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Region Based Segmentation Algorithm for Remote Sensing Image Based on Heterogeneity of Objects

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Abstract: Image Segmentation is a fundamental technology implemented on Object-Based Image analysis in Remote Sensing images. It is also a major key role for pattern recognition. In this paper we propose a Region based Segmentation Algorithm for Remote Sensing Image based on Heterogeneity of Objects. This algorithm reduces the over-segmentation that is difficult to reduce any segmentation algorithm. The experiments results shows that the proposed methodology and algorithm is very robust and it can be successfully implemented in any noisy Remote Sensing images.

Key words: Image Segmentation · Region based Segmentation · Remote Sensing Image · Heterogeneity Object

INTRODUCTION

Satellite digital images are very important and challenging one in Remote Sensing. They are widely used in Meteorology, Oceanography, Geology and many relevant areas. Many applications are only focusing on some salient region in the image. In satellite image most of the information are concentrated on edges. Because variants of light could affect the appearance of a region. Distance, camera viewpoint and illuminance are some challenges for capturing Remote Sensing Image. And due to the noise or shadow objects cannot be recognized properly.

In the analysis and processing of Satellite images, Segmentation is very important for remote sensing. Many approaches are used for segmentation. In Histogram Thresholding, threshold value is selected to segment the image [1]. In Region growing approach region is grown from the seed point by adding similar neighboring pixels. In model based approach, model is used to formulate the lesion contour and the model is revised based on local features such as edges, intensity gradient, texture and so on. In machine learning features to separate the lesion from the background are extracted first and a machine learning method is trained to do the classification based on pixel-level.

In remote sensing image analysis, the images has to be processed are often polluted by various types of noise. If the noise is high level then it will affects segmentation results. To alleviate these impacts, we develop the Region based segmentation to reduce the impact of noise on segmentation results.

A segmentation algorithm required a preprocessing step such as noise smoothing to reduce the effect of artifacts [2]. It has to decompose different domains of images into a number of disjoint regions. The preprocessing image works as input of segmentation algorithm. The proposed Segmentation algorithm reduces the Over-Segmentation problem faced by other traditional approaches. Over-Segmentation is generally happened in images complex and very detailed local texture. Reducing Over-Segmentation is a challenging one because it produce minute segments that will confuse global information and we cannot proceed for further analysis for getting accurate image.

The expectation of a segmentation result is to automatically extract all objects of interest in an image concerning on certain task. Alternatively a segmentation method was developed which beneath the spectral and textural properties of the objects to be detected also takes into account their different size respectively.

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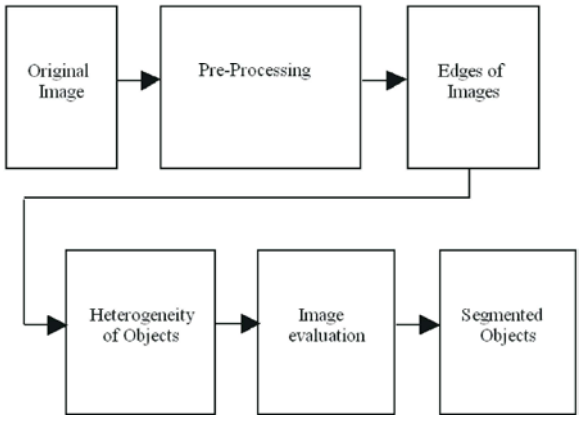

Fig. 1: Block diagram of Heterogeneity of Object Segmentation

MATERIALS AND METHODS

Due to many challenges to noise and image effect, the uniformity in intensity and texture between neighboring images makes difficult task of identifying distinct boundaries between images. So the region based segmentation introduced the concept of heterogeneous objects. When evolving the heterogeneous object, The Interconnection conceives the modeling the forces of attraction, completion and reputation.

In the proposed region based Interest algorithm includes preprocessing of images which produces edges of image. The heterogeneous object segments the images from the different number of edges from each image. Then the common evaluation method is applied for finding impact and value for segmentation. Finally the segmented images received with the high value of segmented image. The block diagram Fig. 1 is as follows.

Image preprocessing is to improve the image and to reduce speckle without destroying the basic features. Edges of each image will be identified by the region image sets[3]. This can be defined by Image objects. Image segmentation separates the image into different non-overlapping regions and it separates the objects from the background image. The boundaries of the objects are delineated. Based on the selected features, the suspicious regions will be classified into different categories.

Image Enhancement: The imbalance occurs when an image has light shades broadly rather than dark shades or vice versa. Therefore direct segmentation is not convenient for Remote sensing image in applications. A more convenient way to enhance remote sensing images is using only the necessary data for equalization [4]. Since the big dark shades which are seen outside the region are redundant and aggravating, we can throw these parts of the image and use the information of the rest for segmentation.

Segmentation Algorithm: To improve the efficiency of coding and maintaining the critical information, Region of Interest (ROI) coding is used in a way that the critical information are coded with specific region.

$$R_{i\ge j} = \frac{\psi \cdot \frac{|R_i||R_j|}{|R_i| + |R_j|} \cdot \|u_i - u_j\|^2 + (1-\psi)\cdot e\omega}{1\left(\partial(R_i, R_j)\right)} \quad (1)$$

where R1 and R2 are two adjacent regions of the area. $((R_i,R_j))$ is the length of the common boundary or two regions. ☻ is weight of (0,1); ☻ is boundary strength. ui and uj are spectral values of two regions. Here the pixel is implemented as an object pixel judging solely on its gray value of the context. At the edges of each object, however, where the mask which includes the pixels from both the background and the object. The correct procedure would be to limit the mask size at the edge to points of either the object or the background.

Classification: Classification is the most widely used method in remote sensing to compute regional points in remote sensing image. The specific factors that are defined in the classification are energy (E), contrast© and entrophy (En). These factors are defined as

$$E = \sum_{i}^{n}\sum_{j}^{n}\{R(i,j)\}^2 \quad (2)$$

$$C = \sum_{i}^{n}\sum_{j}^{n}(i-j)^2\, R(i,j) \quad (3)$$

$$E = \sum_{i}^{n}\sum_{j}^{n} R(i,j)\, \lg R(i,j) \quad (4)$$

where R is a region and I and j are coefficient values. In practice, as many regions have different average grey, combining grey character with regional object is superior than the only using region sets in identifying the different regions.

Region Detection: In the initial step, the features are computed disregarding any object boundaries. Then a preprocessing of segmentation is performed and the features are computed again, now using the segmentation

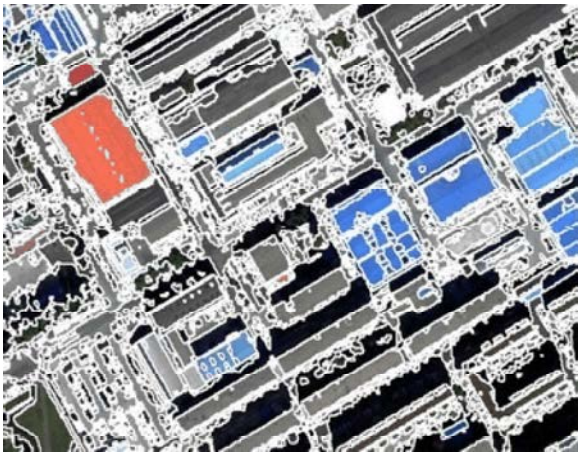

Fig. 2a

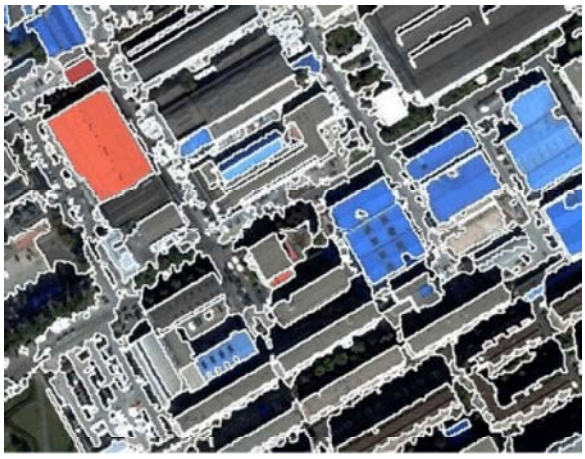

Fig. 2b.
Region marking results with different threshold values

results to limit the masks of the neighborhood operations at the object edges to either the background pixels or the object, depending on the location of the center pixel [5]. To improve the results, feature computation and segmentation can be iteratively done until the procedure converges into a stable result. Region marking are performed after the preprocessing of segmentation. The edges size can be controlled by using different merging thresholds.

Regions obtained by segmentation can express true objects is a key question for image processing. For processing of remote sensing image, especially for high-resolution image, image segmentation is a primary step in classification or other analysis [6]. The main difficulty of image segmentation lies in efficient region generation and merging. The algorithm treats each local minimum and surrounding area as a basin for catchments and the basin watershed as a boundary of image segment. Based on this theory, a deeper analysis can be discussed on merging technique. Actually, for many existed algorithms, high complexity is one of the bottlenecks of their practical application.

The Region based technique can be used to isolate features of a particular portion within a satellite image. Because it requires that the desired regions are specified in some parametric form. It is most commonly used for the detection of regular curves such as lines, circles, ellipses, etc. Due to the computational complexity of the satellite image and Despite its domain restrictions, the region based image segmentation retains many applications, as most manufactured parts contain feature boundaries which can be described by regular curves[7]. The main advantage of this technique is that it is tolerant of gaps in feature boundary descriptions and is relatively unaffected by image noise.

Automatic Region Point Selection: A region point is the initial point for region based method. Its selection is important to the segmentation result. If a region point is selected outside the region of interest (ROI), the final segmentation result would definitely be incorrect. Due to the low quality of images, most region based methods require the region point be selected manually in advance. In order to make the region based segmentation fully automatic, it is necessary to develop an automatic region point selection method for remote sensing images [8]. The run length features were calculated around the points selected by the co-occurrence boundaries. If all the run length boundaries are selected and its neighborhood points were equal, the point was considered as a region point [9].

Removing the pair wise context term does not have a significant effect on our results. This is due to the encoding of remote sensing images through the region term and the fact that all images were of urban scenes.

Based on the observation and study, energy, contrast and grey-weighting fractal dimension are chosen as the division features of the image. Because the whole image has been segmented and classified, it is more effective for computing boundary region as it is only necessary to the selected blocks.

CONCLUSION

In the present day world computer vision has become an interdisciplinary field and its applications can be found in any area be it medical, remote sensing, electronics and

so on. Thus, to find an appropriate segmentation algorithm based on your application and the type of inputted image is very important.

In this paper, a region based segmentation algorithm is proposed for remote sensing image based on heterogeneity of objects. In order to reduce the overall computation complexity, some improved methods of classification and detection are used. We have shown that the classification task can be accomplished with regional sets. The object based features on remote sensing image shows a good result in segmented objects. In another hand, image evaluation is used for the detection of linear features to identify Region of Interest... As the original image has been divided and classified, it achieves a notable complexity reduction at the expenses of computation and storage. The results shows that a good reconstructive image in ROI region when the whole image compressed in a high ratio.

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