A Method of Segmentation for Hyper spectral & Medical Images Based on Color Image Segmentation

Praveen Agrawal,
M. Tech (pursuing), Dept. of Electronics & Communication
Arya Institute of Engineering & Technology, Kukas
Jaipur, India
praveen.0417@gmail.com

Ashok Kajla
Associate Professor, Dept. of Electronics & Communication
Arya Institute of Engineering & Technology, Kukas
Jaipur,India
kajla_ashok@yahoo.com

Manish.N.Raverkar
Associate Professor, Dept. of Electronics & Communication
Arya Institute of Engineering & Technology, Kukas
Jaipur,India
manishr1008@gmail.com

Abstract: - The paper propose an original and simple segmentation strategy based on the EM approach for hyper spectral images. In a first step, to simplify the input color textured image into a color image without texture. The final segmentation is simply achieved by a spatially color segmentation using feature vector with the set of color values contained around the pixel to be classified. The spatial constraint allows taking into account the inherent spatial relationships of any image and its colours. This approach provides effective PSNR for the segmented image. These results omit the better performance athe segmented images are compared with Watershed & Region Growing Algorithm. This approach provides the effective segmentation for the Spectral Images & Medical Images. With proposed approach it can be fascinated that the data obtained from the segmentation can provide accurate information from the huge images.

Keywords: *region adjacency graph, K-Means, VIBGYOR*

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1 Introduction:- Images contains many information in it, some of part of an image is important for research and application. Image processing is an essential process to seprate those important from the image. For image segmentation there are various existing algorithms.[6] Among which the widely used one is *k* means clustering algorithm. The other techniques used so far includes histogram based methods, edge detection, graph partitioning based method, another one is watershed transformation, level 3 set methods, model based segmentation, multi scale segmentation, neural network segmentation and lot more. As a review on image segmentation methods in suggests some of these methods use only gray level histogram. Most of these methods are not suitable for noisy environments and those which are robust to noise are computationally expensive. The k means clustering algorithm has disadvantage that it takes number of cluster as an input parameter whose inappropriate choice may yield poor results. The quality of the segmentation depends a lot on image. Solar radiation spectrum which are reflected by Earth's surface are measured by Airborne and satellite hyper spectral sensors. For identification of elements on the surface of earth like minerals, farming land , water sources and environment etc., these spectrum might used and are often unique. This data is often in range of hundreds of megabytes so it requires considerable time and computing resources. For a particular application relevant information should be extracted from the huge amount of data. We propose an algorithm which is based on basic color approach that can help to segment the required information. Solar radiation spectrum which are reflected by Earth's surface are measured by Airborne and satellite hyper spectral sensors. For identificate elements on the surface of earth like minerals, farming land , water sources and environment etc., these spectrum might used and are often unique. This data is often in range of hundreds of megabytes so it requires considerable time and computing resources. For a particular application relavant information should be extracted from the huge amount of data .[5]

2.Previous Methods:- The paper[1] presents the series of algorithms on watersheds. The pre processing stage involved is an edge-preserving statistical noise reduction approach for the accurate estimation of the image gradient. Then, initial partitioning of the image into primitive regions is carried out by applying the watershed transform on the image gradient magnitude.. This initial segmentation is the input to a computationally efficient hierarchical (bottom up) region merging process to produce an output as the final segmentation. Further this process is accompanied by region adjacency graph (RAG) representation of those image regions produced. Then the most similar pair of regions at each step is chosen (minimum cost RAG edge), to be merged accompanied by updation of corresponding RAG. Traditional way of implementation included sorting all RAG edges in a priority queue. The author propose a significantly faster algorithm, which additionally maintains the so-called nearest neighbour graph, due to which the priority queue size and processing time are drastically reduced. According to the propose algorithm The aim of the first stage is the reduction of the noise corrupting the image while preserving its structure, based on the above homogeneity/heterogeneity assumption for the image regions. The proposed noise reduction technique is applied locally by processing the neighborhood of each pixel separately. The underlying idea is estimating the true pixel intensity by detecting the presence (or absence) of image structure (homogeneity versus heterogeneity) and by applying the appropriate estimation technique. At the second stage, the gradient of the smoothed image is calculated using the Gaussian filter derivatives with a small scale since the noise has already been substantially reduced at the first stage. Then, the gradient magnitude is calculated and thresholded appropriately. At the next stage, the resulting gradient magnitude is passed on to the watershed detection algorithm, which produces an initial image partition. At the final stage, a novel fast region-merging process is applied to the most similar pair of adjacent regions at each step. The merging process may be terminated either interactively or with the use of a given stopping rule based on hypothesis testing. The proposed solution to accelerate region merging is based on the observation that it is not necessary to keep all RAG edges in the heap but only a small portion of them [2]

An another technique[3] for Quaternion Framework for Color Image Smoothing and Segmentation the author using Hamiltonian quaternion framework. The key innovation for this work here is a unified approach to color image processing using (i) a novel quaternion Gabor filter (QGF) to extract the local orientation, and (ii) continuous mixtures on the unit sphere to model the derived orientation for developing spatially varying smoothing and segmentation kernels. In this the author First, introduce a filter named quaternionic Gabor filter (QGF) which can combine the color channels and the orientations in the image plane which are optimally localized both in the spatial and frequency domains and provide a good approximation to quaternionic quadrature filters. the local orientation information in the color images are extracted. Second, in order to model this derived orientation information, continuous mixtures of appropriate exponential basis functions and derive analytic expressions for these models. These analytic expressions take the form of spatially varying kernels which, when convolved with a color image or the signed distance function of an evolving contour (placed in the color image), yield a detail preserving smoothing and segmentation, respectively. In the paper the author first describe the quaternion algebra and quaternion Fourier transform, and then present a novel definition of the QGFs. After this author introduce a continuous mixture model for quantifying the derived orientation information to perform color image smoothing. An another proposed technique is continuous mixture model on the derived orientation information for use in segmentation. The proposed methods handle the coupling between the channels through the application of QGFs to the quaternion representation of color images. This process also integrates the color information and the texture information. In segmentation, the active contour evolution is controlled by this unified information. Similarly, in the denoising task, image channels do not evolve independently because the orientation space and the color components are linked through the QGFs. For[4] High spatial resolution remote sensing image segmentaion an edge based embedded marker based wateshed algorithm was proposed to make it more effective and efficient with two key steps of maker extraction and pixel labeling. At first marker image was extracted by binarization. Beside of determine a single fixed thresold for the whole image , each pixel of thresold is determine , so a good marker image is achieved. Now without deduction of any edges through marker more informantion of edges are added into the extraction of marker. The Meyer’s method is improved to label the pixels with only one queue and one data structure in the next stage. In the proposed Edge Embedded Marker-Based Watershed Algorithm there are some parameter which affects the final segmentation result directly. According to the need of segmentation the value of parameter like T (scale factor) , A (the appropriate area threshold) n (number of the pixels) and α (significant value) are decided. For the different value of significant value α the level of segmentation varied .When the value of α is less than appropriate value the condition of over segmentation occur but when this value of α exceeds from the appropriate value then this condition is called under segmentation so for the proper segmentation the range of α [0-0.7]. There must be the area of smallest discernable object on the image which is equal to the appropriate area threshold (A). When the value of the area threshold is higher than A , the removal of real markers leads to under segmentation condition but the small markers caused by noise or texture leads to over segmentation when the value of area threshold set lower than A. The range of T is [0.6-0.70] to avoid the over segmentation and under segmentation condition.[4]

3. Proposed Work :- The paper proposed a new EM algorithm is very similar in setup to the K-Means algorithm. Similarly, the first step is to choose the input partitions. For this case, the same initial partitions as used in the color segmentation with K-Means were used in order to make the comparison of results more meaningful. Here, RGB color was again chosen as the comparison parameter. The EM cycle begins with an expectation step which is defined by the following equation:

$$E[z_{ij}] = \frac{p(x = x_i \mid \mu = \mu_j)}{\sum_{n=1}^{k} p(x = x_i \mid \mu = \mu_n)} \text{............}$$

In the proposed algorithm first we select color image which we want to segment. In the next step information of the pixel are being extracted . Then the electromagnetic based classification which consist pixel value for each color representation. The colors are now to be represented in VIBGYOR. If image consist any noise then in the next step we go through the image from a filter which remove the noise from image. Then we proposed a distance vector analysis using single value Decomposition which can change in the pixel with the relevant portions. In the next step coorelation between the pixels are determined with the help of mean and variance and Eigen vector and then objects are classified on the basis on color estimation.

3. Experimental Results: We applied the proposed EM algorithm on a hyper spectral image of a geographical area and some parameters are compared with the conventional Watershed algorithm and Region Growing method which is given in the table 3.1. Original hyperspectral image is in figure 3.1 and some results of watershed are shown in figure 5.2 and 5.3 then results from Region growing are also shown in figure 5.5 and figure 5.6 and the results from the EM algorithm are shown in next two figures . In figure 5.7 Blue color is segmented from the original image which is the desired information and in the figure 5.8 Green color is segmented.

TABLE 3.1 RESULTS OF HYPERSPECTRAL IMAGE 1 IN PARAMETER

S. No.	Approach → Parameter ↓	Region Growing	Watershed	EM Based	EM Based (Eq)
1	Time (Sec)	6.9436	5.3452	0.0524 *	0.4
2	MSE	233.8495	119.8061	63.9143	63.9143
3	PSNR	24.4414	27.3460	30.0748	30.0748

* Indicates A single Color Expectation Analysis

Fig. 3.1. Original hyperpectral image of a geographical area

3.1.1 Some results of Watershed Algorithm:

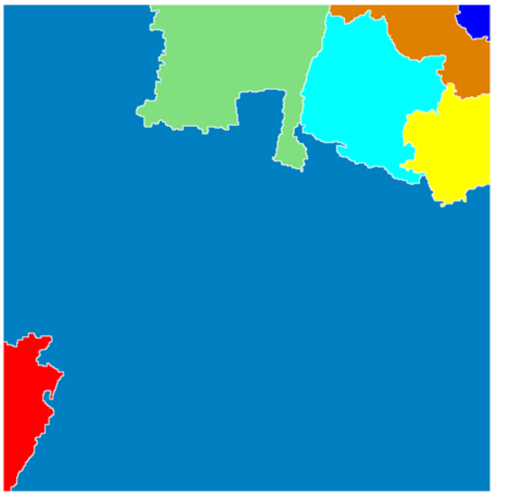

Fig. 3.2 colored watershed label matrix (Lrgb)

Fig 3.3 Markers and object superimposed on original image(I4)

3.1.2 Results of Region Growing Approach on Hyper spectral image of Georaphical area:

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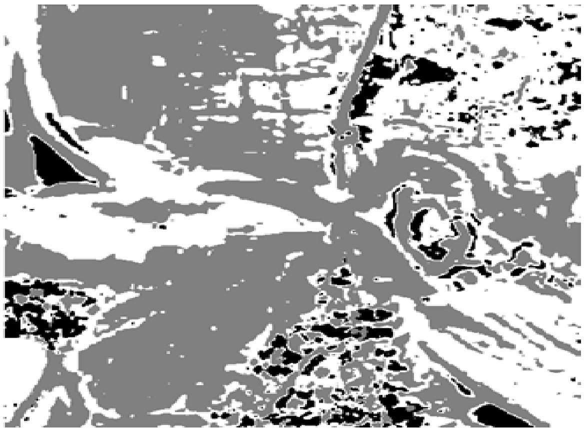

Fig 3.4 Image labeled by cluster index

Fig 3.5 Objects in cluster 1

4.3 Results of EM Algorithm:

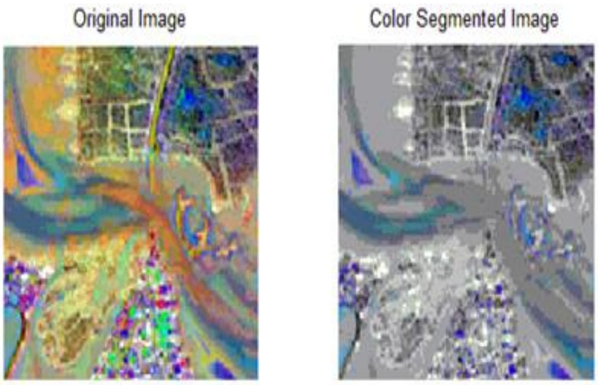

Fig. 4.7 Blue colors segmented

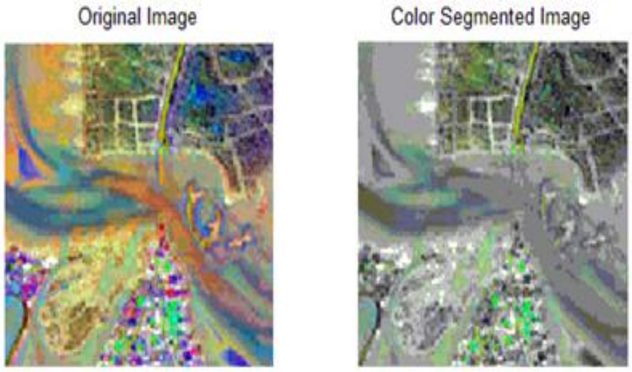

Fig. 4.8 Green color segmented

6. Conclusion: - The technique employs a feature-based, inter-region dissimilarity relation between the adjacent regions of the images under consideration. Finally, the regions are grouped to achieve the desired segmented outputs. The grouping strategy however, is dependent on the chosen inter-region dissimilarity relation.

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