to exploit local and spatial properties. J. Z. Wang [13] partitioned an image into smaller blocks and represented them by use of wavelet coefficients in high frequency bands, and set a threshold to control a class prediction of each block. J. Li [14] proposed the ALIP system which used two-dimensional multiresolution HMM trained on color and texture features of image blocks. The problem of these methods is that fixed blocks are sensitive to the location change of objects in the images, thus they are not robust to location translation, which commonly happens in real images. In this proposed work, a new classification algorithm is introduced, which is used to classify and improve the overall accuracy of the SAR images [1, 6].

III. IMA METHODOLOGY

The presented work is about to perform the region classification of the SAR images. In this paper a layered approach is proposed for the classification. At the initial state the segmentation will be performed to identify the number of classes over the images. As the classes identify the moment based analysis is performed and finally as the major stage the classification is implemented for the classification of SAR images. The work is about to identify the homogenous and the heterogeneous regions more clearly over these SAR images. The basic design for the IMA algorithm is given in the form of flowchart as under:



The basic methodologies that will be used in this work are

Clustering:
Clustering is the process of grouping feature vectors into classes in the self-organizing mode. Choosing the representation of cluster centers (or prototypes) is crucial to the clustering. Feature vectors that are beyond from the cluster center should not have as much weight as those that are close. Most of distant feature vectors are outliers usually caused by errors in one or more measurements or a deviation in the processes that formed the object. A Moment analysis based clustering methods have been proposed and most of them are based upon distance criteria. This clustering is been performed based on the intensity analysis and its variation over the image. Similar intensity regions with less variation are taken in one cluster.

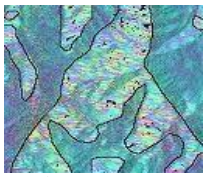
IV. IMA ALGORITHM

Improved Moment based Analysis is a feature oriented process that achieves information sharing by performing the intensity analysis from some normal standard. It is modeled based on the similarity and variation analysis over the image. Moment based analysis operates by transferring the pixel information between different clusters. Based on this variation and similarity similar regions can be identified. The algorithm for the proposed work is given as under.

1. Get the Input Image called Img.
2. Perform decomposition of image under intensity analysis to identify the number of region types over the image.
3. Perform moment based analysis over the image to identify the similar pixel values in different clusters. Cluster of different kind represents different type of region over the SAR image.
4. Initialize the feature parameters such as maximum and minimum intensity ranges, intensity area etc.
5. As the areas are detected, perform the colorization to perform the clear separation of segments.
6. Perform the classification based on cluster area analysis.
7. Calculate the mapping vector over the image with probabilistic value.
8. Implement the same procedure for all the blocks till all images are not gets detected.
9. Exit.

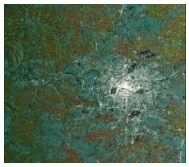
V. RESULT & ANALYSIS

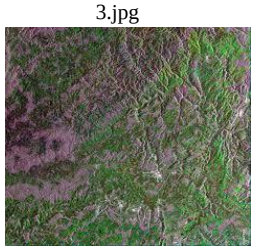
IMA Algorithm for text extraction has been implemented by using MATLAB & has been evaluated on a data set containing 9 images. In this paper, The SAR images are classified by using improved moment analysis (IMA) algorithm. All images are of 256*256 in size and in jpeg format. The images are taken from Google in low resolution as well as in high resolution form. Images shown below are high resolution images (HRI) and the same images are also taken in low resolution form as shown below:

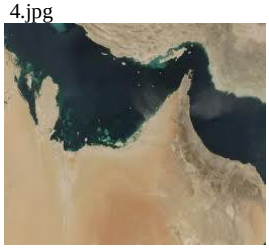

1.jpeg


2.jpeg

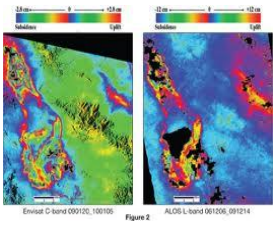

3.jpg


4.jpg



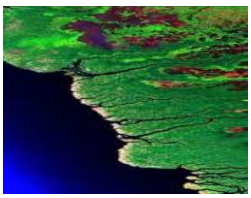


5. Jpeg


7. Jpeg

6.Jpeg


8.Jpeg


9. Jpeg

Simulation Results Processing:

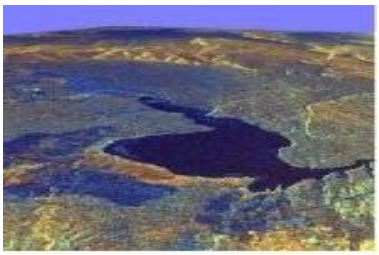


Figure1: Input Analysis of existing Image (HRI)

Here, this figure is showing the input image taken by base paper for the analysis. Same image is taken to perform the performance analysis with existing approach.

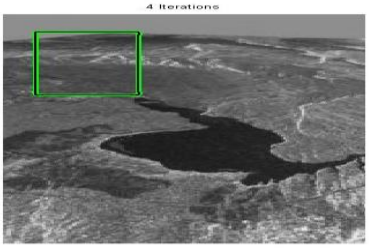


Figure 2 : Processed Image (HRI)

This figure is showing the processed image, As seen the image is first converted to grayscale to perform the segmentation based on gray value analysis. The window shown in green color is the decomposition window that will identify different regions individually over the image.

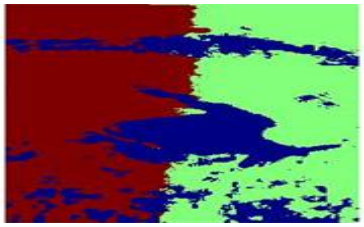


Figure 3 : Result Colorized Image (HRI).

This figure Shows the result Image. As seen the output image is much clear then input images. It means the presented work

is working efficiently and accurately. Based on this work features value calculated for this dataset are shown in the table:

Table I: shows the calculated feature parameter values of SAR images

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Type	Images	Mean value	Standard deviation	Frequency change
HRI	1.jpg	144.70	47.125	29.03
	2.jpg	158.92	98.685	11.27
	3.jpg	69.90	29.445	06.31
	4.jpg	80.01	31.607	14.33
	5.jpg	116.15	54.428	05.01
	6.jpg	90.48	33.491	25.06
	7.jpg	138.41	75.405	18.12
	8.jpg	85.61	60.259	14.30
	9.jpg	57.09	51.899	14.01
LRI	1.jpg	89.93	51.58	37.57
	2.jpg	96.141	85.24	16.13
	3.jpg	38.8	24.83	07.79
	4.jpg	154.31	35.48	18.84
	5.jpg	193.45	68.0	05.22
	6.jpg	194.52	41.69	32.08
	7.jpg	197.72	53.89	14.00
	8.jpg	152.92	59.06	15.42
	9.jpg	118.64	64.688	17.75

Finally the results are shown in the form of graphs

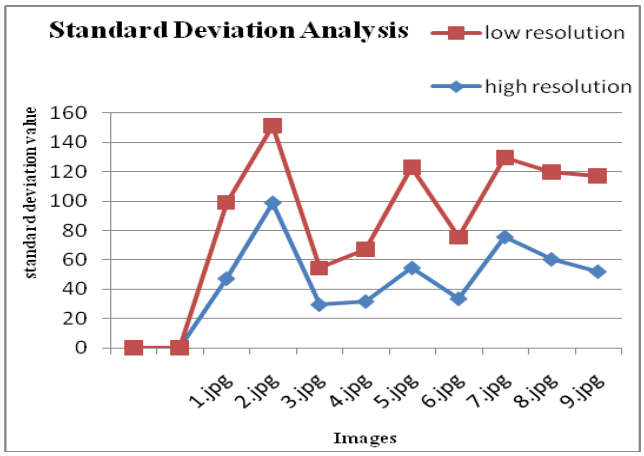

Fig4: Standard deviation analysis of SAR images.

This figure shows the standard deviation analysis for the given dataset of images in high as well as in low resolution form.

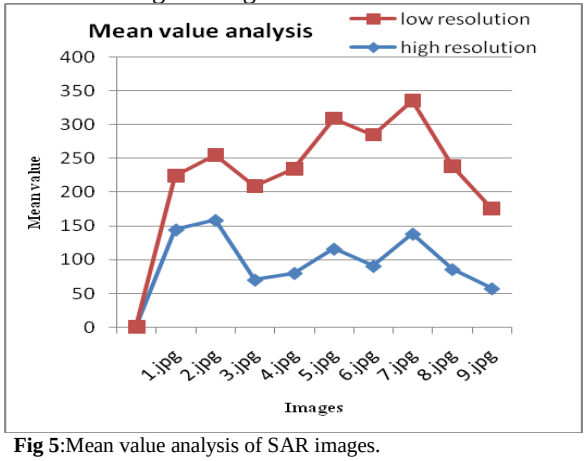

Fig 5:Mean value analysis of SAR images.

This figure shows the mean value analysis for the given dataset of images in high as well as in low resolution form. Now the features value are calculated according to this work and then comparison is performed with the existing features value of the same image. Comparison table of features value:

Table II: Comparison of SAR images (HRI).

Features parameter	**Existing value of the image**	**Proposed value of the image**
Mean	106.22	105.49
Correlation coefficient	0.9714	103.45
Median	103	103
Mode	43	127

This table shows the comparison of Original image and Classified SAR image based on different feature parameters.

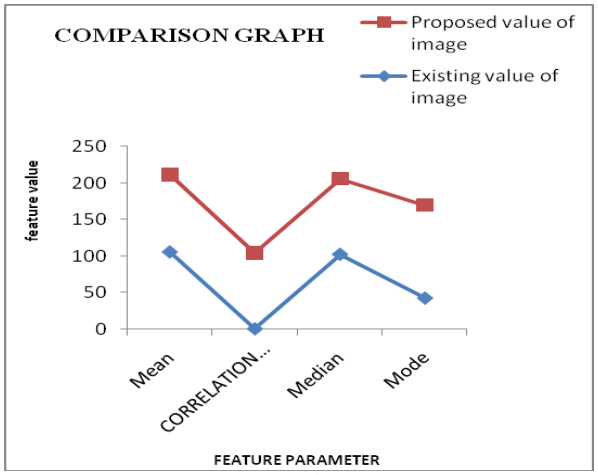

Fig 6: Features value comparison of SAR image.

Here figure 6 is showing the comparative analysis of existing and proposed approach under different parameters. As we can see, the analysis is here drawn for mean, median, mode and correlation based. For each parameters the values obtained in proposed approach is higher that shows that the clear classification of the regions and gives the better visibility to the result.

VI. CONCLUSION

In this thesis work, SAR image classification is performed to separate the image regions by using the improved moment analysis (IMA) algorithm. In this work, a hybrid model of the moment based analysis along with histogram analysis is used over the radar images. This technique based on considering a 3X3 window and calculates the mode, frequency change, mean, median, standard deviation of the SAR Images. In this model, firstly the analysis is performed to identify the number of segments over the image. Afterward the region assessment is been performed to identify the average weights over the pixels. By performing the second level analysis the clustering is been performed to identify the different regions over the image. Finally comparison is performed with the existing

work. Obtained results from the system shows that the effective segmentation is been performed.

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