

Vehicle Counting and Detection



Ravula Arun kumar, D. Sai Tharun Kumar, K. Kalyan, B. Rohan Ram Reddy

Abstract: This paper describes about the system to count the number of vehicles on roads and highways by using adaptive background subtraction and blob tracking technologies. Overall, system requires a video stream captured from static cameras installed on roads and highways. The proposed system consists of four stages: 1) Adaptive background subtraction 2) image segmentation 3) vehicle counting 4) vehicle tracking. The necessity of tracing and counting the vehicles is helpful for traffic surveillance. The primary key features of the system are 1) Ability to count the vehicles 2) efficiency, to show that system would give the results with high perfection.

Key words: Hole editing, Background Subtraction, Virtual Detector, Kalman Filter

I. INTRODUCTION

Freeways, expressways and streets are getting packed with expanding of colossal number of vehicles. Wise transport frameworks are used to assemble and oversee data about transportation streams using different experts, they are trying to make traffic monitoring progressively proficient, solid, and more secure. To identify them and to tally the vehicle is getting indispensable for stream observing, arranging, and controlling of traffic. The identification of any vehicle is frequently customarily accomplished through sensor gear, for example, inductive circle finder, infrared identifier, radar indicator. These would be more cost effective so we came up with a video-based solution. Because the user cannot input any files in the sensor equipment's such as video files. Comparing with other techniques using static cameras to capture the videos would be more suitable also it would fit in the outdoors like in rains, wind storms, etc..The user can reduce the cost by installing video cameras instead of sensor equipment. These video based solutions would be useful for the city engineers for road winding and the data would be stored securely for traffic learning. They have drawn huge consideration from specialists inside the previous decade. The essential issue is starting a track consequently. Here we portray two frameworks during which the issue is assaulted calm in an unexpected way. Initial one is virtual indicator built with a gathering of rectangular locales in each edge.

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* Correspondence Author

Ravula Arun Kumar*, Assistant Professor, Department of IT, Vardhaman College of Engineering, JNTUH, Hyderabad, India. E-mail: arunravula12@gmail.com

D. Sai Tharun Kumar, Student, pursuing final year, Department of IT, Vardhaman College of Engineering, JNTUH, Hyderabad, India. E-mail: durbhavamsam@gmail.com

K. kalyan, Student, pursuing final year, Department of IT, Vardhaman College of Engineering, JNTUH, Hyderabad, India. E-mail: kalyan.kasha9991@gmail.com

B. Rohan Ram Reddy, Student, pursuing final year, Department of IT, Vardhaman College of Engineering, JNTUH, Hyderabad, India. E-mail: rohanram.09@gmail.com

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Since the camera is fixed, the virtual identifier are frequently picked to traverse every path and along these lines the framework at that point screens and the virtual collector will do its job to find the vehicles. The other is mass following. During this calculation, a foundation model is produced for the scene. For each information picture outline, totally the contrast between the information picture and subsequently the foundation picture is prepared to extricate closer view masses like the vehicles out and about. Both over two methodologies experience issues handling shadows, impediments, and huge sized vehicles. Few key methodologies of image processing have been applied in this project. Adaptive background subtraction with virtual detector is used to find the vehicles in a video frame. However it is time consuming and requires some automation to save lots of the time for image count and classification. The paper states about thanks to image process, sort of filter used and proposed technique are ready to detect, count and classify the image accurately.

II. LITERATURE SURVEY

Due to more traffic congestion [1-11] Intelligent vehicle counting system has been developed with different methods.[1-7] blob analysis, background, image enhancement, sensor based systems, image segmentation, [2]to capture the speed from static cameras, object detection and [3]counting the pedestrians using neural networks, [5] by using night vision.[6] pedestrian detection cameras have been using in many countries. We have designed a software by taking input as a video file to count the number of vehicles.[7] By taking the video frame and perform Image segmentation, vehicle tracking, vehicle detection [8]and blob analysis for traffic surveillance.[9] a different approach to count the vehicles is by convolution neural network it would give real time results with high accuracy.[9] by using virtual coils and CNN could be possible for high accuracy results.[10]counting the vehicles on highways by using ROI and Markovian approaches. The above researches have approached high accuracy in counting the number of vehicles. We would use background subtraction with virtual collector and morphological operations track and count the vehicles on roads and highways.

III. ARCHITECTURE OF THE SYSTEM

This would describe an approach for inventing a system to count the vehicles and to detect from a video frame. Let us go through the flow chart of the system and know about each component and methods that we are using in the system.

A. Overall View Of The System

First, video files are taken from the static cameras installed in highways,

roads in cities, etc., The captured video file is firstly differentiated in frames by using frame differentiation technique.. Fore ground extraction is done on the video frame that can be seen in figure 3. The background subtraction is applied on the video frames with virtual detector to find the foreground objects. Find contour method is used to draw the shapes like square (0, 0, 225) for cars and rectangles (0, 225, 0) for trucks according to their size. Due to wind, rain and illumination difficulties in the outdoor we would use morphological operations in our system to get high accuracy results during extreme weather conditions.[8] blob analysis is done on the video frames. Kalman filter is applied to the system to track the vehicles easily. Feature extraction is done the area of each car and truck passed through red and blue lines.

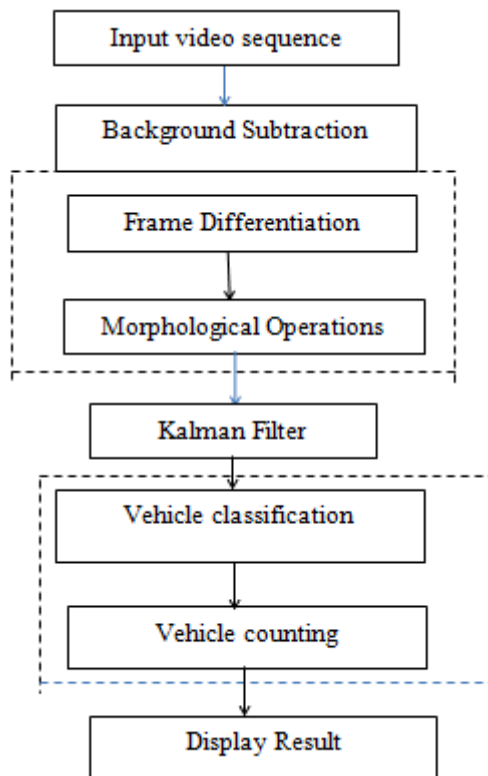


Figure 1. Flow chart for vehicle counting and detection

B. Background Subtractions

Background subtraction is an approach used to find the moving objects in video sequence to change it to foreground image. The foreground image would be formed after the background subtraction as shown in figure (b). Many researchers have developed methods background subtraction like kernel density estimation find out the density of the vehicle. Gaussian mixture model and etc. but in the real time applications there were not good enough.

C. Foreground extraction:

A particular image in figure (b) which has no vehicle on the road after the background subtraction on the video frame converted from color to gray scale image. For every pixel in the video frame the grey scale intensity of background image will be subtracted as shown in figure (b) by using hole editing, binary image and adaptive background subtraction. The total result will be stored in another image that image is called as difference image.

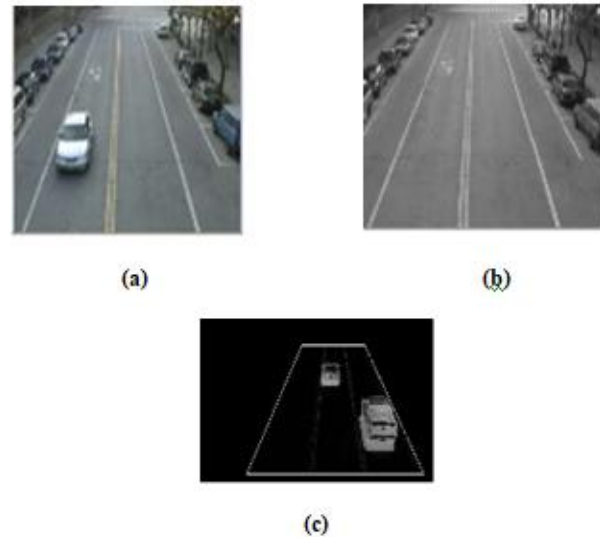


Figure (a) video frame (b) Fore ground mask (c) difference image

3.2 VEHICLE DETECTION

To achieve vehicle detection we have used virtual detector to detect the vehicles and threshold operations are applied on the difference image to separate the foreground image and background image. Fore ground mask is used mask the difference image as shown in figure (a). The morphological operations are applied on the images. They are erosion and dilations as show in figure (b) and (c).morphology is used to draw shapes and boundaries. Firstly, each frame of the output image is compared with the corresponding image with the input image. Dilation would add boundaries to the objects of the image and dilation add the extra boundaries in the image. We are using morphological operations so that we could get high accuracy results during extreme weather conditions or any illuminative issues like wind, rain, etc. By using contours the size of square and rectangle sizes are fixed to calculate are of each vehicle. The size of cars would be set to 5 x 5 and trucks have been set 11 x 11. The values we got from the difference image are more than the value would be set to 1. If we got less value from the difference image then the value would be set to 0. We can use dilation and erosion to remove small objects from the images to make the borders smooth. Further the next step would be to count the number of vehicles.

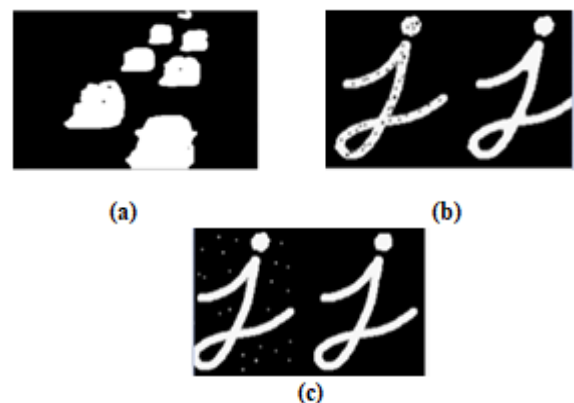


Figure (a) Fore ground mask (b) Dilation (c) Erosion

3.3 VEHICLE COUNTING

Once find contour methods are applied as shown in figure (c), next the area would be calculated for each vehicle and displays a value 1 if the vehicle is counted. And this count would be increased as the numbers of vehicles are detected. If no vehicle is detected then the value would be set to 0, and continue to detect the other frames. As shown in figure (a) the area size would be displayed in the output screen once the vehicle is counted as 1.

As shown in figure (b) the red and blue are used as region of interest and centroid to calculate the area of each vehicle once the vehicle has crossed the red line frame differentiation is done to count the vehicles. After crossing the blue line the vehicle would be counted. It would work on bi-directional ways and also in single direction ways .If any vehicle has not detected then binary image would be stored as 0.

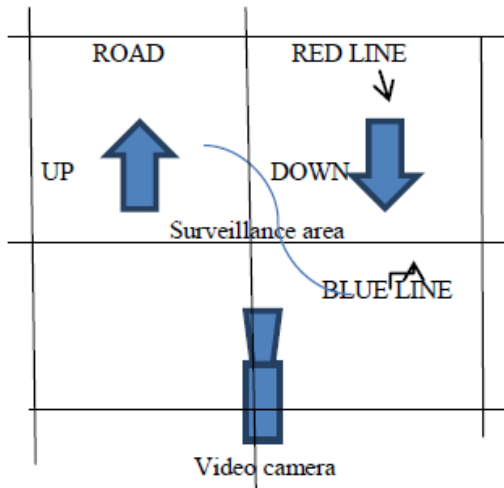
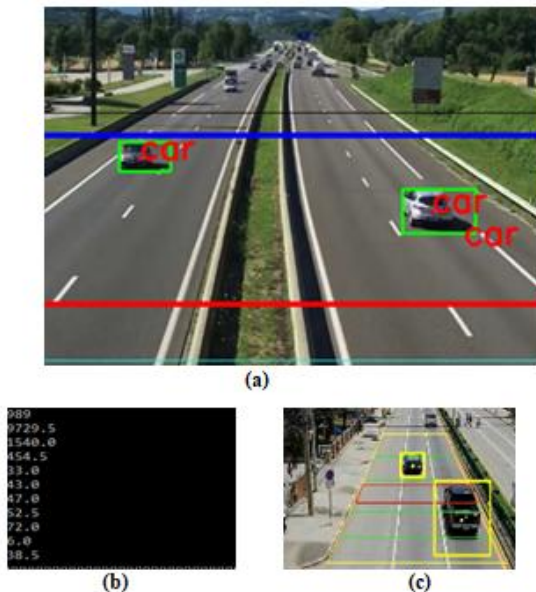


Figure 3.2 System for vehicle counting and detection



IV. EXPERIMENTAL RESULTS AND DISCUSSION

To record the road videos we have installed static cameras on highway and collected around 4 to 6 videos. We have recorded this from morning to evening (10 am to 5pm).we have use 1280 x 720 pixels and around 35 frames per

second. We have implemented this method in python language by using opencv [13]. The video is taken as input in the proposed system the proposed method would give high accuracy results compared to manual counting.

The proposed method would run on the laptop powered by powered by an Intel Core i3 to i7 (2.4 - 2.7 GHz) CPU and 4 GB RAM to 8GB RAM. The experimental results are shown in below table 1.The proposed method has reached an accuracy of 90%-97%. All input video files together have around 541 vehicles out of which 530 have been detected with accuracy 96.85%.

Table 1 would have the components such as r\number of vehicles, accuracy.

Table 1. Experimental Results

Number of videos	Vehicles Crossed Red Line	Vehicles Crossed Blue Line	Accuracy
1	120	116	95.8%
2	75	74	96.5%
3	84	82	96.2%
4	69	69	95.25%
5	78	77	94.8%
6	115	112	96%

V. CONCLUSION

This paper has clearly explained about the vehicle counting detection system to identify and counting the number of vehicles from the video sequence captured from static cameras. Firstly, by using adaptive background subtraction with virtual detector, secondly foreground masking, find contour method, motion analysis and edge detection techniques have been used. By kalman filter and region of interest are used to calculate the area and to detect the vehicle. Open computer vision techniques like threshold calculation and blob analysis, hole filling, morphological operations, are applied to remove objects and to remove noises from the video frames for smoother boundaries.

Thirdly, by using contour methods to identify the vehicles and counting the number of vehicles in the video sequence captured from static cameras. Once the vehicle has reached the region of interest count would begin as mentioned in the above methods. Experimental results have showed an average of 97.25% accuracy in the proposed method.

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AUTHOR PROFILES



Ravula Arun Kumar, M.Tech has published ten papers till now, currently working as assistant professor at Vardhaman College of Engineering in department of IT. E-mail: arunravula@gmail.com



D. Sai Tharun Kumar, currently pursuing B.Tech in the field of Information Technology, at Vardhaman College of Engineering, Hyderabad. E-mail: durbhavamsam@gmail.com



Kasha. Kalyan, currently pursuing B.Tech in the field of Information Technology, Vardhaman College of Engineering, Hyderabad. E-mail: kalyan.kasha@gmail.com



B. Rohan Ram Reddy, currently pursuing B.Tech in the field of Information Technology, at Vardhaman College of Engineering, Hyderabad. E-mail: durbhavamsam@gmail.com