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Automatic detection of satellite images using blob detection and boundary tracking techniques

Abhay Chaturvedi[1], Aasheesh Shukla[2]

[1,2]*Department of Electronics and Communication, GLA University, Mathura*

abhay.chaturvedi@gla.ac.in, aasheesh.shukla@gla.ac.in,

Abstract: Automatic detection of vehicles data has been widely used in the area of traffic surveillance system where the efficient traffic management along with safety is the main concept. This project depicts the count of the vehicles present at that particular area of traffic using the data provided by the satellite. The satellite captures the image of the particular traffic junction. This satellite image is further processed in order to find the count of the vehicles. The image contains unwanted objects along with the vehicles. For that image, apply thresholding techniques to detect the vehicles and such that unwanted objects whose gray scale values are below the threshold level will be removed. The designed system converts the satellite captured image into gray scale image. This gray scale image is then converted into binary image. It is proposed to develop a unique algorithm for detecting the vehicles using thresholding techniques. If the intensity value is greater than the threshold value, 8-bit of value 255 is assigned else 8-bit of value 0 will be assigned. The edges of the objects present in the binary image will be obtained. Noise will be reduced using filters. The bright areas which are bounded will shows the vehicles present in the image. Boundary formation is useful for detecting the objects in the image. Using Blob detection method, the properties of the objects are depicted and using the Moore Boundary tracking algorithm the boundaries of the objects are detected. Detecting the vehicles and finding the count of the vehicles are the objectives of this project.

Keywords: Segmentation, Morphological Reconstruction, Object Detection

1. INTRODUCTION

1.1 Motivation

The increasing density of the traffic in the metropolitan cities is the major problem. The major idea is to reduce the traffic. This can be done by knowing the densities of the traffic at particular road junctions. A system is designed using Digital Image Processing techniques in MATLAB R2017a. During the last three to four decades a number of techniques have been introduced and developed in Digital Image Processing background.

1.2 Related Work

Digital Image Processing techniques are applied on various images and are processed to get required outputs. In this designed system, the input is the image of a particular road junction containing vehicles. This input must be converted to gray scale image and then to binary image. Detect the edges of the objects and fill the regions of the objects in the image. Morphological reconstruction contains the repeated steps of dilations. Then filter the noise present in the image. The boundaries of the objects can be detected using the Moore Boundary tracking algorithm. The properties of the objects can be known using Blob detection method. Finally, detection of the vehicles and the count of the detected vehicles are the required outputs.

2. TECHNIQUES

In Digital Image Processing, there are different algorithms for different techniques. Figure shows the block diagram of the vehicles detection from satellite images using digital image processing.

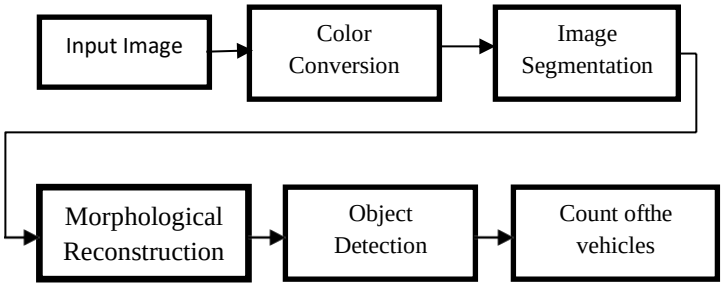


Fig.1. Block diagram of Vehicles Detection from Satellite Images using Digital Image Processing

The major techniques include image segmentation, morphological reconstruction, object detection. Image Segmentation means partitioning an image into segments. Depending on the properties of the intensity values of the image, segmentation is classified into two types. One is segmentation based on similarities which refers the approach to partition the image into regions that are similar according to particular criteria. Algorithms used in this approach are region growing, region splitting, region merging, thresholding. Another one is segmentation based on discontinuities which refers the approach to partition the image based on abrupt changes. The algorithm included in this approach edge detection. Morphological Reconstruction is the procedure to extract the meaningful information from the images. Morphological reconstruction techniques include region filling algorithm. Object detection refers detection of the objects present in the image. Using Blob analysis and Moore Boundary tracking algorithm, the vehicles can be detected and the count of the vehicles can be displayed.

3. METHODOLOGY

Methodology refers the step by step approach to detect the vehicles present in the input image. Figure shows the flowchart for the vehicles detection from satellite images using digital image processing. Weighted Sum method, gray_value= (0.298×R) + (0.597×G) + (0.114×B)

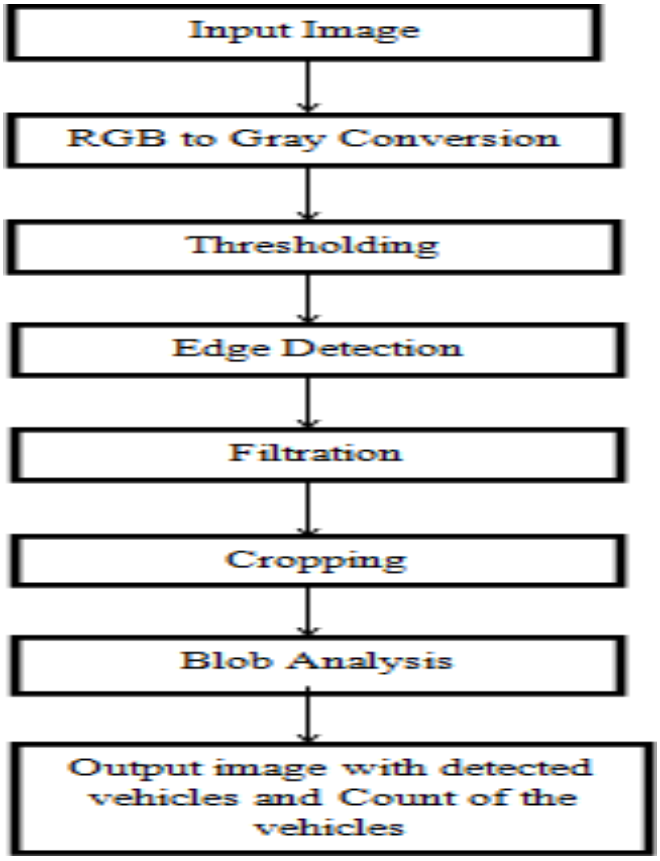


Fig.2. Flowchart representation of vehicles detection from satellite images using digital image processing

A. Inputimage

The input image refers the image of the traffic road junction taken by the satellite using EMR (Electromagnetic Radiations).

Fig.3. Input Image

B. RGB to Gray conversion

The satellite image obtained is colored image. This colored image is then converted into gray image using one of these two methods.

Fig.4. Gray Image

C. Thresholding

The gray color image is then converted into binary image using thresholding techniques. Global and Local thresholding's are available thresholding techniques. Local thresholding technique is used to form a binary image. If the intensity value is less than the threshold value then gray value "00000000" is assigned else gray value "11111111" is assigned. In this manner a gray image is converted into a binary image. Mathematical representation for local thresholding technique is as shown,

G (x, y) = 255 if f (x, y)>T

0 elsewhere

Where f (x, y) represents the gray image, g (x, y) represents the binary image and T represents the threshold value.

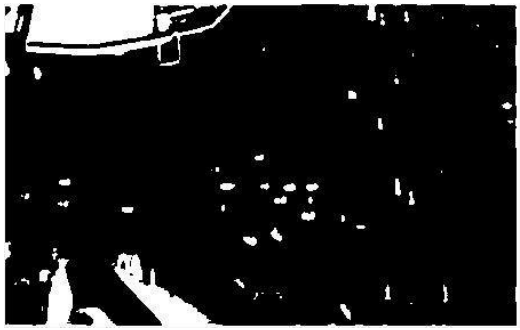


Fig.5. Binary Image

D. Edge Detection

Using segmentation techniques detect the edges of the objects present in the image. Canny edge detection technique algorithm is used to detect the edges.

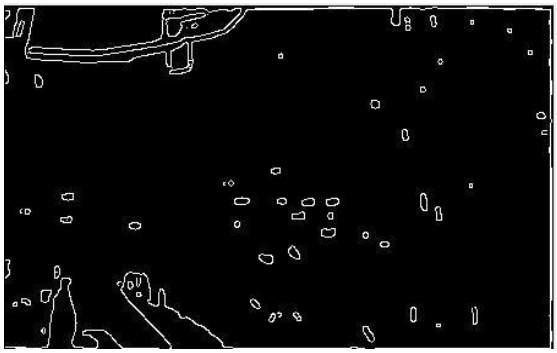


Fig.6. Edge Detection Image

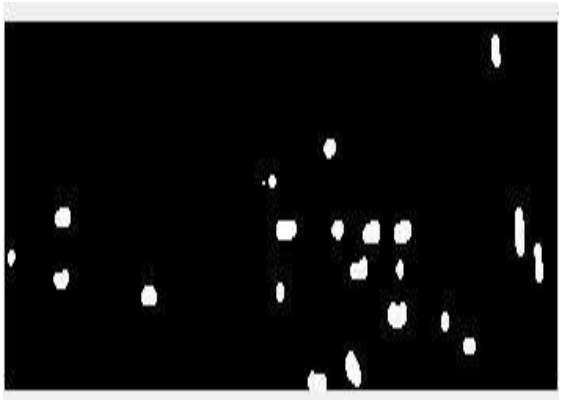


Fig.7. Region Filling Output

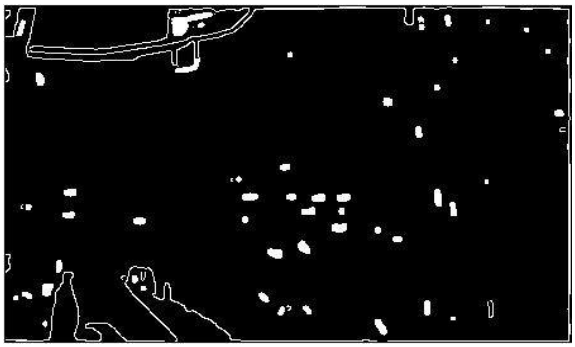
E. Region Filling

The region bounded by the detected edge is then filled using repeated dilations technique known as Region Filling technique. Region filling is one of the algorithms in Morphological Reconstruction techniques. Let A be the mask image, B be the structuring element and the reconstruction of the image is denoted by X_k.

$X_k=(X_{k-1}B) \cap A^c$

Where X_{k-1} denotes previous iteration of reconstruction process, A^c denotes the compliment of the mask image.

Fig.8. Filtration Output



F. Filtration

The region filled image is filtered using mean filter which is a 3×3 spatial mask.

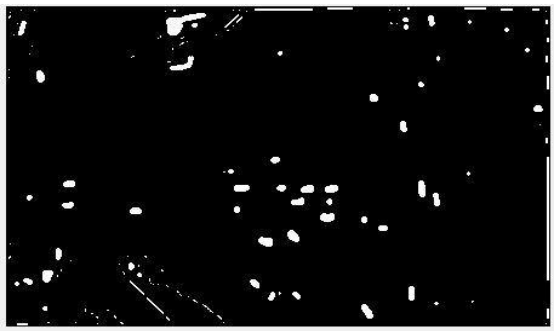


Fig.9. Cropped Image

G. Cropping

The selected area of the image is cropped where the maximum number of vehicles is present.

H. Blob Analysis

In the blob analysis, the properties of the blobs are detected using the Moore Boundary tracking algorithm. Using this algorithm, the boundary of the blob is detected.

Fig.10. Output Image

4. RESULTS

The input for the designed system is the image containing the vehicles at a particular road junction and output is the image containing the detected image along with the display of the count of the vehicles. Green colored box highlights the vehicles and the count of the vehicles is displayed in green color text format.

5. CONCLUSION

Using the internet connection, an application can be designed with this designed system such that an image with detection of vehicles along with the count of the vehicles at a particular road junction can be provided. Alternative paths can be provided in the emergency purposes.

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