# Object Detection in Remote Sensing Images: A Review

**Er. Tanvi Madaan, Er. Himanshu Sharma**

M.M. University, Mullana, Ambala, India

***Abstract-*** In this paper, we address the problem of pre-segmentation for object detection and statistics in remote sensing image processing. It plays an important role in reducing computational burden and increasing efficiency for further image processing and analysis. We follow the paradigm of object detection by Active Contour Method, then imposes structural constraints for the detection of the entire object. We have analyzed the performance of the proposed scheme comprehensively and specifically using some measured data, and carried out comparisons of the existing algorithms. The results show that the proposed scheme could improve the application ability in target detection.

***Keywords-*** Remote Sensing Images, Active Contour Method, Hough Transform

## I. Introduction

As the advance of remote sensing technology, the very high quantity remote sensing images become widely available. With the increasing volume of image data, it is desirable to develop the technique for remote sensing image analysis and understanding. However, the overwhelming amount of image data impose heavy computation constrain. Also, many applications, such as target or object detection, are only focusing on some salient regions in the image [1]. It is desired to extract regions of interest before further processing and analyzing. Salient region extraction is an important method to detect the region of interest. It is operated to select a subset of the available sensory information before further processing and sample the most relevant features, most likely to reduce the complexity of scene analysis [2].. Due to such superiority, salient region extraction has been adopted in widely applications, such as image compression [3], distinctive objects detection [4], image segmentation [5] etc.

Most information of an image is concentrated in edges. Variations of light can influence the appearance of a region markedly, but not its edges. Remote sensing images are frequently influenced by several changes, such as camera viewpoints, distance and illuminance, so different targets automatic recognition methods in remote sensing images by using edges or gradient have attracted many researchers in recent years. Edges are detected to enhance the linear features. However, in these algorithms, edge detectors are often used to find region boundaries or edge details in an image and they only utilize the gradient magnitude but neglect the area, threshold, radius etc. In this paper, an object recognition method with the object statics is proposed. This method realizes the object detection combining the texture and geometry characteristics.

## II. PROPOSED METHOD

Here the aim is to analyze the image in order to find out the objects. Due to noise or shadow, objects cannot be recognize properly. So some steps can be followed to remove these factors and after that find the objects and calculate their statistics. Following are the steps to be followed:

a) Process the image to remove noise and shadow present in the image. A segmentation algorithm often needs a preprocessing step like noise smoothing to reduce the effect of undesired perturbations (artifacts) which might cause over- and under-segmentation.
b) The purpose of image segmentation is to decompose an image domain into a number of disjoint regions so that the features within each region have visual similarity, strong statistical correlation and reasonably good homogeneity. The preprocessed image works as the input to segmentation algorithm.
c) After segmentation either follow binary conversion of image using thresholding or grey scale conversion:-The goal of thresholding is to create a binary representation of the image & to discard irrelevant data and keep only the important segments of data which lie above threshold curve. It segments the digital image based on certain characteristics of pixels (for example intensity value).Grey scale dumps all the color information and leaves with very little information to work with. NTSC standard is used for the conversion to grey scale There exist several methods for segmenting gray-level images. Gray-level thresholding is one of the oldest techniques for image segmentation.
d) Contour extraction, depending on the image quality & structure has two possibilities. The first one is performing image segmentation based on color & texture. If color based segmentation is not possible due to unknown information about objects, then the second way to compute the contour is direct edge detection since one need contours with a thickness of one pixel. Finally, calculate the threshold, region, boundary and the area of extracted objects using Hough transformation.

## III. ACTIVE CONTOUR METHOD

Besides challenges due to imaging noise and partial volume effects, the similarity in intensity and texture between neighboring structures complicates the task of identifying distinct boundaries between the structures. So the active contour method was introduced which developed the concept of shape contours .When evolving shape contours, the interaction consists of

modeling the "forces" of attraction, repulsion, and competition by taking into account the relationship between object contours and their shape estimates.
An active contour is an ordered collection of 'n' points in the image plane:

$$v = \{v_i, \ldots\ldots\ldots\ldots v_n\}$$
$$v_i = (x_i, y_i)_i, i = (1_i, \ldots., n) \quad \text{--- (1)}$$

The points in the contour iteratively approach the boundary of an object through the solution of an energy minimization problem. For each point in the neighborhood of 'Vi', an energy term is computed:

$$E_i = \alpha E_{\text{int}}(v_i) + \beta E_{ext}(v_i)$$

Where $E_{\text{int}}(v_i)$ is an energy function dependent on the shape of the contour and $E_{ext}(v_i)$ is an energy function dependent on the image properties, such as the gradient, near point $v_i.\alpha, \beta$ and are constants providing the relative weighting of the energy terms. $E_i, E_{\text{int}} and E_{ext}$ are matrices. The value at the center of each matrix corresponds to the contour energy at point $v_i$. Other values in the matrices correspond (spatially) to the energy at each point in the neighborhood of $v_i$.

Each point, $v_i$ is moved to the point $v_i'$, corresponding to the location of the minimum value in $E_i$. Corresponding to the location of the minimum value in $E_i$. This process is illustrated in Figure 1. If the energy functions are chosen correctly, the contour, $v$, should approach, and stop at, the object boundary.

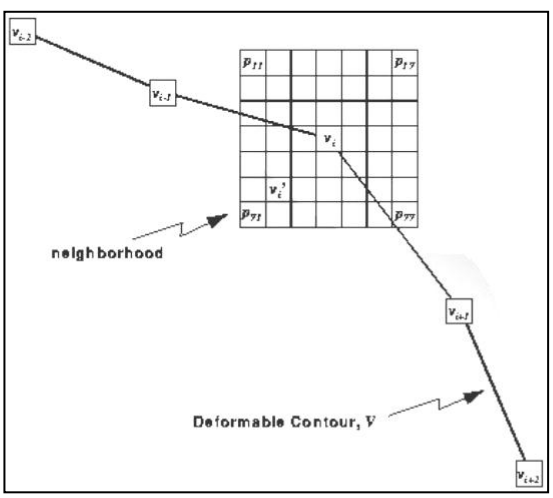


**Figure 1: Procedure for feature extraction**

### 3.1 Internal Energy

The internal energy function is intended to enforce a shape on the deformable contour and to maintain a constant distance between the points in the contour. Additional terms can be added to influence the motion of the contour.

The internal energy function used herein is defined as follows:

$$\alpha E_{\text{int}}(v_i) = cE_{con}(v_i) + bE_{bal}(v_i) \quad \text{---(2)}$$

Where $E_{con}(v_i)$ is the continuity energy that enforces the shape of the contour and $E_{bal}(v_i)$ is a balloon force that causes the contour to grow (balloon) or shrink. 'c' and 'b' provide the relative weighting of the energy terms.

**Figure 2: Extraction of object using Active Contour Method**

### 3.2 External Energy

The external energy function attracts the deformable contour to interesting features, such as object boundaries, in an image. Any energy expression that accomplishes this attraction can be considered for use.

Image gradient and intensity are obvious (and easy) characteristics to look at (another could be object size or shape). Therefore, the following external energy function is investigated:

$$\beta E_{ext}(v_i) = mE_{mag}(v_i) + gE_{grd}(v_i) \quad \text{--(3)}$$

Where $E_{mag}(v_i)$ is an expression that attracts the contour to high or low intensity regions and $E_{grd}(v_i)$ is an energy term that moves the contour towards edges. Again, the constants, m,g are provided to adjust the relative weights of the terms.

## IV. HOUGH TRANSFORMATION

The Hough transform is a technique which can be used to isolate features of a particular shape within an image. Because it requires that the desired features be specified in some parametric form, the classical Hough transform is most commonly used for the detection of regular curves such as lines, circles, ellipses, etc. A generalized Hough transform can be employed in applications where a simple analytic description of a feature is not possible. Due to the computational complexity of the generalized Hough algorithm, we restrict the main focus of this discussion to the classical Hough transform. Despite its domain restrictions, the classical Hough transform (hereafter referred to without the classical prefix) retains many applications, as most manufactured parts (and many anatomical parts investigated in medical imagery) contain feature boundaries which can be described by regular curves. The main advantage of the Hough transform technique is that it is tolerant of gaps in feature boundary descriptions and is relatively unaffected by image noise.

The Hough transform algorithm uses an array, called an accumulator, to detect the existence of a line $y = mx + b$. The dimension of the accumulator is equal to the number of unknown parameters of the Hough transform problem. For example, the linear Hough transform problem has two unknown parameters: m and b. The two dimensions of the accumulator array would correspond to quantized values for m and b. For each pixel and its neighborhood, the Hough transform algorithm determines if there is enough evidence of an edge at that pixel. If so, it will calculate the parameters of that line, and then look for the accumulator's bin that the parameters fall into, and increase the value of that bin. By finding the bins with the highest values, typically by looking for local maxima in the accumulator space, the most likely lines can be extracted, and their (approximate) geometric definitions read off. The simplest way of finding these peaks is by applying some form of threshold, but different techniques may yield better results in different circumstances - determining which lines are found as well as how many. Since the lines returned do not contain any length information, it is often next necessary to find which parts of the image match up with which lines. Moreover, due to imperfection errors in the edge detection step, there will usually be errors in the accumulator space, which may make it non-trivial to find the appropriate peaks, and thus the appropriate lines.

## V. CONCLUSION

With the aim of designing a highly practical process of target detection in remote sensing images, this research has proposed an improved scheme consisting of algorithms for object detection. At the systematic level, an integrative frame sequentially combining the algorithm based on feature extraction and the knowledge of object has been presented. At the algorithmic level, first, the discriminative features have been extracted. Second, a HOUGH TRANSFORM algorithm has been presented. According to the comparisons of the existing algorithms and abundant experimental results, the proposed scheme is found to improve the application ability in object detection.

## REFERENCES


[1] X. Gang, “Extracting salient object from remote sensing image based on guidance of visual attention pb -,” *Proceedings of SPIE – The International Society for Optical Engineering*, vol. 6790, 2007.

[2] M. Jager, “Saliency and salient region detection in sar polarimetry,” *IGARSS 2005: IEEE International Geoscience and Remote Sensing Symposium, Vols 1-8, Proceedings*, pp. 2791–2794, 2005.

[3] C. Christopoulos, “Efficient region of interest coding techniques in the upcoming jpeg2000 still image coding standard,” *2000 INTERNATIONAL CONFERENCE ON IMAGE PROCESSING, VOL II, PROCEEDINGS*, pp. 41–44, 2000.

[4] B. C. Ko, “Object-of-interest image segmentation based on human attention and semantic region clustering,” *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA A-OPTICS IMAGE SCIENCE AND VISION*, vol. 23, no. 10, pp. 2462–2470, 2006.

[5] U. Rutishauser, “Is bottom-up attention useful for object recognition? Pb -,” *Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, vol. 2, pp. II37–II44, 2004.

[6] R. Achantay, “Frequency-tuned salient region detection pb -,” *2009 IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops, CVPR Workshops 2009*, pp. 1597–1604, 2009.

[7] Qihao Weng, Ph.D.,” Remote Sensing and GIS Integration, Theories, Methods, and Applications” McGraw-Hil-2010

[8] Xu Yuanjing,Wang Qiaojue,Shen Huanfeng,Li Pingxiang,Zhang Hongyan,A Remote Sensing Image Restoration Method Estimation and Regularization Model,[J]. Journal of Geomatics,2010(6).

[9] Y. N. Xu, Y. Zhao, L. P. Liu, and X. D. Sun, “Parameter identification of point spread function in noisy and blur images,” vol. 17, No. 11, pp. 2849-2856, Nov 2009.

[10] P. L. Rosin, “A simple method for detecting salient regions,” *PATTERN RECOGNITION*, vol. 42, no. 11, pp. 2363–2371, 2009.


## AUTHORS


**First Autho** – Er. Tanvi Madaan, M.Tech Scholar, M.M. University, Mullana,Ambala, Email: ertanvimadaan@gmail.com

**Second Author**– Er. Himanshu Sharma, Department of Electronics and Communication Engineering, M.M. University, Mullana, Ambala, Email: himanshu.zte@gmail.com