



Computer Vision Based Vehicles Detection and Counting for Four Way Traffic

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Abstract: Moving object detection is very crucial part in the video surveillance system. Moving vehicles detection is nothing but the evaluating the motion of vehicles from the certain video i.e. from .AVI, .VLC etc. files. There are some methods for moving object detection such as optical flow method, frame differencing method and background subtraction method. From these methods background subtraction is most widely used for the moving vehicles detection. The method of subtracting moving vehicles from the traffic video is nothing but background subtraction method. The implementation of background subtraction is done on the basis of some parameters that include accuracy, processing time, complexity and segmentation. Once the object is detected using background subtraction method counting is done using Gaussian mixture model (GMM) and BLOB analysis. Gaussian mixture model(GMM) is used for segmentation which is applied on original image after detection of vehicles. BLOB analysis counts the vehicles and gives bounding boxes to the vehicles.

Keywords: Computer vision, Background subtraction method, Counting, Gaussian mixture model, BLOB analysis.

I. INTRODUCTION

Computer vision is behavior of automatically understanding, analyzing 2D and especially 3D images or sequence of images i.e. video using different algorithms and techniques. In traffic control system detection of moving vehicles is important and crucial part. In this, vehicles are detected using background subtraction method. This method is applied on the four way traffic road. In this system four static cameras are used to capture the moving vehicles on each of four roads. Background subtraction method subtracts the moving vehicles from static roads. This procedure is done by pixel by pixel. Area of the vehicles is also main consideration. Once the vehicles are detected from static roads using background subtraction method counting is done on each of the four roads. Gaussian mixture model (GMM) and BLOB analysis method is applied on roads for counting the vehicles. Gaussian mixture model gives the better segmentation to the original images. BLOB analysis produces the bounding boxes to the vehicles. Number of counted vehicles is displayed using MATLAB. Traffic control is the main application because huge amount of traffic creates the problem on road it may causes the accident on the road. There is a no need of workers, man-power etc. Basic flow of algorithm for vehicles detection and counting of the vehicles:

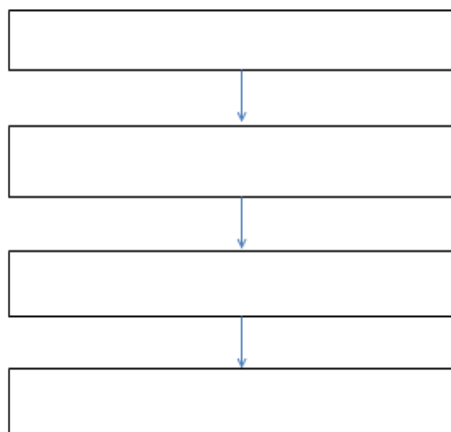


Fig1. Flow of basic process

II. LITURATURE REVIEW

For motion detection three methods are evaluated: 1) Optical flow method 2) Frame differencing method 3) Background subtraction method.

1) *Optical flow method:* It causes the motion of the vector characteristics which changes with time and detects the image in the video [3]. It evaluated the good performance under the moving cameras, complexity is more, and more calculations are needed. It doesn't produce better output for the traffic control system.

2) *Frame differencing method*: It is nearly similar to the background subtraction method. In this pixel by pixel subtraction is done. Current frame pixel values are subtracted from previous frame pixel values. If the obtain pixel value is greater than given pixel value then it is considered as a foreground and rest of the part is background. This method is easy to implement. Less calculation is needed. It is generally fails in detecting relevant pixel information from some types of moving objects [1]. For complex system it can't recognize the object properly.

3) *Background subtraction method*: This is a most relevant method used for subtracting moving object from static images. The basic of this method is it initiates the background first and subtracts the current frame from background frame.

III. PRAPOSED WORK

1. Object detection using background subtraction method

In this, two models are used first is foreground and second is background. The subtraction of foreground from background is nothing but background subtraction. Background model is static once and foreground model is moving objects. In this system roads are background model and moving vehicles are foreground model. Algorithm used for background subtraction method:

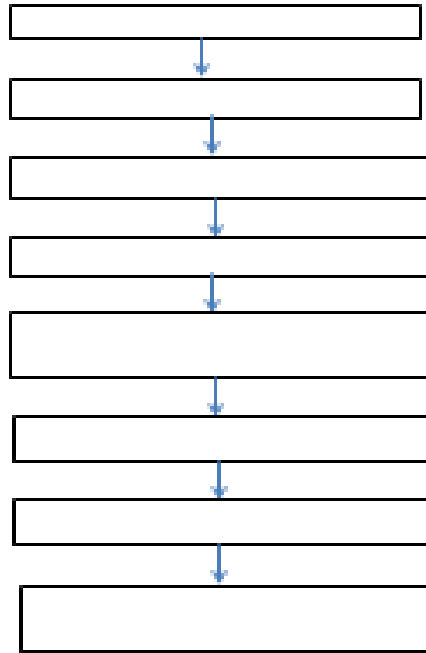


Fig2. Flow of background subtraction algorithm

1) Conversion of video into frames: First video is taken as an input. After that using the using MATLAB function conversion of video into frames is done. In this video frames are 536.

2) RGB to GREY conversion: The input image is color image we have to convert it into grey scale image. After the conversion of video into frames, color image is converted into black and white scale.

3) Preprocessing using median filter: Preprocessing process used to reduce the noise in each frame. Preprocessing is done using various filters such as median, mean, and convolution filter. In this system median filter is used. The mask of the filter will multiply with frame and noise will get removed so it produces accurate result [1].

4) Background frame initialization: Background frame initialization is essential part in this algorithm. In this first frame or the average of the brightness of the frames is considered as a background frame and other frames are foreground.

5) Subtraction of background from current frame: once the background frame is initialized subtraction is done pixel by pixel i.e. current frame is subtracted from the background frame.

$$|f(x, y) - B(x, y)| > T_h(1)$$

$f(x, y)$ is the foreground pixel frames. $B(x, y)$ is the background pixel frames. T_h is the threshold level value.

5) Segmentation using thresholding: In this thresholding value is practically set. If the value is greater than threshold value then it is considered as a background image and of it is less than threshold value it is considered as a foreground image. Processing is done pixel by pixel. In image processing black color is represented by binary 1 and white color is represented by binary 0. So segmentation using thresholding gives the moving vehicles in white and static road black color. In this way detection is done.

6) Morphological filtering: It is used for reducing the noise in detected images. A morphological operation gives the better edges to the moving vehicles and produces the better output. In this various operations are performed like closing, erosion, dilation, opening etc. operations are done pixel by pixels.

7) Object is detected from background image: Using the entire steps objects is detected accurately and properly from the background image i.e. vehicles are detected accurately from the roads.

This algorithm is nothing but the background subtraction algorithm. Using this algorithm vehicles are detected each of the four way road.

2. Counting of vehicles

Counting of vehicles is important for the traffic control system. Counting is done for each of the four way road. For counting of the vehicles Gaussian mixture model (GMM) and BLOB analysis are used.

1. Gaussian mixture model: Gaussian mixture model (GMM) is important part counting of vehicles. It is important for the segmentation purpose. It is applied on the original image. It provides the expectation stuffer presented an adaptive Gaussian mixture model by a mixture of K Gaussian distributions. Gaussian mixture model (GMM) evaluated the pixel values from reference pixel mean and variance. It is evaluated for each pixel and updated with each new frame value. At the every new frame some of the Gaussians approximately equal to the current value. For these frames mean and variance is updated. Single Gaussian causes the multimodal behavior of Gaussian mixture model. Some parameters of Gaussian mixture model are implemented such that number of Gaussians, number of training frames, learning rate, variance, subtraction ratio etc. using these entire parameters Gaussian mixture model is applied to the original image.

General formula for Gaussian mixture model,

$$P(X_t) = \sum_{i=1}^K W_{i,t} \eta(X_t; \mu_{i,t}, \Sigma_{i,t}) \quad (2)$$

Where

$$\sum_{i=1}^K W_{i,t} = 1 \quad (3)$$

Mean of Gaussian mixture

$$\mu_t = \sum_{i=1}^K W_{i,t} \mu_{i,t} \quad (4)$$

Where, X is the variable which gives the current pixel in frame, K is the number of distributions, and t represents time, w is an estimate of the weight of the ith Gaussian in the mixture at time t, μ_t is the mean value of the ith Gaussian in the mixture at time t. this Gaussian mixture model is applied on the four way traffic road. After the segmentation morphological filtering is used to reduce the noise. In morphological filtering closing operation is performed.

2. BLOB analysis: BLOB analysis is nothing but the collection of the connected pixels. BLOB analysis is used for the various applications such that counting of vehicles on traffic road, counting of people in crowded area, robot vision system etc. It produces the statistical characteristics of crowded area. It is most widely used to find out the statistical information such that size, area, location etc. BLOB analysis is very power full method which reduces the execution time and gives the better output and also improves the efficiency.

In the BLOB analysis some parameters are implemented such that bounding box, output area, and minimum blob area etc. it is also applied on the four way traffic road. It produces the bounding boxes to the vehicles and output is displayed in MATLAB.

IV. RESULTS



Fig.3 Four road traffic vehicles



Fig.4 Moving vehicles detection using background subtraction method

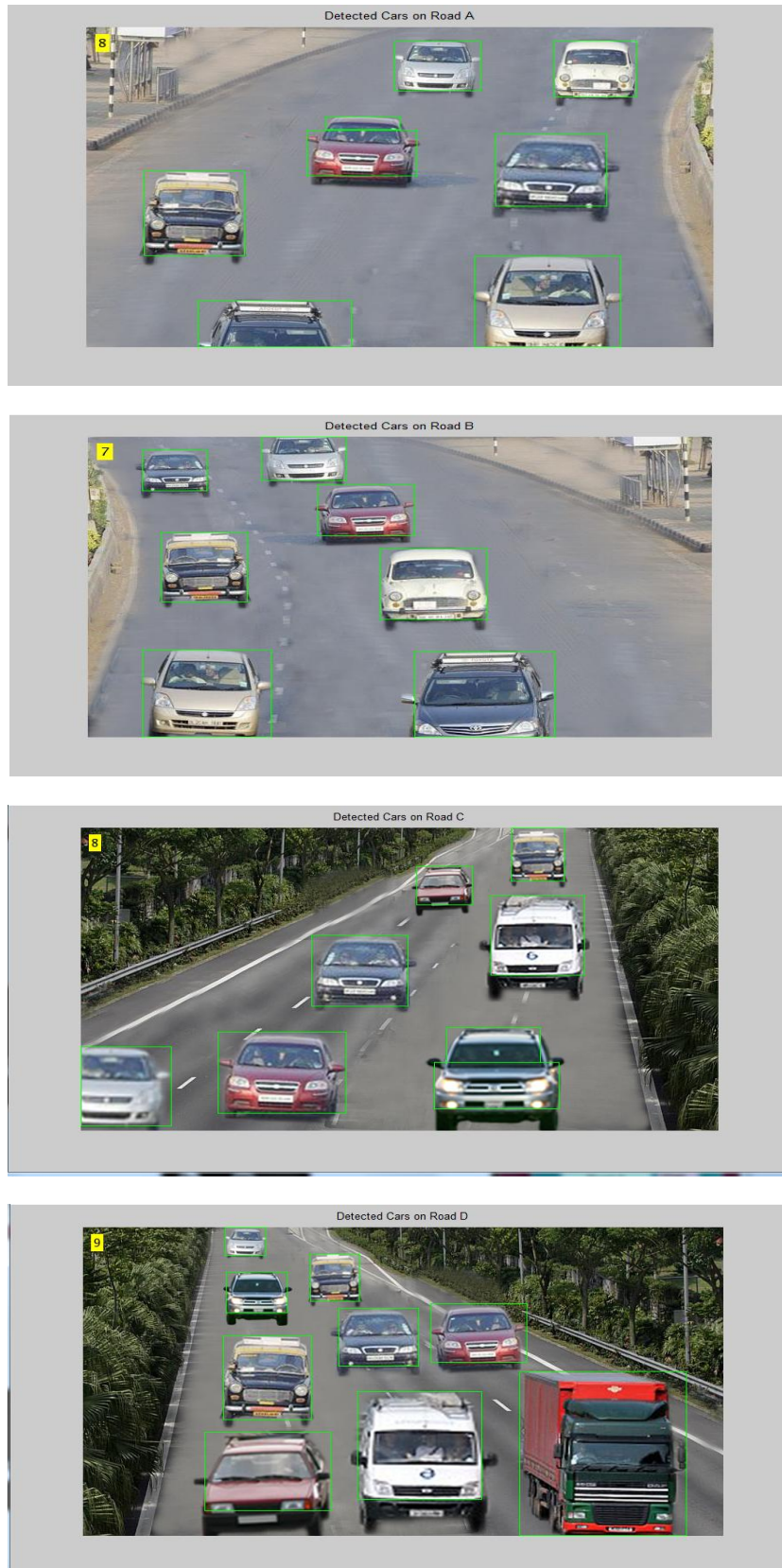


Fig.5 Vehicles counting on each of the four way road

V. CONCLUSION

From all these results we conclude that, background subtraction method gives us better and accurate result for moving vehicles detection. It also evaluated the better segmentation for moving vehicles and produces good output within a microseconds. After the vehicles detection counting is accurately done using the Gaussian mixture model and BLOB analysis method. BLOB analysis produces the accurate bounding boxes to each of the vehicles on four way traffic road. After the counting of vehicles controlling of the traffic is also done. The road which having more traffic gives the first preference to that road. By maximizing or minimizing the time period of that particular road we control the traffic.

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