# Study of Satellite Object Detection Algorithms with Pixel Value and Otsu Method Algorithm

[1]Vivek Sharma,
M.Tech Scholar,
Gyanvihar University,
Jaipur, Rajasthan, India

[2]Deepika Gupta
Asst. Prof. Dept of CSE
Marudhar Engineering College,
Bikaner (Rajasthan)

***Abstract*:** Object detection with the help of a satellite is always been a tough task. Normally satellites are used for communication of signals and cover entire earth and give us reliable information like TV signals, mobile communication, broadband, microwaves, internet and many more. In Signal processing, Image processing is the very important parameter. In this paper we will discuss about the various algorithms which are useful in image processing applications like vehicle detection, Storm detections etc. The main powerful algorithm are pixel level and otsu method algorithm system.

***Keywords:*** *Otsu Method, Line pixel, Satellite, object, detection*

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## I. INTRODUCTION

The main role of Image processing is to converts an input image file into digital form and able to make perform some operations on it, to increase an image property and extract useful information, an image can be easily repaired and manipulated using different image processing methods and various algorithms. In Image processing where we consider input is an image, it may be everything like any video frame or photograph and output may be also image or other characteristics which correlate with image. Normally, image processing system is behaving like a two dimensional signals and then apply the various set of signal processing methods to them. Image processing is widely and vast used and increasing rapidly growing technologies today and its applications are also working in a various business. During the last decades a number of techniques are came to existence in image processing.

## II. Different Algorithms

Vehicle detection from a satellite image or aerial image is a type of the object recognition system. This system is the most interesting and challenging research topic from past few years. We know that the traffic is increasing day by day in the developing and developed countries. Satellites images are normally used for weather forecasting and geographical applications. So, Satellites images may be also good for the traffic detection system using Image processing. So simple morphological recognition methodmay be used for vehicle detection using pixel value, Otsu method etc.

**Otsu method:** In computer vision and image processing, Otsu's method, named after Nobuyuki Otsu , is used to automatically perform clustering-based image which make the reduction of a graylevel image to a binary image. The algorithm assumes that the image contains two classes of pixels following bi-modal histogram (foreground pixels and background pixels), it then calculates the optimum threshold separating the two classes so that their combined spread (intra-class variance) is minimal, or equivalently (because the sum of pairwise squared distances is constant), so that their inter-class variance is maximal Consequently, Otsu's method is roughly a one-dimensional, discrete analog of Fisher's Discriminant Analysis.

**Pixel level Algorithm:**

- Faced with an image scanned in to the computer, the first group of processes deal with pixel-level transformations.
- Thresholding is the determination of whether a particular pixel position is to be treated as white or black, given that it is actually perceived as some level of color or gray: We don't address this task in our programs, relying instead on the scanner (perhaps with its low-level software) appropriately adjusted, to come up with the (binary level) image. While such an arrangement can be fooled by inverse-color printing, printing on top of halftone, etc., we have found that the scanners we've used can be adjusted satisfactorily to produce 2-level images. This decision to leave well enough alone could be re-examined and we could either write our own thresholding program or directly use a gray-scale. This latter approach would seem to be far most costly that our binary bitmap approach, but it seems plausible to trade-off some low-resolution gray-scale for high-resolution 2-level images.
- Noise reduction. This can include a host of transformations attempting to modify or filter the shapes represented, including morphological processing

and ``k Fill" filters. We don't do this, although it could be added. We do not provide this; partly we have not found it very useful; Further, at least some of these processes are not entirely natural in our representation.

- Thinning/skeletonization This is a kind of higher-level morphological concept that can be applied to images which is especially useful in images that are graphs, maps, etc. Thinning for the purpose of text recognition appears less appropriate. A solid circle thins to a dot. A slice of swiss cheese is unrecognizable.
- Chain coding and vectorization We do not do either of these *per se*, though run-length encoding on a row-by-row basis serves some of the same needs: it is easier to compute connectivity, and it is potentially far more compact.
- Region detection/ connected components

**DIFFERENT METHODS OF ALGORITHM**

**K Filters for Pixel level threholding method:**

***k*-means filtering cluster** is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. *k*-means clustering aims to partition *n* observations into *k* clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells.

The problem is computationally difficult (NP-hard); however, there are efficient heuristic algorithms that are commonly employed and converge quickly to a local optimum. These are usually similar to the expectation-maximization algorithm for mixtures of Gaussian distributions via an iterative refinement approach employed by both algorithms. Additionally, they both use cluster centers to model the data; however, *k*-means clustering tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes.

The algorithm has nothing to do with and should not be confused with *k*-nearest neighbor, another popular machine learning technique.

**Otsu Thresholding**

Converting a greyscale image to monochrome is a common image processing task. Otsu's method named after its inventor Nobuyuki Otsu is created many binarization algorithms.

In computer vision image processing, **Otsu's method**, named after Nobuyuki Otsu, is used to automatically are using perform clustering-based image thresholding technique or, the reduction of a graylevel image to a binary image.

In Otsu's method useful for the threshold that helps to minimizes the intra-class variance (the variance within the class), defined as a weighted sum of variances of the two classes:

$$\sigma_w^2(t) = \omega_1(t)\sigma_1^2(t) + \omega_2(t)\sigma_2^2(t)$$

Weights $\omega_i$ are the probabilities of the two classes separated by a threshold $t$ and $\sigma_i^2$ are variances of these classes.

Otsu shows that minimizing the intra-class variance is the same as maximizing inter-class variance [1]

$$\sigma_b^2(t) = \sigma^2 - \sigma_w^2(t) = \omega_1(t)\omega_2(t)\left[\mu_1(t) - \mu_2(t)\right]^2$$

which is expressed in terms of class probabilities $\omega_i$ and class means $\mu_i$.

The class probability $\omega_1(t)$ is computed from the histogram as $t$:

$$\omega_1(t) = \Sigma_0^t p(i)$$

while the class mean $\mu_1(t)$ is:

$$\mu_1(t) = \left[\Sigma_0^t p(i)\, x(i)\right] / \omega_1$$

where $x(i)$ is the value at the center of the $i$th histogram bin. Similarly, you can compute $\omega_2(t)$ and $\mu_2$ on the right-hand side of the histogram for bins greater than $t$.

The class probabilities and class means can be computed iteratively. This idea yields an effective algorithm.

The Otsu method produces a threshold on the 0:1 scale. This threshold applies to the dynamic range of pixel intensities present in the image. For example, were the image to only contain pixel intensities in the range of 155 to 255, an Otsu threshold of 0.75 would map to a grayscale threshold value of 230 (not 191 as it would if the image contained pixels in the full range of 0-255). Common photographic images will tend to contain a full range of pixel intensities, making it a moot point, but other applications could be sensitive to the distinction.

## III. CONCLUSION

These algorithms can be developed using morphological recognition algorithm and Otsu method thresholding technique. The complete procedure of image processing is that where input image is captured from camera and converted into gray scale image for pre-processing .After conversion, image complemented, binary conversion is applied on image. After conversion canny edge detection method has done and passed this detection to the dilation process. After filtration and dilation, , that area is selected

where our region of interest is found and header and text are recognised from the image . Both pixel level and otsu method is suitable for thresholding techniques.

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