Recognition of Vehicle License Plate in Real – Time Videos

Soumen Bhowmik, Riaz Kajal, Laxmi Kumari Pathak

***Abstract*— Automatic video analysis from traffic surveillance cameras is a fast-emerging field of computer vision techniques. Intelligent transport system (ITS), public safety and traffic management can be done efficiently by this key technology. Here, a study of full-featured automatic system is presented for detecting vehicle, tracking and license plate recognition. The system has four modules- Acquisition of video, Vehicle detection and tracking, Extraction of License plate and Character recognition unit. Detection of moving objects in video streams is the first step of information and background subtraction is a very popular and effective approach for foreground segmentation. Next step is Extraction of License plate, which is an important stage in license plate recognition for automated transport system. A region-based method is used to segment the extracted license plates into individual characters. The recognition scheme combines adaptive iterative threshold with a template matching algorithm. This system has wide range of applications such as access control, tolling, border patrolling, traffic controlling, finding the stolen cars, etc. In this technology, any installation on cars is not needed, such as transmitter or responder**.

Index Terms— **Automatic video analysis, intelligent transport system, automated transport system, region-based method, transmitter, responder.**

I. INTRODUCTION

In recent years, there has been an increased scope for automatic analysis of traffic activity. In traffic scenarios several monitoring objectives can be supported by the application of computer vision and pattern recognition [1],[2] techniques, including the traffic violations detection (e.g., illegal turns and one-way streets) and the identification of road users (e.g., vehicles, motorbikes, and pedestrians). At present most reliable approach is through tracking of vehicle license plate in real time videos [6],[9].

The increase of contemporary urban and national road networks over the last three decades emerged the need of efficient monitoring and management of road traffic. Conventional techniques for traffic measurements, such as sensors [3] or EM microwave detectors, inductive loops, undergoes serious shortcomings, bulky in size, expensive to install, they demand traffic disruption during installation or maintenance. On other hand, video based systems are easy to install and they use the existing infrastructure of traffic surveillance [4]. They can be easily upgraded and they are flexible to redesign the system and its functionality by simply changing the algorithms of the system [4]. These systems can measure vehicle's speed, count the number of vehicles, and identify traffic incidents such as accidents or congestion.

Many difficulties occur during the detection and extraction of number plate [5] due to the following reasons-

i. Different vehicles have plates located on different position.
ii. Noise can occur during camera capture.
iii. Time of day affects lighting thus resulting into contrast problems.
iv. Weather conditions are responsible for noise arrival.
v. Unwanted characters, frames and screws introduce confusion.
vi. Low or uneven illumination, blurry image, reflection, low resolution input image, shadow affect the efficiency of number plate area extraction.

II. CATEGORIZATION OF MOTION DETECTION

Motion detection is the most important and difficult step towards real time vehicle number plate detection. Following are the some existing approaches which are reportedly good for the same.

A. Frame Differencing- Frame differencing is a pixel-wise differencing approach which is carried out between two or three consecutive frames in an image sequence to detect regions corresponding to moving object such as vehicles and human [10]. The threshold function determines change and it depends on the speed of object motion. If the object's speed changes significantly, then maintaining the quality of segmentation is difficult. The inter-frame differencing technique detects parts of moving objects by comparing two successive frames. But, it can identify only differences in the background and, that's why it detects only parts of a vehicle covering the background in the previous frame. Despite some enhancing techniques this approach cannot satisfactorily deal with realistic traffic circumstances where vehicles might stop for a long time.

B. Optical Flow- To detect moving regions in an image, optical flow uses flow vectors of the moving objects over time. This approach [7] is used for motion-based segmentation and tracking applications. It is a dense field of displacement vectors which defines the translation of each pixel region. Optical flow is best suited in presence of camera motion, but

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however most flow computation methods are computationally complex and sensitive to noise.

C. Background Subtraction- The background subtraction is the most popular, widely accepted and common approach for motion detection [8]. In this method the current image is subtracted from a reference background image, which is upgraded during a time interval. It works well only in the presence of static cameras. The subtraction leaves only non-static or new objects, which include silhouette region of an object. This approach is very simple, effective and computationally affordable for real-time systems, but is extremely sensitive to dynamic scene changes from lightning and incidental event etc. Therefore it is highly dependent on a good background maintenance model.

III. MODULES OF THE PROPOSED SYSTEM

The system is having mainly four modules:

A. Acquisition of Video

In video acquisition, videos are taken by the static camera situated at traffic scenario. A camera network that transmits images in real time to a central operational centre is very time consuming. The processing of the images can be carried out on-site saving valuable network bandwidth as it transmits only the outcome of the calculations. The complete process can also be performed either in real time video streaming from an operational centre or in already stored videos.

B. Vehicle Detection and Tracking

In detection of vehicle, the background subtraction technique overcomes the problems of varying illumination condition, background clutter, shadow and camouflage. Motion segmentation of foreground object has been done in real time. It's tough to get this entire problem solved in one background subtraction technique. So the idea is to simulate and evaluate their performance on various video data taken in different types of situations.

C. Extraction of License Plate

License plates are first located in current frame then they are extracted using various available techniques such as Hough Transform method, Template matching technique, Edge Detection Approach and Histogram Approach. Intensity transformations are applied to enhance the quality of the image for further processing. The following transformations are applied on the color JPEG image:

•RGB image into is converted into a Gray-scale Intensity image.
•Intensity image is converted into a Binary image.
•Gray-scale Image is converted into an edge detected image.

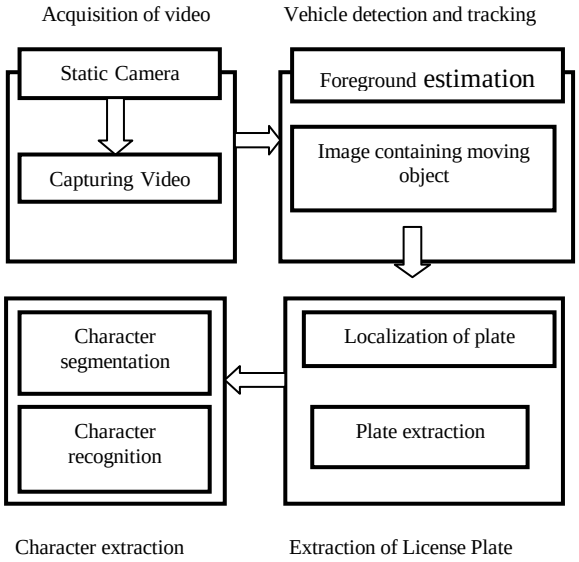
D. Character Extraction

Images of the extracted plates are the input to this module. Here first license plate image is cropped in lines, and then characters are segmented and recognized. For isolating Characters we assume that the license plate is horizontal and we proceed.

There are two ways to extract the characters of License Plate.

a) Histogram Approach- Two histograms are computed for the segmented license plate image - the first one along the X-axis, and the second one - along the Y-axis. In Y-histogram a uniformly distributed pattern of low-valued breaks between characters is detected, whereas in X-histogram the top and bottom borders of the character set are identified.

b) Connected Pixels Method- In this method we first take the negative of the image and then find out the connected objects in that.



IV. CONCLUSION

This proposed system has the ability to track vehicles and extract traffic parameters in real time videos. Moreover, the system can utilize any existing traffic surveillance infrastructure without any modification. The installation does not cause any disruption on traffic. This system extracts the license plate numbers and stores in a text file. Searching of a vehicle's license plate number in a text file is easier rather than searching it in a video stream. In normal traffic conditions the system responds well and the outcome results regarding vehicle license plate are accurate enough. This integrated system is capable of real time operational working and unobstructed operation without human intervention. The system works well either in real time mode or in already stored videos.

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