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Moving Vehicle Detection And Counting To Allot Run Time

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Abstract

Intelligent traffic management system is growing day by day. Traffic congestion is increasing issue in current century due to industrialization. In many cities, people are facing this problem every day. Therefore the research is going on to find solution on this problem. Moving vehicle detection is crucial part of any traffic surveillance system. In this paper, we have discussed the framework that detects moving vehicle and counts the vehicles. After counting the vehicle it allots specific time according to number of vehicles so that at traffic signal the waiting time would be less. This framework can be implementing in traffic management system so that according of vehicle count it will allot the run time. Background subtraction is use for detection of moving vehicles. This framework is simple and effective.

***Key Words*:**Traffic Jam; Background subtraction; Computer Vision; Image Analysis; Vehicle Detection; Vehicle counting.

1 INTRODUCTION

In many countries of world, transportation via road is the very common mode of transportation. The number of vehicles is increasing day by day which causes the traffic jam on roads. In many metro cities everyone is facing this problem in day-to-day life [1]. Traffic congestion is serious problem of this century. Many researchers are working on this issue to implement the intelligent traffic management system. When we consider any traffic management system or any traffic surveillance system, vehicle detection plays an effective and significant role. Vehicle detection is the main part of traffic monitoring system. There are so many methods in computer vision that are used to detect the moving objects. Also some new improved methods are also involving now-a-days. In traffic management system there are two parts, one is day time traffic and another is night time [1]. So in such cases the techniques used are different for each of them. Light illuminations are different in day time and night time also there are shadows of vehicles on road during the day time. Hence while designing traffic surveillance system one has to consider these all factors so that the system will be efficient and robust in all conditions including the climate change. Vehicle detection is applicable in many areas like traffic monitoring, vehicle tracking, number plate recognition, speed detection, stolen vehicle detection, vehicle counting, intelligent transportation system (ITS) and many more applications [6]. Due to camera movements, human interference, vehicle size, shape, vehicle color designing of the computer vision based vehicle detection system is challenging job [7].

Traffic flow analysis is growing area and many new techniques are arising for improvisation of conventional traffic systems. In our examination we are proposing a superior answer for this issue. This paper focuses on the moving vehicle detection and counting. For vehicle detection we have used the background subtraction method. We have implemented the algorithm that detects the moving vehicles; counts number of vehicles and allot run time according to vehicle density. We can implement this algorithm to design an intelligent transportation system.

2 LITERATURE SURVEY

This chapter discusses the study and analysis conducted during this research on various conditions of traffic density estimation. A close glance on different methodologies, algorithms, techniques and their limitations are presented in this chapter. This process would enable the researchers to understand the research contributions in the area of traffic density estimation.

R. Cucchiara et.al,[1] proposed a framework for recognizing vehicles in traffic videos for daytime and night time by methods for picture investigation and administer based thinking. On moving layouts used spatio transient analysis in daytime pictures, and for fog light used morphological analysis. And these are combined in night pictures which are performed by picture preparing modules. At night time, they identified the vehicles on the basis of headlights.

A system to estimate traffic density with the cell transmission model is proposed by Laura Munoz et.al, [2]. Instead of cell occupancies cell densities are used as state variables. System takes non uniform cell lengths. It allows and maintains congested condition at the downstream boundary of a modeled freeway section. Cell densities allow including uneven cell lengths, for greater flexibility in partitioning the highway.

Tomas Rodriguez et.al, [3] proposed a system on real-time traffic monitoring; it is able to operate autonomously for long periods of time and also self-adaptive. System is able to appropriately select the algorithm for day time, night time and transition periods. Also it is able to work in all weather conditions. This system is robust to illumination changes and it can work on vehicle shadows, and shadows from parallel roadways. Its performance is hardly affected by the camera movement but the system is robust to temporal tracking errors. System treats occlusions adequately and heavy vehicles are provided in this, and obtained good results in dense traffic.

P.F Alcantarilla et.al,[4] proposed a system which is automatically control road traffic and monitoring system for day time sequence using a black and white camera. Different computer vision methods are used to get information about road traffic such as speed of vehicle, dimensions and vehicle count etc.

For extraction of moving objects frame-differencing algorithm and texture information based on grey scale intensity method is used. Top hat transformations and morphological operators are used to remove shadows of moving objects. Also they used Kalman filter for object tracking, and measured parameters such as position of vehicle, dimensions of vehicle, distance and speed of moving objects. For counting vehicles, moving objects are extracted from images.

M. Vargas et.al, [5] proposed a system for video based traffic density estimation. The system for traffic monitoring is adaptive to different conditions. They have included algorithms for detection of moving vehicles and steady vehicles. Foreground detection and feature tracking is included. Sigma-delta adaptation of background subtraction algorithm has been presented. Sigma delta adaptation keeps the simplicity and computational efficiency of the original method; hence robustness is achieved in background model in typical urban traffic scenes.

Shaif Choudhury et.al, [6] used a technique of haar feature-based classification for vehicle detection and counting. Haar like features which are generally used for face detection but in this system these are used for vehicle detection. They combined several features into a cascade, i.e. a sequence of tests on the image, each based on the results of one or more different Haar features. Object gets recognized after passing through all stages of classifiers. There are some steps like asset preparation, creating metadata and testing the classifier. Asset preparation is nothing but the training of image classifiers to detect the object.

3 THEORY

A. Background Subtraction

Background subtraction is a concept that belongs to areas like image processing and computer vision. Background subtraction is also known as the foreground detection. This technique is widely used to detect moving objects from video. In this technique, foreground of an image is extracted for further processing. It is the process of separating out foreground object of an image from the background in frames of video sequence. A background

subtraction is reliable and robust algorithm.

B. Morphological operations

Morphological operations are very useful in image segmentation because it directly deals with shape extraction in an image. After processing an image for enhancement or other operations like thresholding, there is more chance of distortion of an image due to some noise. Therefore there is chance for existence of imperfections in image. The aim of morphological operations is to remove such imperfections or noise which can affect the structure, shape and texture of image.

C. Contour Detection

A contour is basically a line or a curve having same color or intensity. Contours are mainly used to analyze shape and to detect and recognize the objects. To get better accuracy, we have used binary images. So we can apply thresholding on image or edge detection before finding contours. In this approach we have used contours to count number of vehicles.

D. Artificial Neural Network An artificial neural network consists of a pool of simple processing units which communicate by sending signals to each other over a large number of weighted connections. The neural network is a type of computer system architecture. It processes data by neurons arranged in layers. The corresponding results are obtained by modifying the weights of those neurons that are responsible for the error through the learning process. Neural network provides flexible mapping between inputs and outputs, this is a major advantage of neural network.

4 PROPOSED SYSTEM

Fig.1 shows basic block diagram for proposed system. Videos of the traffic are provided as an input to the system. For real time implementation we can mount cameras on the road and capture the videos. But here we have collected the videos and perform the algorithm on them.

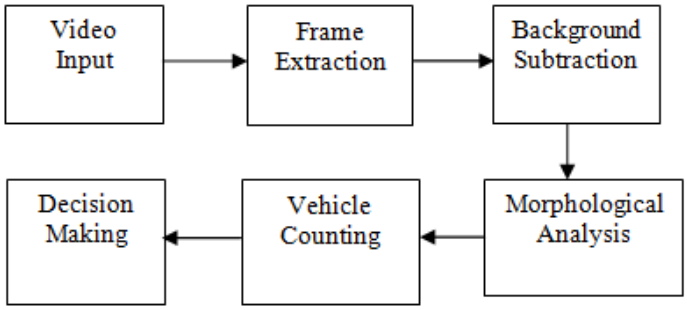

Fig. 1 Proposed System

To analyze the traffic density and allowing the run time for each road we have given the four different videos as input to the system. After applying video inputs, next task is to extract the frames from videos. Frame extraction will make the further processing easier. Then store the frames into any folder so that we can analyze those later if required. After frame extraction, next thing is pre-processing. For pre-processing here used the adaptive background subtraction method. In background subtraction foreground of an image is extracted for further processing. Here first frame is used as the background frame and other frames are subtracted from it. So that we can get only objects i.e. vehicles.

In pre-processing, next step performed is morphological operations on the output of background subtraction. Here erosion, dilation, and opening such morphological operations are used. So that to get clearer foregrounds (i.e. vehicles). Once we get the foreground or objects then vehicles are detected with the help of contours. Contours are used to count the vehicles. Contours will calculate the height, width, vehicle perimeter and vehicle perimeter. By counting the number of contours we can count the number of vehicles in each frame. This will give the vehicle count. Using these similar processes counted the number of vehicles in each video. This is the traffic density estimation. Then numbers of vehicles are provided as a feature to artificial neural network. Here ANN is used for the decision making. Artificial neural network works as classifier. Here the run time is allotted for the roads as per the number of vehicles on that road. For example, if the numbers of vehicles on one road are greater than any three roads then allow more run time to that road. At that time all

other traffic lights are red. Similarly, if the number of vehicles is less then allot the less time for that road. So here we achieve the less waiting time at the signals. We have used the 4 input layered, 20 hidden layered and 1 output layered feed forward back propagation neural network. Training data is provided to the neural network. This system is implemented on the Raspberry Pi board.

5 RESULTS AND DISCUSSION

Figures which are given below show the result of background subtraction. Fig.2 is first frame of video and it is consider as a background frame for all other frames since it doesn't have any vehicle and it gives the clear background. Fig.3 is a current frame which will be subtracted from the background frame so that we will get a foreground (in this case a vehicle). The result of background subtraction is shown by fig.4. We can see that, the foreground is detected by method of background subtraction. From the fig.4, it is observed that the result is quite good and the method is very effective.

We can see in fig.4, a result of background subtraction is better but still there is some noise and imperfection present. To remove this noise and imperfections morphological operations are used on a background subtracted image. Fig.5 is erosion operation. The erosion process enlarges the number of pixels of background and shrinks the number of pixels of foreground.

Fig.2 Background frame

Fig.3 Current frame

Fig.4 Result of background subtraction

Fig.5 Result of Erosion

Fig.6 Result of Dilation

Fig.7 Result of Opening

Fig.8 Result of Contour detection Vehicle counting

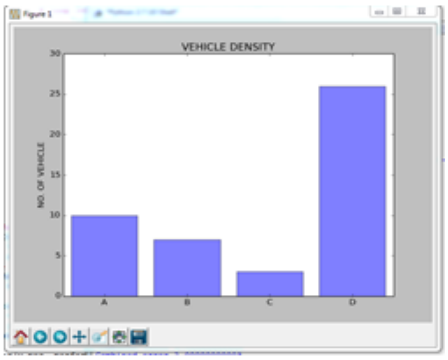

Fig.9 Plot of Number of Vehicles Vs Roads

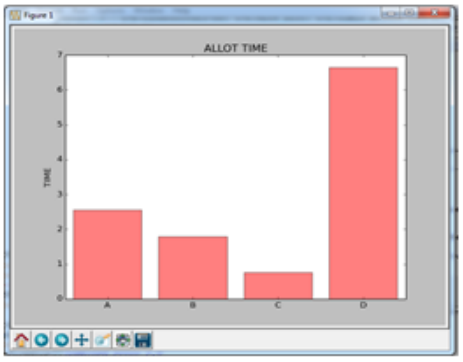

Fig.10 Plot of Allotted time Vs Roads

Erosion is analogous to sharpening high pass filters. Diation is shown in fig.6. The dilation process enlarges the number of pixels of foreground and shrinks the number of pixels of background. Dilation is analogous to smoothing spatial low pass filters.

Fig.7 is resultant of the opening. Opening operation is combination of erosion and dilation. In opening, first erosion takes palce and then resultant of erosion is dilated. Opening smoothes the outline of an object, clears the narrow bridges and also eliminates minor imperfections present in the object. By comparing the results of fig.4 and fig.7, after opening we ge clear foreground than background subtration. Therefore only background subtraction is not enough. Bacground subtraction followed by morphological operations gives best results. After opening we get the actual foreground that is vehicle in this case.

Fig.8 is showing the result after applying contour and detection of vehicle. The area for contour is decided such that it can only detect the vehicles. This contour gives count of vehicles. All these results give clear picture of the system. Figure 9 and figure 10 are plots for the traffic density and allotted time for each road. These are results for the videos in which there are 10, 8, 2, and 26 vehicles respectively at road A, road B, road C and road D. Here A, B, C, D are the different roads at signal. Figure 9 is for Traffic density which is plot of Number of Vehicles Vs Roads. Figure 10 is for allotted run time for each road. It is the plot of Allotted time Vs Roads. From figure 9 and 10 we can make table as given below. In this table, first column is road or the four videos. Second column gives the count of vehicles in respective video. Allotted time for each video is given in third column.

TABLE I. SAMPLE RESULTS FOR RUN TIME

Road	Number of vehicles	Run Time (Sec)
A	10	2.55
B	8	1.77
C	2	0.76
D	26	6.67

6 CONCLUSION

The traffic growth in terms of number of vehicles has led to traffic jams. The method used above of detecting and counting the vehicles and processing the duration of the traffic signal, can be used for controlling the traffic, avoiding traffic congestion, accidents, etc. Background subtraction is conventional method for object detection and gives clear foreground. To remove the noise

background subtraction is followed by morphological operations. The system is robust in nature and main advantage of this system is processing time of the system is less.

References

[1] R. Cucchiara, M. Piccardi and P. Mello, 'Image Analysis and Rule-Based Reasoning for a Traffic Monitoring System', IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, vol. 1, no. 2, pp. 119-130, 2000.

[2] L. Munoz; Xiaotian Sun; R. Horowitz; L. Alvarez, "Traffic density estimation with the cell transmission model", Proceedings of the 2003 American Control Conference, 2003. Year: 2003, Volume: 5 Pages: 3750 - 3755 vol.5

[3] Toms Rodrguez. "An adaptive, real-time, traffic monitoring system", Machine Vision and Applications, CVPR97 Proceedings of the 1997 Conference on Computer Vision and Pattern Recognition

[4] P. F. Alcantarilla; M. A. Sotelo; L. M. Bergasa, "Automatic Daytime Road Traffic Control and Monitoring System", 2008 11th International IEEE Conference on Intelligent Transportation Systems, Year: 2008 Pages: 944 - 949

[5] S. Toral; M. Vargas; F. Barrero; M. G. Ortega, "Improved sigma-delta background estimation for vehicle detection", IET Journals Magazines, Year: 2009, Volume: 45, Issue: 1, Pages: 32 34

[6] Shaif Choudhury, Soummyo Priyo Chattopadhyay, Tapan Kumar Hazra, "Vehicle Detection and Counting using Haar Feature-Based Classifier", 2017 8th Annual Industrial Automation and Electromechanical Engineering Conference (IEMECON), Year: 2017, Pages: 106 109

[7] K.A Ahmad, M.H Mohd Noor, Z. Hussain, Noramalina Abdullah, "Improvement Moving Vehicle Detection using RGB Removal Shadow Segmentation", 2011 IEEE International

Conference on Control System, Computing and Engineering, Year: 2011, Pages: 22 26

[8] Charls Barnwell, Dale Avery (2005), Building an Integrated GIS Transportation Network for Municipality of Ankarage, Http:// gis.esri.com/ library/ userconf/ procos/papers/ pap 2173.pdf.

[9] Zhao Nan Huang; Hua Biao Qin; Qing Liu, "Vehicle ROI Extraction Based on Area Estimation Gaussian Mixture Model", 2017 3rd IEEE International Conference on Cybernetics (CYBCONF), Year: 2017, Pages: 1 7

[10] Cover, R.K. Fletcher, D. R. Handerson, T.E.(1994) Emerging Information System Technology for Transportation T.R.No.171, TR News, TRB, NRC, Washington D.C.