Journal Of Harmonized Research (JOHR)

Journal Of Harmonized Research in Engineering
2(1), 2014, 120-125

ISSN 2347 – 7393

Original Research Article

TRAFFIC SIGNAL SYNCHRONIZATION USING VIDEO STREAMING

Priya Thakur*, Shruti Wankhade*, Gayatri Wavhal*

BE,Dept. of E&TC, V.I.I.T,Pune-48.

Abstract

In today's era, there is an emerging need for the introduction of an advanced technology which would be useful to improve the traffic control. It is important to know the road traffic density especially in mega-cities for signal control and effective traffic management. The objective of the paper is to deal with the real time traffic density for signal control and traffic management. This project involves video surveillance system using image processing techniques. The video is expected to have shadows of the vehicles present. Hence shadow removal is done to remove the error due to shadows. Blob analysis is done in order to classify the vehicles based on area calculations. Hence the density is calculated for a definite time slot. Signal synchronization will be done as an application of the traffic density calculation.

Keywords—Thresholding, shadow removal, LAB color space.

INTRODUCTION

Traffic analysis is required to obtain useful information such as real time traffic density and number of vehicle types passing these roads. Development of intelligent systems that extract traffic density and vehicle classification information from traffic surveillance systems is crucial in traffic management. This paper deals with traffic controlling which can be further extended to deal with banning of over-sized vehicles, making traffic signal time variable, time estimation for reaching a location, recommendation of alternate routes. Decisions like road widening, materials to be used, etc. can be made, exact verification of collection of toll charges, density measurement, vehicle tracking and classification can be done. This paper calculates the number of vehicles passing a particular road for a specific period and hence the traffic density. This is followed by the shadow removal in order to reduce errors. Eventually, synchronization of the signal is done accordingly.

In an intelligent transportation system, traffic data may come from different sensors such as

For Correspondence:
priyathakur0208@yahoo.in
Received on: February 2014
Accepted after revision: February 2014

loop detectors, ultrasonic sensors, radar, infrared or cameras, ultrasonic, and microwave detectors. These sensors are expensive with limited capacity and involve installation, maintenance, and implementation difficulties.

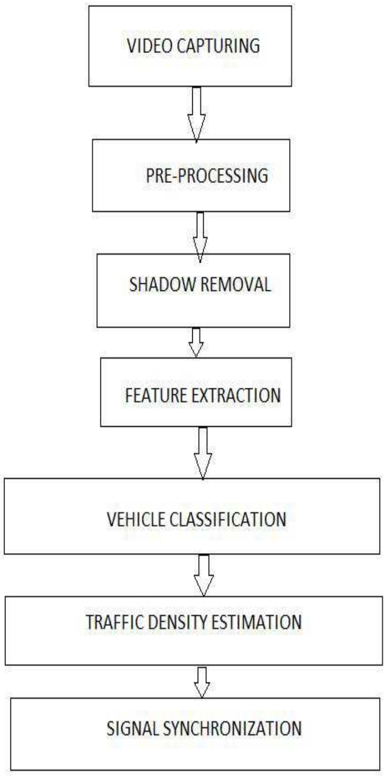
The use of video cameras coupled with computer vision techniques, offers an attractive alternative to other sensors. Video-based camera systems are more sophisticated and powerful because the information content associated with image sequences gives precise information. Detection of moving objects including vehicle, human, etc. in video can be achieved by background subtraction.

Background subtraction is a computational vision process of extracting foreground objects in a particular scene. A foreground object can be described as an object of attention which helps in reducing the amount of data to be processed as well as provide important information to the task under consideration. In background subtraction, background can be static, in which previously a fixed background is obtained and used in the entire process. We have employed this method in this paper.

Initially, we take a video for a particular period and convert a specific frame to gray scale image and subtract it from a static background frame. Then a threshold is applied to this difference image obtained in the previous step. Then a morphological operation like dilation is applied to the threshold image. Then the shadow removal is done using LAB color space algorithm. This is done in order to avoid any errors in the further processing of the video. We get a binary image showing the detected shadows in the frame. Then we extract features of the detected objects and use this information for counting the objects in the frame and hence the whole video. Using this count we can estimate the traffic density. The extracted features are then used to classify all the vehicles in the frame. The density of the road is then calculated using the count of the vehicles and based upon it the timing of the traffic signal is varied.

IMPLEMENTATION

Basic block diagram



1. Video capturing:

The input from video camera is considered. So the video is taken and stored for further processing.

2. Pre processing

Image pre processing is done to isolate the objects which we would require for further study. The video clip is divided into a number of frames and processing is done on them. The background is firstly fixed. All the frames are converted into gray scale images. All the frames are subtracted from the background to obtain only the vehicles. Then a threshold value is considered to convert the frames into binary. Morphological operations like dilation are performed to reduce the effect of errors.

3. Shadow removal:

The video is expected to have some shadows in it. These shadows can cause an error, as the area of the object increases if the shadow is also considered. Hence to reduce the error, the shadow removal becomes the essential part of the project.

4. Shadow removal:

Once the preprocessing is completed we implement a shadow removal algorithm to remove the shadow. Here we used LAB color space algorithm.

5. Feature extraction:

The frames are processed in order to extract the objects of our interest. The features are chosen such that we can get relevant information regarding the objects. In this project, the feature which we have extracted is the area. This is done to classify the objects.

1. Vehicle classification:

In the vehicle classification, the vehicles would be classified based on their areas.

2. Traffic density estimation:

All the different frames are considered for the counting of the vehicles. Some of the vehicles might come into two or more number of successive frames. Hence labeling is done in order to avoid repetition of vehicles while counting. The traffic density is calculated from the information obtained about the number of vehicles in the video per time period of the video.

3. Signal synchronization:

The main aim of the project is to achieve signal synchronization. Based on the traffic density calculation, the traffic signal timing is made variable. For a denser road, the duration of green light of traffic signal is made longer. Hence optimization of traffic on the cross roads can be achieved.

SHADOW REMOVAL IMPLEMENTATION

A shadow appears on an area when the light from a source cannot reach the area due to obstruction by an object. The shadows are sometimes helpful for providing useful information about objects. However, they cause problems in computer vision applications. For this paper, the shadow has to be removed as it may cause increase in the count. It may also result in increase in the area of the vehicle, leading to wrong classification.

i) Shadow detection phase:

In this work, shadow detection is done in LAB colour space. Initially the RGB image is converted to its LAB equivalent image. Then, based on the mean value of the image in A and B planes, one of the methods is selected for shadow detection. Since the shadow regions are darker and less illuminated than the surroundings, it is easy to locate them in the L channel since the L channel gives lightness information. The B channel values are also lesser in the shadow areas in most of the outdoor images. Thus combining the values from L and B channels, the pixels with values less than a threshold are identified as shadow pixels, and others as non-shadow pixels.

The major steps involved in the shadow detection phase are:

1. Convert the RGB image to a LAB image.
2. Compute the mean values of the pixels in L, A and B planes of the image separately.

1. If mean (A) + mean (B) ≤ 256

Classify the pixels with a value in L ≤(mean(L) – standard deviation(L)/3) as shadow pixels and others as non-shadow pixels.

Else classify the pixels with lower values in both L and B planes as shadow pixels and others as non-shadow pixels.

ii)Shadow removal phase:

Once the shadow has been detected after the use of the mentioned algorithm, the resultant image has white pixels for the region where the shadow has been identified. Other pixels are all dark. The coordinates of these white pixels are replaced by the pixels of the background corresponding to the same coordinates.

SOFTWARE ASPECTS

Simulation software like MATLAB with various toolboxes will be used for the proposed work. The video stream generated will be converted to gray scale to be used for the validation of the proposed work. Vehicle detection is done using thresh holding method. A threshold value is set which will convert gray scale images to binary images. Morphological operation of dilation (edges are thickened) is done to reduce unwanted small regions in the image.

This is done using the operation 'imdilate'.Also the operation 'imareaopen' is used to remove all the connected components that have less than a specified number of pixels. The disadvantage with thresh holding method is the selection of an appropriate pixel value so as to get a desired binary image.

MATLAB SIMULATION RESULTS

Fig.1: counting of the vehicles for density calculation (video processing)

Fig.2: original image with shadow

Fig.3:image with shadow removed

APPLICATIONS

It is important to know the traffic density in order to have an efficient signal control and traffic management. It can be used for estimation of time to reach from one destination to another and for classification of vehicles for traffic control. Depending on the density of the road, the traffic signal can be made variable. Correct estimation of the toll charges can be done. It can be helpful in selection of material for construction of roads and estimation of pollution emitted by the vehicles.

FUTURE SCOPE

The paper presents a method to calculate the density under proper illumination conditions. Further processing is required for calculations during night time. A night vision camera may be used for that. A larger number of signals on the cross roads may be synchronized if the angle is changed. Background updating would be required when there are illumination changes in the video that is captured by the camera.

CONCLUSION

This paper counts the number of vehicles and classify them in order to get the density for a specific time period. The shadows of the vehicles have been successfully removed in order to enhance computer vision and thus calculate correct density of vehicles. Based upon it the traffic signal is synchronized by making the timing of green light of the signal more for higher densities.

REFERENCES

[1]Mariagrazia Dotoli, Maria Pia Fanti, Carlo Meloni, *"Coordination and Real Time Optimization of Signal Timing Plan for Urban Traffic Control"*, Proceedings IEEE international Conference on Networking, Sensing 8 Control, 2004.

[2]Ikuko Nishikawa, Takeshi Iritani and Kazutoshi Sakakibara, *"Improvements of the Traffic Signal Control by Complex-Valued Hopfield Networks"*, International Joint Conference on Neural Networks, 2006

[3] Yinghua Lu, Huijie Xin, Jun Kong, Bingbing Li, Yan Wang, *"Shadow Removal Based on Shadow Direction and Shadow Attributes"*, International Conference on Computational Intelligence for Modelling Control and Automation, and International Conference on Intelligent Agents, Web Technologies and Internet Commerce,2006

[4] Jie Zhou, Dashan Gao and David Zhang, *"Moving vehicle detection for automatic traffic monitoring,"* IEEE Trans. Vehic. Tech. 56(1), 51-59, 2007.

[5] Cecil Ozkurt and Fatih Camci, Fatih University (Istanbul, Turkey),*"Automatic Traffic Density Estimation and Vehicle Classification using Neural Networks"*, Association for Scientific Research.

[6] P.M. Daigavane, P. R. Bajaj, M.B. Daigavane, *"Vehicle Detection and Neural Network Application for Vehicle Classification"*, 2011 International Conference on Computational

Intelligence and Communication Systems.
[2] Jun-Wei Hsieh , Shih-Hao Yu , Yung-Sheng Chen, Wen-Fong Hu *"Automatic Traffic Surveillance System for Vehicle Tracking and Classification"*, IEEE Transactions On Intelligent Transportation Systems, Vol. 7, No. 2, June 2006
[3] W. Zhang, X. Z. Fang, X. Yang, *Moving vehicles segmentation based on Bayesian framework for Gaussian motion model*, Patt. Recog. Let. 27, 956-967, 2006
[4] R. Waterfall, & K. Dickinson, *Image processing applied to traffic.* Traffic Engineering Control, 25, 60–67, 1984.
[5] X. Li, Z. Q. Liu, K. M. Leung, *Detection of vehicles from traffic scene using fuzzy integrals*, Patt. Recog. 35, 967-980, 2002.
[6] X. Ji, Z. Wei, Y. Feng, *Effective vehicle detection techniques for traffic surveillence systems*, J. Vis. Commun. Image R. 17, 647-658, 2006.
[7] J. B. Kim, H. J. Kim, *Efficient region-based motion*.