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Image Processing Based Vehicle Detection And Tracking System

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Abstract: The difficulty of obtaining the initial background there is the inaccuracy of real-time background update and the difficulty of controlling the update speed in moving vehicle detection of traffic video. The project aim proposes an accurate and effective moving vehicle detection method which can be used in complex traffic environment. Vehicle detection and tracking system plays an important role for civilian and military applications such as in highway traffic surveillance control, management and urban traffic planning. Vehicle detection process on road are used for vehicle tracking, counts the vehicle, average speed of each individual vehicle, traffic analysis and vehicle categorizing objectives and may be implemented under different environments changes. In this review, we present a concise overview of image processing methods and analysis tools which used in building these previous mentioned applications that involved developing traffic surveillance systems. More precisely and in contrast with other reviews, we classified the processing methods under three categories for more clarification to explain the traffic system.

Keywords: Vehicle detection, Tracking, Traffic surveillance, Occlusion, Shadow & Classification

1. INTRODUCTION

Vehicle detection plays an important role for the localization of an image or robust vehicle detection is the first step in video processing. The efficiency & accuracy of vehicle detection is of great importance for vehicle tracking, vehicle movement expression, and behavior understanding and is the basis for subsequent processing. The vehicle detection process was divided into appearance based and motion based techniques. The appearance based techniques uses the appearance features like shape, color & texture of the vehicle to detect the vehicle or separate it from the background, whereas the motion based techniques uses the moving characteristic to distinguish vehicles from the stationary background image.

Vehicle tracking is a challenging and important research area of image processing. It is broadly used in computer vision and video image. This paper detects and tracks vehicle for safety and traffic surveillance system. The conception of vehicle tracking in built upon the vehicle segmentation method. It represents various methods for tracking vehicle, many researchers have been worked on the vehicle tracking algorithm. In this paper we propose motion vehicle detection and segmentation approaches. This method first constructs initial background image according to the real-time situation of traffic emend then segment lies the current frame into foreground region and background region accurately using the combined method of inter-frame difference and subtraction method. The experimental results show that this method can detect moving vehicles fast and accurately in complex traffic situation. Traffic detection method to track each vehicle, these methods show accurate and low error estimation result comparing with all the methods and the result depends on the quality of vehicle detection.

2. LITERATURE REVIEW

From the rigorous review of related work and published literature it is observed that many researchers have designed different techniques.

H. Chung-Lin, et al and L. Wen-Chieh, et al presents a new approach to identifying one of the significant applications of video-based supervision systems is the traffic surveillance. So, for many years the researches have investigated in the Vision-Based Intelligent Transportation System (ITS), transportation planning and traffic engineering applications to extract useful and precise traffic information for traffic image analysis and traffic flow control like vehicle count, vehicle trajectory, vehicle tracking, vehicle flow, vehicle classification, traffic density, vehicle velocity, traffic lane changes, license plate recognition, etc. In the past, the vehicle detection, segmentation and tracking systems used to determine the charge for various of vehicles for automation toll levy system.[1]

N. K. Kanhere, et al and S. T. Birchfield, et al introduced a Real-Time Incremental Segmentation and Tracking of Vehicles at Low Camera Angles Using Stable Features," Intelligent Transportation Systems. "Vision-based detection,

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tracking and classification of vehicles using stable features with automatic camera calibration, also related work on "Vehicle type classification from visual-based dimension estimation," in Intelligent Transportation Systems. The Intelligent Transportation System (ITS) provides services related to different modes of transport and traffic management systems with an integration of traffic control centers. Video-Based investigation for traffic surveillance has been a vital part of ITS. The traffic surveillance in urban environment have become more challenging compared to the highways due to various factors like camera placement, cluttered background, pose variation, object occlusion and illumination changes. This paper provides review on video-based vehicle surveillance for detection, tracking and behavior analysis with systematic description. In this survey we classify the dynamic attributes of vehicle with respect to vehicle motion and appearance characteristics, including velocity, direction of movement, vehicle trajectories on a single camera.[2,3-4].

W. Wei,et al, and K. H. Lim,et al Provides vehicle recognition system, it is used to detect (the vehicles) or detect the traffic lanes [4-6] or classify the type of vehicle class on highway roads like cars, motorbikes, vans, heavy goods vehicles (HGVs), buses and etc,[5,6].
However, the traditional vehicle systems may be declines and not recognized well due to the vehicles are occluded by other vehicles or by background obstacles such as road signals, trees, weather conditions, and etc., and the performance of these systems depend on a good traffic image analysis approaches to detect, track and classify the vehicles.
Recently, **B. Han, et al** proposed an enhanced version of Motion-segmentation-based change detection. The detection of moving object's regions of change in the same image sequence which captured at different intervals is one of interested fields in computer vision. An important large number of applications in diverse disciplines are employed the change detection in its work, such as video surveillance, medical diagnosis and treatment, remote sensing, underwater sensing and civil infrastructure [16]. One of the video surveillance branches is the traffic image analysis which included the moving/motion vehicle detection and segmentation approaches. Even though various research papers have been showed for moving vehicle detection (background subtraction, frame differencing [17-22] and motion based methods) but still a tough task to detect and segment the vehicles in the dynamic scenes. It consists of three main approaches to detect and segment the vehicle, as mentioned below:
1. Background Subtraction Methods.
2. Feature Based Methods.
3. Frame Differencing and Motion Based methods.

Raad Ahmed Hadi, This paper presents vehicle detection and tracking applications are important area in military and civilian such as in urban traffic planning, management and highway traffic surveillance control. The vehicle detection method used for vehicle tracking on road for counts, average speed of each vehicle, vehicle categorizing element and traffic analysis. this paper aims a concise overview of image processing methods, analysis and implemented under various environment changes. For developing traffic surveillance systems the processing methods classified under three categories to solve the occlusions. The proposed technology focuses in vehicle detection, vehicle tracking and classification with shadow and partial occlusion in traffic video. Transportation planning and traffic application extract the useful information for traffic analysis and traffic flow control such as vehicle's: velocity, count, speed, flow, classification, objectives and traffic density, traffic lane changes etc. Several vehicle tracking methods have been proposed by different researchers for different problem such as region based tracking method, contour tracking methods, 3D Model-based tracking methods, color and pattern-based methods.[7]

During the study of this paper the tracking target to be calibrated manually and can track single target at a time. This paper proposes a vehicle tracking is based on double difference method and CAMShift (continuously adaptive mean-shift) algorithm. By using a multi-tracker CAMShift algorithm moving vehicles in traffic video can automatically improve and achieve multi-target tracking. Effectively tracking interested target in video sequences is an important problem in computer vision area it can contain more information as compared static single frame images. The real time detection and multi-moving vehicle tracking is the base of intelligent monitoring system, It is use to detect and track moving vehicles in traffic video surveillance and mark it for different operations such as classification and identification. Real-time detection and tracking of moving vehicles locate vehicle quickly and accurate without subtraction foreground by background image from current video frame, because the background often dynamically changes with light and environment, so it needs to maintain and update the background model. So this paper proposes multi-vehicle detection and tracking methods, The moving vehicles contain in video sequences and whose motion detects by using double-difference method for improve frame-difference method and commonly used for motion detection [9], Then detected moving vehicles target as region of interest and referred to as ROI and finally use a CAMShift multi-tracker to multi-vehicle tracking and for noise removal.
The experimental result shows on the basis of this paper real-time multi-vehicles tracking in traffic video have good scalability. In video image vehicles locate the position, estimate the motion of blobs and follow the movements between

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two consecutive frames. The experimental result presents that the proposed line-based method uses line group for remove all undesirable shades accurately in minimal error.

3. METHODOLOGY

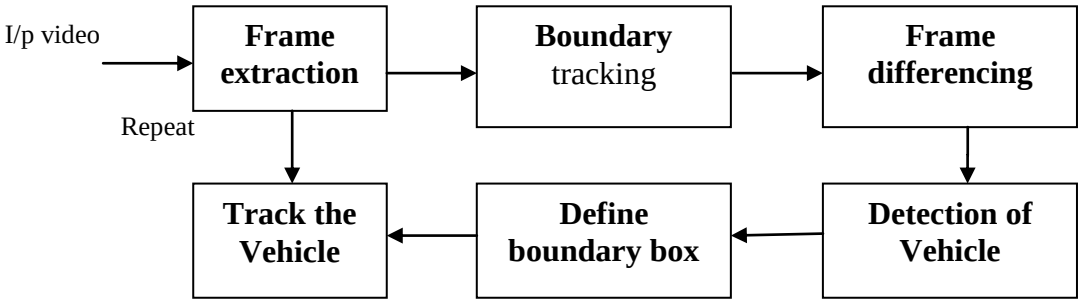

Fig:1 Automatic Moving Vehicle detection and tracking system

This block diagram represent the automatic moving vehicle detection and tracking system based on reloaded video at the input to the system. In this input the system like a frame image. Its extracted from video sequence. It is assumed that camera is stationary and there is no change in background. after that we are taking the difference of two frames, frame differencing is applied for detecting the existence and position of a moving objects. Each extracted sub image is subtracted from the respective portion of a ground image to determine the existence of an object.

Flow Chart :

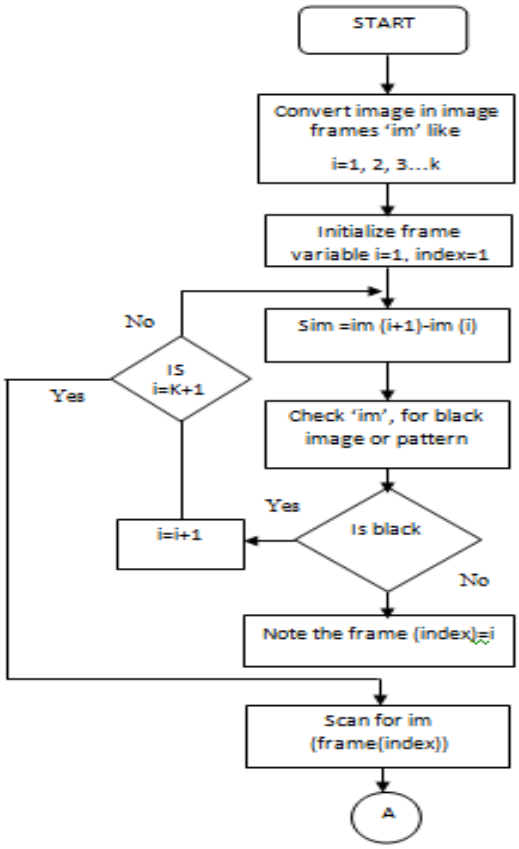

Fig. 2 Flowchart of Methodology (a)

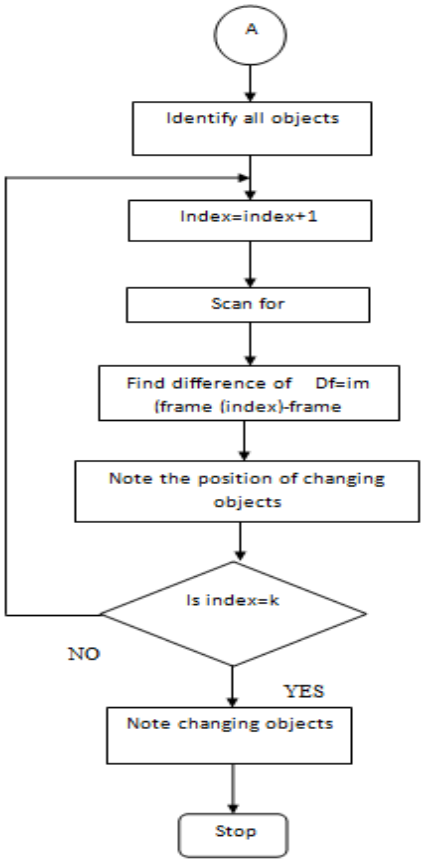

Fig. 3 Flowchart of Methodology (b)

- **DESCRIPTION**

First we are taking video which is input to the system. Then frame is extracted from video sequence, it is assumed that camera is stationary and there is no change in background. After that we are taking the difference of two frames, frame differencing is applied for detecting the existence and position of a moving objects. Each extracted sub image is

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subtracted from the respective portion of a ground image to determine the existence of an object from first position to last position.

Frame difference method identifies the presence of moving object by considering the difference between two consecutive frames. The traditional approach makes use of image subtraction operator that obtains output image by subtracting second image frame from first image frame in corresponding consecutive frames. Frame differencing method lacks in obtaining the complete contour of the object as a result of which morphology operations are general used to obtain better results.

After that identify the objects which are changing its position in a successive frames. We can also define position of objects in which it is moving, that is from left to right or from up to down and vice versa. The object position in each frame is noted and store in X and Y array. The difference of consecutive X and Y position give us the movement direction as follows.

$$X\_diff = X(k) - X(k+1)$$
$$Y\_diff = Y(k) - Y(k+1)$$

If the X_diff is positive and the difference is more as compare to Y_diff, which is slightly varying or constant. We conclude that object is moving from left to right. Similarly If the X_diff is negative and the difference is more as compare to Y_diff, which is slightly varying or constant. We conclude that object is moving from right to left.
If the Y_diff is positive and the difference is more as compare to X_diff, which is slightly varying or constant. We conclude that object is moving from down to up. Similarly If the Y_diff is negative and the difference is more as compare to X_diff, which is slightly varying or constant. We conclude that object is moving from up to down.
If X_diff is positive and more as well Y_diff is positive and more, we conclude that the object is moving from bottom-left to top-right. If X_diff is negative and more as well Y_diff is positive and more, we conclude that the object is moving from bottom-right to top-left. If X_diff is positive and more as well Y_diff is negative and more, we conclude that the object is moving from top-left to bottom-right. If X_diff is negative and more as well Y_diff is negative and more, we conclude that the object is moving from top-right to bottom-left.

Add the following table in result

	dir_x_left	**dir_x_right**	**dir_y_left**	**dir_y_right**	**x_shift**	**y_shift**	**Result**
v1	30	4	10	24	32	3	Right to left
v2	0	33	5	28	27	0	Left to right
v3	1	31	28	4	3	19	Down to up
v4	18	7	1	24	6	17	Up to Down
v5	29	3	1	31	32	17	top-right to down-left
v6	1	33	32	2	29	18	Bottom-left to top-right
v8	28	6	26	5	27	18	Top-right to bottom-left
v9	4	30	6	28	33	23	Top-left to bottom-right

CONCLUSION

This paper provides a summarizing study on the proposed techniques which have used in traffic video. It focuses in these areas, namely vehicle detection, tracking, and classification with appearance of shadow and partial occlusion. Also, we present and classify the traffic surveillance systems to three types based on specific methods which used for developing it. These types shows the detailed information about how the traffic surveillance systems used the image processing methods and analysis tools for detect, segment, and track the vehicles. In addition, shadow and gives better understanding and highlights the solutions for traffic surveillance systems.The experimental result shows on the basis of this paper vehicles detect and tracking in traffic video have good scalability. In video image vehicles locate the position, estimate the motion of blobs and follow the movements between two consecutive frames. The result presents that the Frame difference method identifies the presence of moving object by considering the difference between two consecutive frames. The traditional approach makes use of image subtraction operator that obtains output image by subtracting second image frame from first image frame in corresponding consecutive frames. Frame differencing method lacks in obtaining the complete contour of the object as a result of which morphology operations are general used to obtain better results.

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