SAR IMAGE CLASSIFICATION USING FUZZY C-MEANS

Debabrata Samanta, Goutam Sanyal
Department of CSE, National Institute of Technology, Durgapur,
Mahatma Gandhi Avenue, West Bengal, India

ABSTRACT

Image Classification is the evolution of separating or grouping an image into different parts. The good act of recognition algorithms based on the quality of classified image. The good feat of recognition algorithms based on the quality of classified image. An important problem in SAR image application is accurate classification. Image segmentation is the mainly practical loom among virtually all automated image recognition systems. Fuzzy c-means (FCM) 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 Fuzzy c-means technique. Here we proposed spatial information with the FCM clustering for improving the SAR image classification result. Hear two different fuzzy clustering techniques on SAR images that minimize two different objective functions for merging different region to get the classified SAR images.

KEYWORDS: *FCM, SAR image, color map.*

I. INTRODUCTION

Synthetic Aperture Radar (SAR) grants such a capability. SAR systems take advantage of the long-range propagation characteristics of radar signals and the complex information processing capability of modern digital electronics to provide high resolution imagery. Synthetic Aperture Radar (SAR) image classification is becoming more and more increasingly important in military or scientific research. **.** Region specification is a crucial step towards automatic classification of SAR images. 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 color segmentation may significantly affect the quality of an image understanding system.

The motivation of this work is to develop a novel classification algorithm, which can be used to classified the SAR images and improve the overall accuracy [7] [9]. Classification algorithms for Synthetic Aperture Radar images have been suggested in the field of categorization [6]. During the past years, different techniques were in use for classification of synthetic aperture radar (SAR) images, based on the Maximum Likelihood (ML) [1], artificial Neural Networks (NN) [2] [3], fuzzy methods [4] or other approaches. The NN classifier depends only on the training data and the discrimination power of the features. Fukuda and Hirosawa [5] [11] proposed the wavelet-based texture feature sets for classification of multi frequency polar metric SAR images. So the Classification accuracy depends on quality of features and the employed classification algorithm. [8] [12] Fuzzy c-means is a method of clustering, which allows one piece of data belongs to two or more clusters.

In this paper, we proposed the modification of an unsupervised fuzzy clustering technique to guide the classification process by adding a-priori geometrical information in order to improve the final classification result.

II. FUZZY C-MEANS CLUSTERING ALGORITHM

The Fuzzy c-means clustering algorithm is an iterative clustering method that produces an optimal *c* partition by minimizing the weighted within group sum of squared error objective function T_{fc}

$$T_{fc} = \sum_{k=1}^{r}\sum_{l=1}^{c}(U_{rc})^{q} f^{2}(X_r, Y_c) ---(1)$$

Where $P = \{p_1, p_2, \ldots . u_n\} \subseteq U^q$ is the data set in the p-dimensional vector space, is the number of data items, *c* is the number of clusters with 2 £ *c* < *n*, u_{rk} is the degree of membership of P_r in the r*th* cluster, *q* is the weighting exponent on each fuzzy membership, v_c is the prototype of the centre of cluster r, $d2(X_r, Y_c)$ is a distance measure between object P_c and cluster centre V_c of SAR image.

A solution of the object function T_{fc} can be follows::

- Set values for the SAR image are c,q,€,
- Initialize the fuzzy partition matrix of segmented region.
- Set a loop counter c=0.
- Calculate c cluster for $\{Y_c^{(b)}\}$ with $U^{(b)}$

$$Y_c^{(b)} = \frac{\sum_{l=1}^{n}(X_{irc}^{(b)})^{p} u_c}{\sum_{l=1}^{n}(X_{rc}^{(b)})^{p}} ----------(2)$$

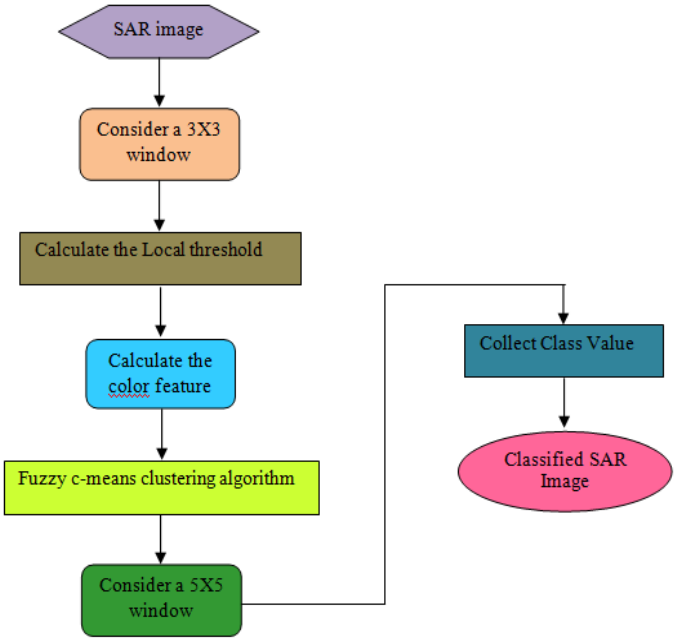
In this case we can write for a SAR image:

$$2\sum_{l=1}^{n} y_{rc}^{\ p}(X_r - Y_c) = 0 -----(3)$$

III. PROPOSED ALGORITHM

- Select initial class prototype of SAR image $\{V_i^{(b)}\}$
- Update the memberships of U_{ij}
- Obtain the prototype of clusters of SAR image of weighted average.
- The termination occurred when $| V_{new} - V_{old}| \leq €$

IV. PROPOSED WORK FLOW DIAGRAM



V. EXPERIMENT RESULT

In this thesis work, we have considered synthetic aperture radar images. The SAR images are classified by using novel approach based on Fuzzy c-means technique. The figure (Fig 1 to Fig 2) shows the original SAR images and corresponding histograms and the figure (Fig 1(a) to Fig 2(a)) shows the histograms of classified SAR images.

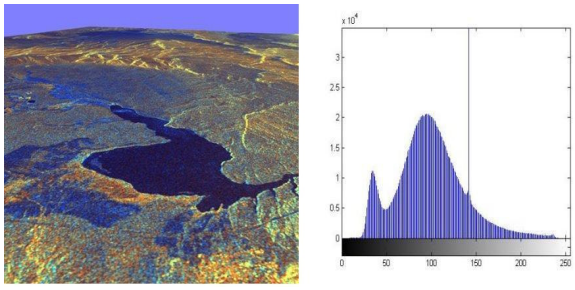


Fig1: SAR image1 and Histogram

If we taking the pick values we get the no. of class are 4. After using our methodology we get the Histogram given below:

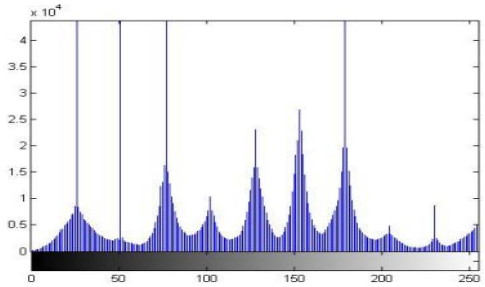


Fig1a: Classified Histogram based on Fuzzy c-means technique

If we taking the pick values we get the no. of class are 10.

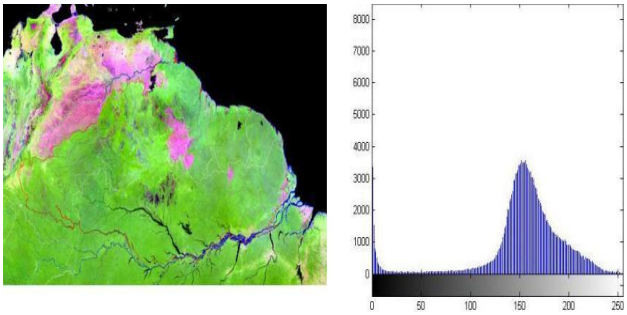


Fig2: SAR image2 and Histogram

If we taking the pick values we get the no. of class are 3.

After using our methodology we get the Histogram given below:

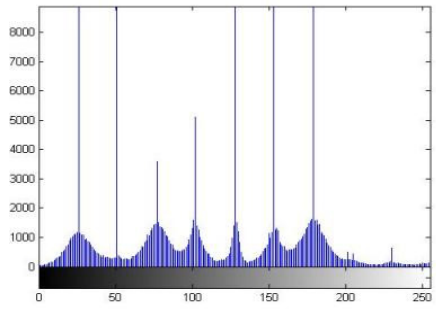


Fig2a: Classified Histogram based on Fuzzy c-means technique

If we taking the pick values we get the no. of class are 9.

Table1:-Class Table of SAR images.

SAR IMAGE	CLASS BASED ON	
	NORMAL HISTOGRAM	FUZZY C-MEANS TECHNIQUE HISTOGRAM
Image1	4	10
Image2	3	9

VI. CONCLUSION

In this paper, a novel algorithm based on the Fuzzy c-means 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 Fuzzy c-means of same SAR image for better result. The proposed algorithm gives better result compared with Histogram based classification of SAR images.

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AUTHORS

Debabrata Samanta is a member of the IAENG, Board member of the Seventh Sense Research Group Journals (SSRGJ), member of Editorial Board of IJSCE. He obtained his B.Sc. (Physics Honors) in the year 2007, from the Vivekananda Collage, Takurpukur, under Calcutta University; Kolkata, India .He obtained his MCA in the year 2010, from the Academy Of Technology, under WBUT. He is working his PhD in Computer Science and Engg. In the year 2010 from National Institute of Technology, Durgapur, India in the area of Image Processing .He is presently working as a Guest Faculty of CSE in University Institute of Technology, Burdwan, West Bengal, India. His areas of interest are Artificial Intelligence, Natural Language Processing and Image Processing. He has guided 6 PG and 15 UG thesis. He has published 34 papers in International Journals / Conferences.

Gautam Sanyal is a member of the IEEE. He has received his B.E and M.Tech degree from National Institute of Technology (NIT), Durgapur, India. He has received Ph.D. (Engg.) from Jadavpur University, Kolkata, India, in the area of Robot Vision. He has published nearly 98 papers in International and National Journals / Conferences. 3 Ph.Ds (Engg) have already been awarded under his guidance. At present he is guiding eight Ph.Ds scholars in the field of steganography, Cellular Network, High Performance Computing and Computer Vision. He is presently working as a Professor in the department of Computer Science and Engineering and also holding the post of Dean (Students' Welfare) at National Institute of Technology, Durgapur, India.