International Journal of Computational Intelligence Research
ISSN 0973-1873 Volume 13, Number 5 (2017), pp. 697-705

http://www.ripublication.com

Vehicle Detection from Satellite Images in Digital Image Processing

Noorpreet Kaur Gill
M.Tech Scholar
CET, MUST, Lakshmangarh, India.

Anand Sharma
Assistant Professor, CSE Department
CET, MUST, Lakshmangarh, India.

Abstract

Nowadays, a new agenda of extracting small scale objects as vehicles from high resolution satellite images have been evaluated. Less research is performed using high resolution satellite imagery as it is a challenging task. Though various studies have been performed, still there is a need to develop a fast, robust, and suitable approach. The approach described in this paper gives out the accuracy rate of vehicles captured from satellite images It simply workout the full numbers of vehicles within the desired space in the satellite image and vehicles are shown underneath the bounding box as a small spots.

Keywords: Image Enhancement, Morphological Image Processing, Segmentation, Otsu Threshold, Edge Detection

INTRODUCTION

Traffic data is laid low with higher changes in satellite resolution & object-oriented detection methodology in satellite pictures; it may be even quicker as well as newly obtained within the large area images from satellite instead of the traditional data obtaining method. Two thresholding techniques are used for this: initial is pixel level and second is Otsu method. With this approach better thresholding technique may be distinguished.

Because of difficulty created by factors like chaos, illumination, weather, & shadow disturbance vehicle detection from the real satellite image becomes tough. So, to

boost the vehicle identification rate and once the detection must be good, there is an associate degree urgency of enhancing the acquisition of the satellite pictures before the vehicle extraction [1][9]. Essentially this theory uses the sharpening process as well as the histogram equalization processing of image enhancement method. Histogram has the key goal of building the centralized gray zone of the initial image histogram into the uniform distribution among all of the gray scale [2]. As an answer to the present stretching the image nonlinearly and reconstructs the image pixel values will be done. As per this manner, the amount of pixels within a convinced range of gray can be roughly similar.

RELATED WORK

As a primary step Semantic analysis of changes in satellite imagery needs the detection of changes [12]. Most notable of those kind rely on background modeling. In this category, a variety of images of the scene are used to learn what the normal background look of the scene ought to appear so that given a brand new image, the pixels with abnormal look can be detected as changes. Relatively less researched field in pc vision is 3-d change modification. Earlier approaches used manually made 3-d website models to form correspondences between pictures so that modification detection algorithm rule is applied [3] [4]. For this sort of approach to be utilized in modern applications and therefore the overhead of constructing 3-d geometry is unworkable. Heller et al. use stereo pairs of satellite pictures to reconstruct 3-d pure geometry of the scene and then compare reconstructed pure geometry from totally different pairs of pictures to find 3-d changes to the scene [5]. This algorithmic rule is additional applicable but is also relied on having stereo pairs and it cannot find appearance changes on the surfaces of the scene like moving vehicles and shadows. Frequently, a brand new approach that joints the ability of Stauffer-Grimson style appearance modeling with machine driven 3-d geometry discovery has been projected [5]. This volumetric appearance modeling (VAM) approach is better for modification detection from satellite imagery for varied reasons.

PROPOSED APPROACH

1. *Image Enhancement*

A brief distribution of enhancement technique will be as under [7]:

1. Spatial domain strategies, that is direct affected to the pixels.
2. Frequency domain strategies, in image it works on the Fourier rework

2. *Morphological Image Processing*

In image process, Morphology could be a tool that is employed to extract the elements of image so that illustration and description of the region shape form a sort of a skeleton and boundaries are provided [8]**.** Thus, the morphological operations and their operators also can be used for filtering, dilution and pruning.

i. Morphological Algorithms

Boundary Extraction:

With the assistance of erosion morphology technique boundaries or edges of an area and shape can be extracted by applying on A by B and then subtracting the eroded A from A.

$$\beta(A) = A - (A \ominus B)$$

3. Segmentation

To remove noise and artifacts if a picture has been preprocessed, than in deciphering the image typically segmentation is the main step. The features or region with the Image segmentation, are having similar characteristics, they are than known and later classified together [2]. Statistical classification could also be utilized in it, edge detection, thresholding, region detection or any of the mix of those techniques. A collection of classified elements is segmentation step output, segmentation techniques are relied on region or edge [14].

- Edge-based techniques admit the discontinuities in a picture values between the distinct regions, and therefore the objective of the segmentation algorithmic program is to precisely demarcate the boundary separating of those regions.
- Region-based techniques admit the common patterns within the intensity values in a cluster of the neighboring pixels. The cluster of the neighboring pixels is known as the region, and therefore target of the segmentation algorithm is to cluster the regions according to the functional or anatomical roles.

4. Edge Detection

With the robust intensity distinct edges are placed within the image. As edges mainly take place at the image locations that replicate object boundaries, in image segmentation edge detection is generally used when there is a demand to separate the image into the areas with reference to the various objects [11].

For the steps that are corrupted by white noise it is optimal for them. With reference to these areas optimality to the three criteria they are [13]:

- Detection criterion ... vital edges should be there, fake responses should be avoided.
- Localization criterion ... minimum distance should be prevailing between the particular and the located position of the edge.
- One response criterion ... multiple responses into a one edge are reduced (moreover it is somewhat coated by initial criterion as when there in single edge there are two responses one in every of them should be treated as wrong).

5. Otsu Threshold

To find a best threshold value k* the Otsu threshold employ the class reparability and magnifies the middle-class variance [10]. With this threshold use of objects from their background is extracted. In Otsu threshold k* technique MATLAB includes built-in function that access it. By directly relating to the Otsu threshold to the testing image it will observe the bright vehicles, however there is chance of lane markers and road dividers to be available on the highways. To cut back the issue of road dividers and lane markers a pre-process step is applied. During this pre-process step the sliding neighborhood operation is registered to the testing image. The sliding neighbor operation could be assigned to every pixel of testing image with the highest level of intensity to its neighborhood (it is a final rectangular space of 3-by-3 pixels, because it is center pixel it is allotted by operation).

METHODOLOGY

Morphological recognition algorithms are used to develop an automated system in MATLAB R2013a. In which satellite images are taken as input and converted into gray scale image for pre-processing. After conversion these images are converted into binary images after image complement. After conversion canny edge detection method has done and passed this detection to the dilation process. The area is selected after filtration and dilation where number of vehicles is maximum and vehicles are recognized from the image in the form of bounding box. The number of vehicles is counted by blob analysis. Here we are using reference image New 5.

The steps are elaborated below:

1) Satellite Image Acquisition
2) Necessary Operations
3) Image segmentation process
4) Image Enhancement

1. process to detect vehicles from satellite images

Process to detect vehicle include many steps.

i. Image Acquired

Initially stage of any vision system is the image acquisition stage. Once the input image has been obtained, a number of methods of processing can be applied to the image to perform the different vision tasks required today. Figure 1 shows the image that we acquired as a reference.

Figure 1: Acquired image

However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement. Here we will read the satellite image in Matlab to detect the vehicle. .

ii. RGB to Gray Scale Conversion

The algorithm described here is relies mainly on the gray level of an image for processing and fetching the required information. Color components like RGB value are not used throughout this algorithm. So, if the input document image is a multicolor image represented by 3D array in MATLAB, it is converted to a 2D gray image before further processing. All these process are shown on the image GUI.

Figure 2: RGB to gray scale

iii. Binary Conversion

A binary image is stored as a logical array where each pixel of the image assumes only one of the two discrete values: either 1 or 0. An image consists of numeric values between 0 - 255. Thus the numerical value of the picture is reduced from 0 – 255 to only to two values with binary level. Thus, an image is converted into 2 - bit format

from 8 – bit format. The threshold value must be determined for this conversion. If the pixel value in the image is greater than threshold value, then the pixel value is shown as "0"; and if the image pixel' value is less than threshold value, the pixel value is shown as "1". Thus in this way the image is converted into binary image. Image is converted into binary image from gray scale. Intensity change value is calculated easily as compared to gray scale and color image.

Figure 3: Gray to binary image

iv. Canny Edge Detection

Edge detection is an important technique to fetch useful structural data from different vision objects and reduce the volume of data to be processed. Thus, a development of edge detection solution to address these requirements can be implemented in a wide range of situations. The figure 4 shows the demonstration of canny edge detection:

Figure 4: Canny edge detection

v. Filling Holes

Here we will fill the holes which were created on the canny edge detection to extract the text. This is the major step of text extraction. This is the main part of the Morphological operations. Figure of this step is given below:

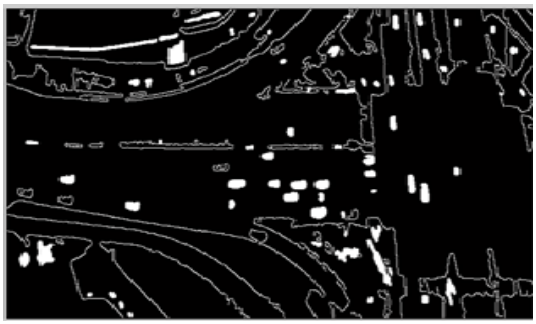

Figure 5: Filling holes

vi. Filtration using High Pass Filter

A high pass filter is the basis for most sharpening methods. An image is sharpened when contrast is enhanced between adjoining areas with little variation in brightness or darkness. Here we got those pixels which are greater than the value of 25. Those pixels whose values are lesser than the 25 pixels are suppressed.

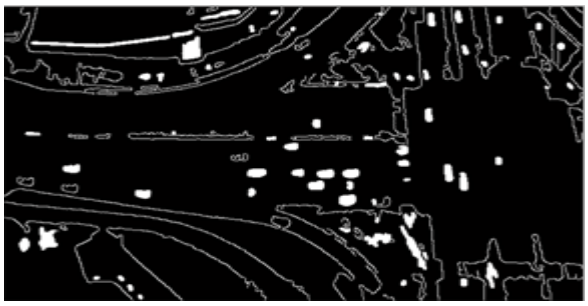

Figure 6: High pass filter

vii. Cropping the area

Here we will crop that area where numbers of vehicles are maximum using imcrop command

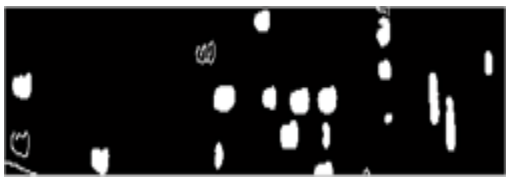

Figure 7: Cropped image

viii. Detected Vehicles using Blob Analysis

Blob Analysis is a fundamental technique of machine vision based on analysis of consistent image regions. As such it is a tool of choice for applications in which the objects being inspected are clearly discernible from the background. Diverse set of

Blob Analysis methods allows creating tailored solutions for a wide range of visual inspection problems.

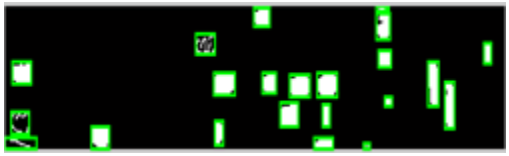

Figure 8: Detected vehicles

RESULTS

Vehicles are evaluated from the proposed algorithm as follows:

Table1: Accuracy rate of detected vehicle

Road	***No. of vehicles***	***Detected***	***Missed***	***Accuracy rate***
Road 1	176	165	11	93.75%
Road 2	89	77	12	86.51%
Road 3	145	132	13	91.03%
Road 4	115	101	14	87.82%
Road 5	93	81	12	87.09%
Road 6	132	120	12	90.90%

CONCLUSION

In the past 3 decades satellite imaging has been used with success for geographical, weather, and geological applications. With the advancement of technology, additional refined sensors offer higher resolutions, and with quicker computer systems, the employment of satellite imaging has opened the fields of application and exploration. Segmentation techniques supported thresholding are used to extract highways and vehicles from pictures containing roadways scenes. Color properties are accustomed to extract vegetation areas from cities and fields scenes. Results of this work might be used to assist transportation agencies within the study of traffic density and trends across huge geographic areas.

REFERENCES:

[1] "Digital Image Processing" book, By Rafael C Gonzalez, page no. 29.

[2] Oscar Firschein and Thomas M Strat, RADIUS: Image Understanding for Imagery Intelligence.: Morgan Kaufmann, 1997.

[3] Andres Huertas and Ramakant Nevatia, "Detecting changes in aerial views of man-made structures," in Proc. of International Conference on Computer Vision, 1998.

[4] Aaron J Heller, Yvan G Leclerc, and Quang-Tuan Luong, "A framework for robust 3-d change detection," in Proceedings for International Symposium on Remote Sensing, SPIE., 2001

[5] Chris Stauffer and W E Grimson, "Adaptive background mixture models for real time tracking," in Proceedings of IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)., vol. 2, 1999, pp. 246-252.

[6] X. L. Tian, "an algorithm based on the satellite for image enhancement," computer knowledge and technology, vol. 11, pp. 315–317, feb. 2008.

[7] Amalopravam.g,harish naik t,jyoti kumari, "Transformation of Digital Images using Morphlogical Operations", ISSN: 2278-9669, January 2013

[8] Ozcanli Ozbay, Ozge Can, "Recognition of Vehicles as Changes in Satellite Imagery", 2010.

[9] Otsu, Nobuyuki, "A threshold selection method from gray-level histograms", IEEE transactions on systems, man, and cybernetics, vol. SMC9, no.1, January 1979, pp.62-66

[10] Lizhu Xie, Liying Wei. "Research on Vehicle Detection in High Resolution Satellite Images", 2013 Fourth Global Congress on Intelligent Systems.

[11] Naoko Evans, "Automated Vehicle Detection and Classification using Acoustic and Seismic Signals", September, 2010, page no.40-47.

[12] K. Sumithra, S. Buvana, R. Somasundaram, "A Survey on Various Types of Image Processing Technique", International Journal of Engineering Research & Technology (IJERT) Vol. 4 Issue 03, March-2015.

[13] Richard O Duda, Peter E Hart, and David G Stork, *Pattern Classification*.: Wiley-Interscience, 2001.

[14] Megha Soni,Anand Khare, Asst. Prof. Saurabh Jain, "a survay of digital image processing and its problem", International Journal of Scientific and Research Publications, Volume 4, Issue 2, February 2014 1 ISSN 2250-3153.