Automatic Object Detection in Image Processing: A Survey

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***Abstract*—** Digital image processing is a fast growing field and many applications are developed in science and engineering. Image processing has the possibility of establish the latest machine that could perform the visual functions of all living beings. Object recognition is one of the most imperative features of image processing.

Object 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. It is known 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.

Keywords- *Digital Image, application, object detection, satellite image.*

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I. INTRODUCTION

Image processing is processes which transform an input image file into digital form and perform some operations on it, in order to get an increase image property or to extract some useful information from it. An image can be easily repaired using various image processing techniques and algorithms. Image processing a type of signal disbursement in which input is image, like video frame or photograph and output may be image or characteristics correlate with that image. Usually image processing system working like two dimensional signals and apply the set signal processing methods to them. Image processing is widely used and rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core research area within computer science, telecommunication, information technology and engineering and disciplines too [1].

During the last three to four decades a number of techniques have been introduced and developed in image processing. Most of the techniques are developed for enhancing images achieve from unmanned, space probes, spacecrafts and military reconnaissance flights. Image Processing systems are becoming popular due to easy availability of powerful personnel computers, graphics software, large size memory devices etc [2].

II. APPLICATIONS OF IMAGE PROCESSING

Image processing field has been widely expanded continuously in recent years. This technology is useful in many different applications. It covers the area of medicine through remote sensing. The enhancement and wide availability of image processing hardware has further increase the usefulness of image processing. The Application of Digital Image Processing conference welcomes contributions of new results and novel techniques from this important technology. Digital image processing applications, including [3]:

1. Image sharpening and restoration
2. Medical field
3. Remote sensing
4. Transmission and encoding
5. Machine/Robot vision
6. Hurdle detection
7. Line follower robot
8. Color processing
9. Pattern recognition
10. Video processing

III. TYPES OF IMAGE PROCESSING

The two types of methods used for Image Processing are Analog and Digital Image Processing.

Analog image processing is also known as visual techniques. This type of techniques is usually used for getting the hard copies like photographs and printouts. The programmer uses the many different fundamentals of interpretation to use these techniques. Image processing not bounded with the study of the area. It is important for analyst to get the good knowledge of image processing techniques. The important tool of image processing through visual technique is Association. In this way analysts apply a combination of personal knowledge and collateral data to image processing.

Second type of image processing is known as Digital image processing. This technique helps in manipulation of the digital images by using computers. As raw data from imaging sensors from satellite platform contains deficiencies. To get over such

flaws and to get originality of information, it has to undergo various phases of processing. The three general phases that all types of data have to undergo while using digital technique are Pre- processing, enhancement and display, information extraction [1].

IV. Digital Images

An image can be defined as a two-dimensional function, f(x,y) where x and y are the spatial coordinates and the amplitude value f represents the intensity (or color) of the image at that point (pixel). When x, y, and f are discrete values, it have a digital image. Digital images are composed of pixels arranged in a rectangular array with a certain height (rows) and width (columns). Each pixel may consist of one or more bits of information (8 bits being the most common), representing the intensity of the image at that point (or color information encoded as RGB triples). The following are the four basic types of digital images [4]:

1. RGB (True Color) Images
2. Intensity (Gray Scale) Images
3. Binary Images
4. Indexed Images

V. Image Segmentation

Image segmentation refers to the process of partitioning a digital image into N number of parts. The images are segmented on the basis of set of pixels or pixels in a region that are similar on the basis of some homogeneity criteria such as color, intensity or texture, which helps to locate and identify objects or boundaries in an image [5].

Objects in an image are detected by extracting the foreground objects. That is, image being divided as foreground and background. Dividing an image into its constituent regions or objects is known as Image Segmentation. The level to which subdivision is carried depends on the problem being solved.

VI. Thresholding Techniques

In many applications of image processing, the gray levels of pixels belonging to the object are quite different from the gray levels of the pixels belonging to the background. Thresholding becomes then a simple but effective tool to separate objects from the background. Examples of thresholding applications are document image analysis where the goal is to extract printed characters [6], [7], logos, graphical content, musical scores, map processing where lines, legends, characters are to be found [8], scene processing where a target is to detected [9], quality inspection of materials [10]. Other applications include cell images and knowledge representation, segmentation of various image modalities for non-destructive testing (NDT) applications, such as ultrasonic images, eddy current images, thermal images, X-ray computed tomography (CAT) , laser scanning confocal microscopy , extraction of edge field, image segmentation in general , spatio-temporal segmentation of video images etc.

VII. Detection of Vehicles from High-Resolution Satellite Images

Rapidly growth in information technologies and in electronics continues to administrate all facet of our modern-day world, it is included our office, home, schools and even our enjoyment, they are also being enforced to transportation network. Transportation infrastructure of highways, streets and bridges and the number of vehicles, including cars, buses, trucks and trains are enhancing rapidly. We should use the existing facilities more accurately so it could provide better transportation facilities. So, it is necessary to develop the automatic management of traffic flow by intelligent traffic control and traffic guidance systems.

Traffic-related data play an important role in urban and spatial planning, e.g., for road planning and for estimation of air and noise pollution. Therefore, an algorithm that automatically detects and counts vehicles from satellite images would effectively support traffic-related applications [11]. Different techniques like installing cameras at fixed locations, weigh-in motion sensors on the pavements are being used for vehicle detection. Though they are well developed systems, they have disadvantages like cameras cannot observe the spatial progression and movement of traffic beyond the field of view [12], sensors can be affected by weather and traffic stress, maintenance of sensors may reduce the pavement lifetime etc. Using satellite images for vehicle detection can eliminate these problems. They can cover wide areas and images of an area can be taken frequently. Using satellite images also have problems like, atmospheric conditions that affect the visibility of vehicles in the images; daytime images provide better information than at night, etc.

VIII. Literature survey

Research work of Sumalatha Kuthadi Department of Computer Science University of Minnesota Duluth Duluth, U.S.A. May 2005[13] describe in this section.

The aim of sumalatha kuthadi research is to develop efficient algorithms for automatic detection, classification and counting of the vehicles from high-resolution satellite images. The images used for that project are 1-m panchromatic images from the IKONOS satellite. Two different Image Segmentation algorithms, which are based on Multiple Thresholds and Otsu Threshold, are developed for vehicle detection. These algorithms were tested on several images and the results were analyzed to determine which algorithm gives better results under which conditions.

The fleet of vehicles in cities continues to increase and monitoring vehicles fleet is an emerging necessity. A number of cities especially in developed countries use field based

equipment such as cameras installed at fixed locations or weigh-in motion sensors on the pavements to monitor traffic. Recently video imaging and airborne imaging is tested especially to provide more synoptic view of traffic and to monitor traffic trajectories (Zhang et al. 2003). Aerial photography has also been evaluated (Hinz 2003, Schlosser et al. 2003) and the newly availably imagery at very high resolution provides a new opportunity and starts also to be considered (Rocio Alba Flores 2004). The comparison of optical, infrared and SAR data (Stilla et al. 2004) shows obviously they are both advantages and limitations. For example SAR sensor is independent from day/night and weather condition but its oblique view causes distortion, the presence of buildings hides some roads and its analysis is very much affected by the experience of the interpreters (Lohmann et al. 2004).

According to [13] Multiple Thresholds does not detect those vehicles that have intensity values similar to the lane markers. Because of the sliding neighborhood operation, the size of the brighter vehicles detected by the Otsu threshold is greater than the size of the brighter vehicles detected by Multiple Thresholds. If the vehicles are very close to each other, then there are possibilities of getting them identified as a single vehicle. While detecting the vehicles, dark and bright vehicles are identified in two different binary images. These two binary images are combined to merge a vehicle with its shadow. If a bright vehicle has no shadow and a dark vehicle is close to this vehicle, then there are possibilities of getting dark and bright vehicles combined as a single vehicle. This will alter the result of the count of the vehicles [13].

According to Lizhu Xie, Beijing Jiaotong Univ., Beijing, China [30] with the improvement of satellite resolution and the object-oriented detection method in satellite images, traffic data can be more quickly and widely acquired in large area satellite images compared with the traditional data acquired method. With the technology of image enhancement, in their paper improved the image quality first, and then utilized the multi-scale segmentation technology and supervised classification method to detect the vehicle from satellite images. In the process, three classification decision trees for vehicles in different situations have been summed up. At last, they achieved the empirical research using the remote sensing images of typical regions in the urban road from Worldview-2 and the GeoEye-1. Based on the precision analysis of the experimental results, shows that the average accuracy is more than 90% [14].

According to Hong Zheng and Li Li Vehicle targets extraction is a new research issue for high resolution satellite imagery application in transportation. In their paper, an artificial immune approach is presented to extract vehicle targets from high resolution panchromatic satellite imagery. This approach uses the antibody network concept inspired from the immune system to learn a set of templates called antibodies for vehicle detection. Based on learned template antibodies, an immune detection strategy is proposed to locate vehicle targets in satellite imagery, and a morphology based preprocessing algorithm is also developed to generate candidate template antibodies. Experiments on 0.6 meter resolution QuickBird panchromatic images are reported in this paper. The experimental results show that the proposed approach has a good detection performance [15].

According to Sun, Q., Liang, Y., Tan, Q., and Zhang, S. (2009) A series of sensors on the pavements being used for traffic flow data detection have some disadvantages. With recent advances in high-resolution commercial remote sensing systems, detecting traffic flow data from remote sensing images over large regions is an attractive option in traffic information collection technology. The main goal of their research is exploring vehicle information from high-resolution satellite remote sensing images. A new method for vehicle detection based on object-oriented image analysis is developed and applied in their paper. Analyzing high-resolution satellite image characteristics, object-oriented segmentation is implemented here in order to generate image objects. Then feature space is created by extracting features of these objects, to be used for vehicle detection, classification, and traffic flow information analysis. Their experimental results described and assessed to show how this method is effective. Their research provides a means of traffic flow information collection in ITS as compared to traditional approaches [16].

According to Eikvil, Line; Koren, Hans; thy ehave looked into the problem of vehicle detection in high-resolution satellite images. Based on the input from the local road authorities, they have focused not only on highways, but also on inner city roads, where more clutter is expected. The study site is the city of Oslo, Norway. To do vehicle detection in these areas, they propose an automatic approach, consisting of a segmentation step, followed by two stages of object classification. In the process, they utilize multispectral images, panchromatic images and a road network. The approach has been tested on Quickbird images, and the results that are obtained have been compared with manual counts and classifications [17].

IX. CONCLUSION

In last couple of decades, the numbers of vehicles or object have been increasing day by day. With this increase, it is becoming difficult to keep track of each vehicle for the purpose of law application and traffic management. Thus, it is needed that type of system, which is capable of providing appropriate solutions to the traffic issues and hence this object detection from satellite image is need to be developed [18].

X. REFERENCES:

[1] http://www.engineersgarage.com/articles/image-processing-tutorial-applications.

[2] K.M.M. Rao, Deputy Director, NRSA, Overview of Image Processing

[3] San Diego, CA USA, "Applications of Digital Image Processing XXXI (OP317) Part of the SPIE International Symposium on Optical Engineering + Applications", 10-14 August 2008..

[4] The MathWorks, Inc., Image Processing Toolbox, URL: http://www.mathworks.com/access/helpdesk/help/toolbox/images.

[5] Rajeshwar Dass, priyanka, Swapna Devi, "Image Segmentation Techniques", IJECT Vol. 3, Issue 1, Jan. -March 2012.

[6] M.Kamel, A. Zhao, "Extraction of Binary Character/Graphics Images From Grayscale Document Images, Graphical Models and Image Processing", 55, No.3 (1993) 203-217.

[7] T. Abak, U. Barış B. Sankur, "The Performance of Thresholding Algorithms for Optical Character Recognition", Int. Conf. on Document Analysis and Recognition: ICDAR'97, Ulm., Germany, 1997, pp:697-700.

[8] O.D. Trier, A.K. Jain, "Goal-directed evaluation of binarization methods, IEEE Tran. Pattern Analysis and Machine Intelligence", PAMI-17 (1995) 1191-1201.

[9] B. Bhanu, "Automatic Target Recognition: State of the Art Survey", IEEE Transactions on Aerospace and Electronics Systems, AES-22 (1986) 364-379.

[10] M. Sezgin, R. Tasaltin, "A new dichotomization technique to multilevel thresholding devoted to inspection applications", Pattern Recognition Letters, 21 (2000) 151-161.

[11] Schlosser, C., Reitberger, J., and Hinz, S., "Automatic Car Detection in High Resolution Urban Scenes Based on an Adaptive 3D-Model", Proceedings of the IEEE/ISPRS joint Workshop on Remote Sensing and Data Fusion over Urban Areas, Berlin, 2003, IEEE, Piscataway, pp. 167 - 171.

[12] Hickman, A., et al., "Methods of Analyzing Traffic Imagery Collected from Aerial Platforms", IEEE Transactions on Intelligent Transportation Systems, Vol. 4, No.2, June 2003, pp. 99-107.

[13] Sumalatha Kuthadi, Department of Computer Science University of Minnesota Duluth Duluth, U.S.A. May 2005.

[14] Lizhu Xie, "Research on Vehicle Detection in High Resolution Satellite Images Beijing Jiaotong Univ.", Intelligent Systems (GCIS), 2013 Fourth Global Congress on 3-4 Dec. 2013 Page(s): 279 – 283.

[15] Hong Zheng and Li Li, "Artificial Immune Approach for Vehicle Detection from High Resolution Space Imagery", IJCSNS International Journal of Computer Science and Network Security, VOL.7 No.2, February 2007.

[16] Sun, Q., Liang, Y., Tan, Q., and Zhang, S. (2009) "Research on Vehicle Information Extraction from High-Resolution Satellite Images". ICCTP 2009: pp. 1-7.

[17] Eikvil, Line; Koren, Hans; Aurdal, Lars, "Classification-based vehicle detection in high-resolution satellite images", ISPRS journal of photogrammetry and remote sensing (Print) (ISSN 0924-2716). 64(1) pp 65-72.

[18] Divyang Goswami, Mrs. Rama Gaur, "Automatic License Plate Recognition System using Histogram Graph Algorithm", ijritcc, Vol. 2, Issue 11, page no. 3521-3527.