Efficient Real Time Vehicles Detection Approach for Complex Urban Traffic Management

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Abstract—*Vehicles now a day are becoming very necessary part of our life this is leading to increase in congested traffic conditions around the world. With our research in this domain of vehicle detection with image processing we are focusing on detection of vehicles. This is then combined with car size detection. Our approach is to first work on the feature of four wheeler i.e., windshield of the car. Then to work with saliency generation of the region of interest which will be containing only windshield part for the vehicles in the frame. With conversion of this frame into HSV color model. From HSV the saturation value within certain limit is kept for the segmentation then on from that leading to the detection of the vehicles in the given frame. Vehicle size detection we have considered eagle eye view for taking out area and on the basis of that deciding threshold for the vehicles into different categories. Categories of vehicles include small, medium, large vehicles for four wheelers.*

Keywords—Saliency generation, Part Based Modeling, HSV Color Model, Type detection.

I. INTRODUCTION

In city traffic conditions because of many numbers of companies and ease of purchasing a four wheeler there are coming more number of cars coming on roads day by day. This is making urban traffic much more congested and crowded. On the other side there is need of traffic management to this problem. In that sense a system which should be helpful for monitoring traffic remotely. In this all vehicles detection and its processing is important. That to in real time basis makes the system more useful. Our system works for real time feeds of traffic in urban traffic conditions. Our main aim is to work on real time and from that detection of the vehicles here we are concentrating more on the detection of the four wheelers.

In our approach we are considering real time traffic videos taken from congested and crowded urban traffic conditions. To work on real time we first need to have frame by frame extraction so that vehicles containing four wheelers with most feature covered. We have worked on the region of interest to get best possible region wherein we get most of the vehicles covered in a given frame. Saliency is generated for each frame followed by conversion into RGB to HSV color model. HSV color model gives certain range of values for feature of car i.e., car windshield with that a threshold is set for segmentation for keeping those pixels as it is. Since we are working on real time basis we are having conditions of foreground and background in the images. For that case we have considered entropy of the pixels. Here in those pixels are having highest entropy which is taken as 1 are considered as foreground pixels and which are low entropy are considered as background pixels considered as 0.

In detection of the vehicles all above methodology goes to check for each frame checking the entropy into consideration so that the detection and count is obtained for each frame. While doing so we need to consider area entropy calculation for each pixel, here in highest energy pixel within the average is taken and from comparing with each pixels so that with highest considered as 1. Then with comparison and threshold we can get the vehicle detection and count for detected vehicles. The methods used is given in brief as follows—

1. Saliency map Detection

Saliency map is a technique involving many types but we have considered is one with color contrast feature and intensity feature. In saliency map detection region based entropy detection and mean of those entropies are calculated to take out region with object detection. This includes contrast feature and intensity feature can be given as follows-

For intensity feature it uses difference between centre pixel and the surrounding pixels.

$$\mathbf{I(c, s) = | I(c) \ominus I(s)|}$$

The color contrast feature differences in the color values to get the contrast, can be given as

$$\mathbf{RG(c, s) = | (R(c) - G(c)) \ominus (G(s) - R(s)) |}$$

Operated denoted by ϴ: Interpolation to finer scale and point-to-point subtraction.

II. APPROACH

Our approach mainly concentrated on vehicle detection and its count for that we are following certain steps to work out our approach this can be given with the help of block diagram-

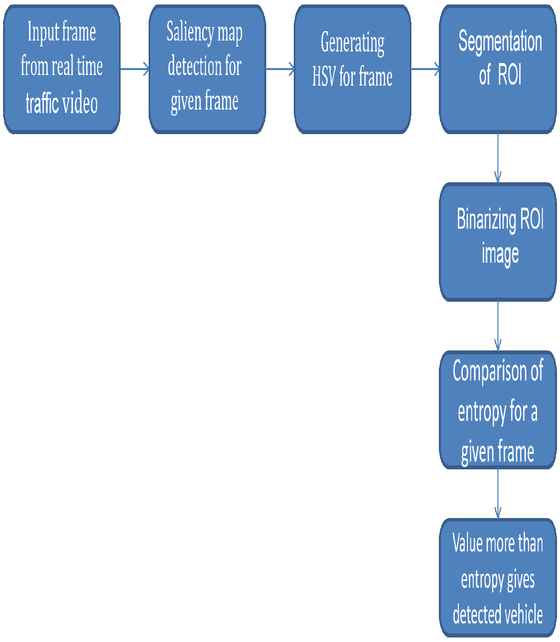

Fig. 1

1. **Input Frame:** Working on real time feeds from given road traffic and then on extracting frames for vehicle detection. Extracted frame containing most types of vehicle covered for the selection of region of interest such that each frame with maximum number of vehicle is selected. This region of interest selection with separation between background and foreground.
2. **Region of Interest:** Appearance of vehicles in image has various ratios because of its many kinds of models such as sedan, SUV and truck. Our region of interest mainly is on four wheelers so to help next process of segmentation we need to focus only on the region of vehicles. This is achieved with help of saliency map detection for a given frame.
3. **HSV Model:** Given frame in RGB within the saliency is converted into HSV color model. The reason for converting into HSV model is to work on Part Based model approach i.e., to work on features of the vehicle. Main feature of a car we are working on windshield of a car so considering the HSV values for that.
4. **Segmentation:** With HSV values, saturation value for car windshield is in the range of 0.85 and around so that pixel keeping as it is and then segmenting the rest. Binarizing the HSV image which gives a certain green color to the windshield pixel of car. This leads to fore ground part and the back ground part for the given image which is important for the detection of occlusion between the vehicles.
5. **Entropy calculation and Detection:** Foreground and background detection leads to need of entropy calculation in the image
Highest energy component → foreground
Low energy component → background
For the best possible entropy Gaussian filter is applied to the given image, that region is extracted from image. Best possible energy is considered as 1 unit to apply the threshold for detection of which is compared with each region of interest the vehicle windshield coming in the next frames. For the coming cars different values for the entropy are taken and their mean is calculated. For the coming cars different values for the entropy are taken and their mean is calculated. Removing rest pixel values, counting the number of regions where for that area value is greater than the mean this gives the car count.

III. IMPLEMENTATION

With our approach defined above we are working on dataset contains videos and images of vehicles under regular Indian (local) road condition. First with frame extraction from given urban road condition and then region of interest, saliency detection for each frame .this output can be given as follows—

Original image—

Fig. 2

Saliency generated image—

Fig. 3

HSV image—

Fig. 3

Binarized image—

Fig. 4

Vehicle detection and count—

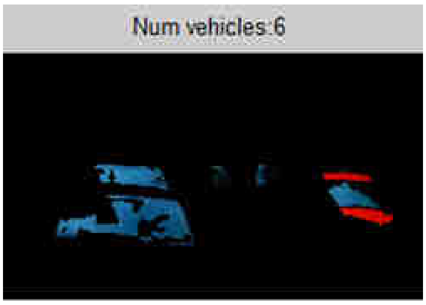

Fig. 5

The above output images are for a single frame with video frames goes on this gets applied for each frame for detection of vehicles from a real time video of congested urban traffic condition. We have performed this for different types of videos and the results are obtained. From those results we are able to detect vehicles in different conditions such as occlusion between two cars, some part of the car is not visible by some occlusion and also we have tried for different light conditions. This can be given in the analysis part.

IV. ANALYSIS

In analysis part we have considered different light conditions and in that conditions vehicle detection is compared. This analysis can be given in following the tabular form—

In below table we have considered different frames in a given real time traffic video in bright sunny conditions in daylight and detection values for vehicles with our proposed methods and the actual count of vehicle is noted down from that efficiency, false alarm rate and miss rate. Similarly in the next table we have considered evening light conditions i.e., low light conditions. Same parameters are considered for this condition too. With this methodology we have tested hundreds of videos so to get the accuracy and relevancy of our method.

Table .1

Type	Videos	Vehicles detected	Actual Vehicles	Efficiency
Day light (Sunny)	Video1	104	125	83.2%
	Video2	80	88	90.90%
	Video3	95	106	89.62%
Low Light (Evening)	Video1	30	37	81.08%
	Video2	48	59	81.35%
	Video3	37	32	84.37%
Overall Efficiency→				85.08%

V. CONCLUSION

In reference to our method for vehicle detection in complex urban traffic environment for cars is tested for most numbers of videos in real time and results were analyzed in every condition of lighting for low light and day light also. With this analysis we have achieved efficiency up to 85% overall. It includes different light conditions and vehicle occlusions. With further training and testing in different environment we wish to achieve more efficiency.

VI. FUTURE SCOPE

In future we wish to have a scope in our system for a algorithm or a technique to indentify of to detect type of vehicle with front view of the vehicles. Such technique will be useful with our technique to build a efficient traffic management system.

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