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Vehicle Detection, Tracking and Speed Measurement for Traffic Regulation

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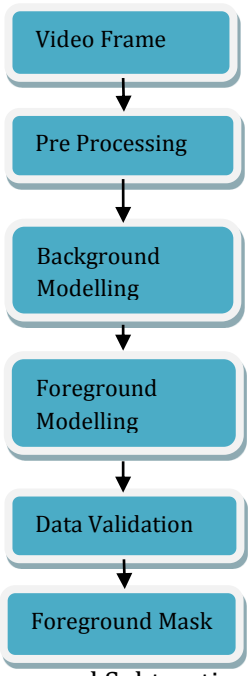
Abstract – *Vehicle Detection Process on road are used for vehicle tracking, counting average speed of each individual vehicle, traffic analysis and implemented under different environmental changes. In this paper we present a concise image processing method in developing traffic surveillance systems. The proposed model implements enhanced preprocessing, background Subtraction, Morphological Operations as well as Feature Mapping Process for Moving Vehicle Detection, Tracking and Speed Estimation. To enhance background subtraction, a novel multidirectional intensity strokes estimation approach has been introduced that plays a significant role for distinguishing vehicle region from other background contents. Here we consider the Regions of Interest (ROI) as vehicle region only. In addition the enhanced thinning and dilation based morphological process has been introduced that exhibits more precise and accurate vehicle detection.*

Key Words: Vehicle Detection and tracking, background subtraction, vehicle speed, morphological processing, regions of interest

1. INTRODUCTION

One of the significant application of video-based supervision systems is the Traffic Surveillance. So, for many years of researches have investigated in the vision based intelligent transportation system. The economic and easily availability of hardware have motivated researchers to develop more efficient solution for computer vision based applications. Image Processing based computer vision has become a promising technology for real time supervision, monitoring and control that serves major areas, ranging from civil applications, industries. Especially considering significance of Intelligent Transportation System, the vision based supervision has the significant contribution, as it can facilitate real time monitoring, vehicle tracking and identification. In addition, other parametric identification such as vehicle speed , Vehicle density, Vehicle Count etc., for efficient traffic monitoring and Control.

However the traditional vehicle systems may be declined and not recognized well due to the vehicles are occluded by other vehicles or by background obstacles such as road signals, trees, weather conditions etc., and the performance of these systems depend on a good traffic image analysis approaches to detect and track the Vehicles.



Background Subtraction Model

1.1 Motion Vehicle Detection and Segmentation Approach

The detection of moving object regions of change in the same image sequence which captured at different intervals is one of the 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, under water sensing and civil infrastructure. One of the video surveillance branches in the traffic image analysis which include the moving /motion vehicle detection and segmentation approaches. Even though various research papers have been showed

for moving vehicle detection (Background subtraction, frame differencing and motion based methods) but still a tough task to detect and segment the vehicles in the dynamic scenes. In our paper we are using Background Subtraction Method using frame differencing method.

Frame Differencing Method

A motion detection algorithm begins with the segmentation part where foreground or moving objects are segmented from the background. The Simplest way to implement this is to take an image as Background and take the frames obtained at time t, denoted by I(t) to compare with the background Image denoted by B. Here using simple arithmetic calculations, we can segment out the objects simply by using image subtraction technique of computer vision meaning for each pixels in I(t), take the pixel value denoted by P[I(t)] and subtract it with the corresponding pixels at the same position on the background image denoted as P[B].

In mathematical equation it is written as

P[F(t)]=P[I(t)]-P[B]

A threshold is put on this difference image to improve the subtraction

|P[F(t)]-P[F(t+1)]|>Threshold.

2. PROPOSED METHOD

Video Data Acquisition:

In this paper in order to examine the performance of the proposed vehicle detection and speed estimation for efficient traffic surveillance the real time video and some standard vehicle traffic data have been used.

Image Pre-Processing:

To develop efficient vehicle detection and speed estimation scheme, the appropriateness of input data and its quality is of great significance. Here the input RGB video frame has been converted into the frames that has been followed by extraction of various parameters such as number of frames, frame rate, color format, frame size etc.

Background Modeling:

This is the matter of the fact that the core of the Background Subtraction approach is to retrieve the background of the moving video. In traffic surveillance system, while recording video on highway it becomes highly intricate to get the image without any moving vehicle. In order to retrieve such image we have implemented Background Subtraction Model.

Vehicle Detection:

We detected the vehicle moving in the input video by using region props function which is an inbuilt function in mat lab and gives more accuracy than bounding box generation method.

Vehicle Tracking:

In this paper the proposed vehicle tracking system has been made on the basis of the feature tracking concept. The features extracted have been tracked over sequential frames retrieved from input traffic video data. Our proposed system represents an object matching scheme that estimates the distance between vehicle features or the features in the previous frame, which has been stored in track graph metrics and instantaneous frame.

Speed Estimation Scheme:

In this paper, the detected moving vehicle possessing its matching ID has been tracked over frames of the video data. In order to calculate the total number of frames having same object has been estimated using following equation

Speed= (Distance)/(Total Frames*Frame Rate)

3. Results:

Input RGB frame

The above depicted image is an input RGB frame taken from video frames obtained from input video

RGB to Gray Scale

The input RGB frame is converted to Gray Scale image for performing edge detections and morphological operations

Background Subtracted

It is a foreground image obtained from subtracting the background

Detected Vehicle

The red mark denotes that vehicle is detected

4. Conclusion:

The moving vehicle detection, tracking and its speed measurement system is of great significance for present day transport system. Considering limitations of the existing systems such as noise and illumination sensitivity etc., in this paper we presented a novel background subtraction model that considers intensity, moving pixel orientation etc., for moving vehicle detection. After subtracting the background image further the enhanced thinning and dilation based morphological process has made proposed system more robust and accurate. Later the vehicle detection with the help of red dot using region props function followed by speed estimation has facilitated tracking and speed measurement. This paper is focused on vehicle detection and tracking on single lane road and that in future it can be developed for multi –lane system. In addition vehicle classification can also be done.

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