

Traffic Intensity Estimation Using Real Time Computer Vision System

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Abstract

For any on-line road traffic management system, estimation of traffic intensity has a crucial importance. In this paper, by using a real time computer vision system, road traffic intensity of vehicles is computed on a per lane basis. The system basically uses video streams obtained from a camera. Later, for the estimation of traffic intensity of video streams, vehicles are counted within the depicted area of each lane. For each calculation, the technique uses two sequenced video frames and later applies image processing methods on them. Eventually, the intensity information is presented including categories low, medium and high.

Key words: Traffic intensity, Computer vision, Image processing

1. Introduction

In parallel to the increase in population is also increasing the number of vehicles in traffic. Especially in large cities, with the growing use of vehicles in heavy traffic, is revealing many problems that urgently need to be worked out. For instance, traffic density is yielding increase of transportation time, energy costs by consuming more fuel and causing air pollution by emission of exhaust gas.

As one solution to these problems, recently, computer vision techniques applied on images taken from camera have become widespread in traffic management implementations. Many metrics are also able to be identified such as license plate, speed and model information of a car or number of cars in specified line by numerous applications. Getting these sort of processes (transactions) quickly in real-time, provides convenience both for the traffic controllers and people who use traffic. In order to solve the traffic problem, especially in large cities, accurate calculation of traffic density is essential for the development of early warning and automatic signaling systems, statistics, planning and some security applications. Moreover, intensity data can be used to help drivers for choosing optimal way among variety of routes.

In this study, by using a computer vision system a real-time traffic density estimation is performed. Density forecasting is done by monitoring the number of incoming and outgoing vehicles on a multilane road. Counting operation is accomplished with having several image processing steps on the frames taken from a specific road monitoring video.

There are numerous researches completed on vehicle counting and traffic intensity estimation in the recent literature. Soh et al. [1], have studied on counting number and detecting speed of

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vehicles in a particular traffic area. Similarly, Pang et al. [2], introduced new method on vehicle occlusion.

Chen et al. [3], developed a new system that counts vehicles in dark environments by using their headlights. On the other hand, Pornpanomchai et al. [4] studied on video vision for counting vehicles. As distinct from Pornpanomchai et al., Mohana et al. [5] studied on counting vehicles in real-time.

Maduro et al. [6], succeed to find velocity of vehicles and traffic density in their study. Similarly Wu and Gu [7] studied on finding velocity and density of vehicles but apart from Maduro and friends, their study was in real-time.

Ozkurt and Camci [8], studied on finding traffic density with using artificial neural network. At the same time Zhao and Wang [9] studied on counting vehicles in hybrid traffic zones.

This paper organized as: the next section deals with implementation and evaluation of the study. Section 3 presents our conclusion and future works.

2. Implementation and Evaluation

Implementation has achieved through images taken with a camera that is placed on two-way highway. It is accepted that the camera focus on center of the road. In this way, when we divide the image vertically, we can determine outgoing and incoming directions easily.

To find the traffic density, firstly we have to find how many cars are in road in a certain time slot. For this process, we have to use the process of counting vehicles that consist of six steps. In Figure 1, it is shown that what steps of process of counting vehicles are on pattern images. Firstly, in Figure 1(a), an image square is chosen from video. As we see in Figure 1(b), a image is taken from the next five frame of Figure1(a) (there are approximately 25 or 30 frames per each seconds and in our study for a minute, frames 570. and 575. are chosen). And then the difference between these two images are calculated as in Figure 1(c). Thresholding process is used to the image in Figure 1 (c) and image is converted to binary image as in Figure 1(d). Morphological process is used to the new image (Figure1 (d));

- First, image is cleaning from black spots and spurs with opening process.
- Then holes and white gaps are eliminated with closing process.

After these processes, conclusions are like as in Figure 1 (e) and (f). Finally, the image is divided vertically and counting process is started. For counting process, our application calculates how many sets are automatically through neighborhood of pixels in the image. In Figure (g), incoming side of road is shown and the result is 2, program is also realized the second car far away from the first one. In Figure 1(h) ongoing side of road is shown and the result is 2 again.

Traffic density calculation is based on the number of vehicles entering the camera's field of view. Application makes deduction of low intensity if the total number of vehicles in each line is between 0-2, medium intensity for numbers between 3-6, and high intensity for more than 6.

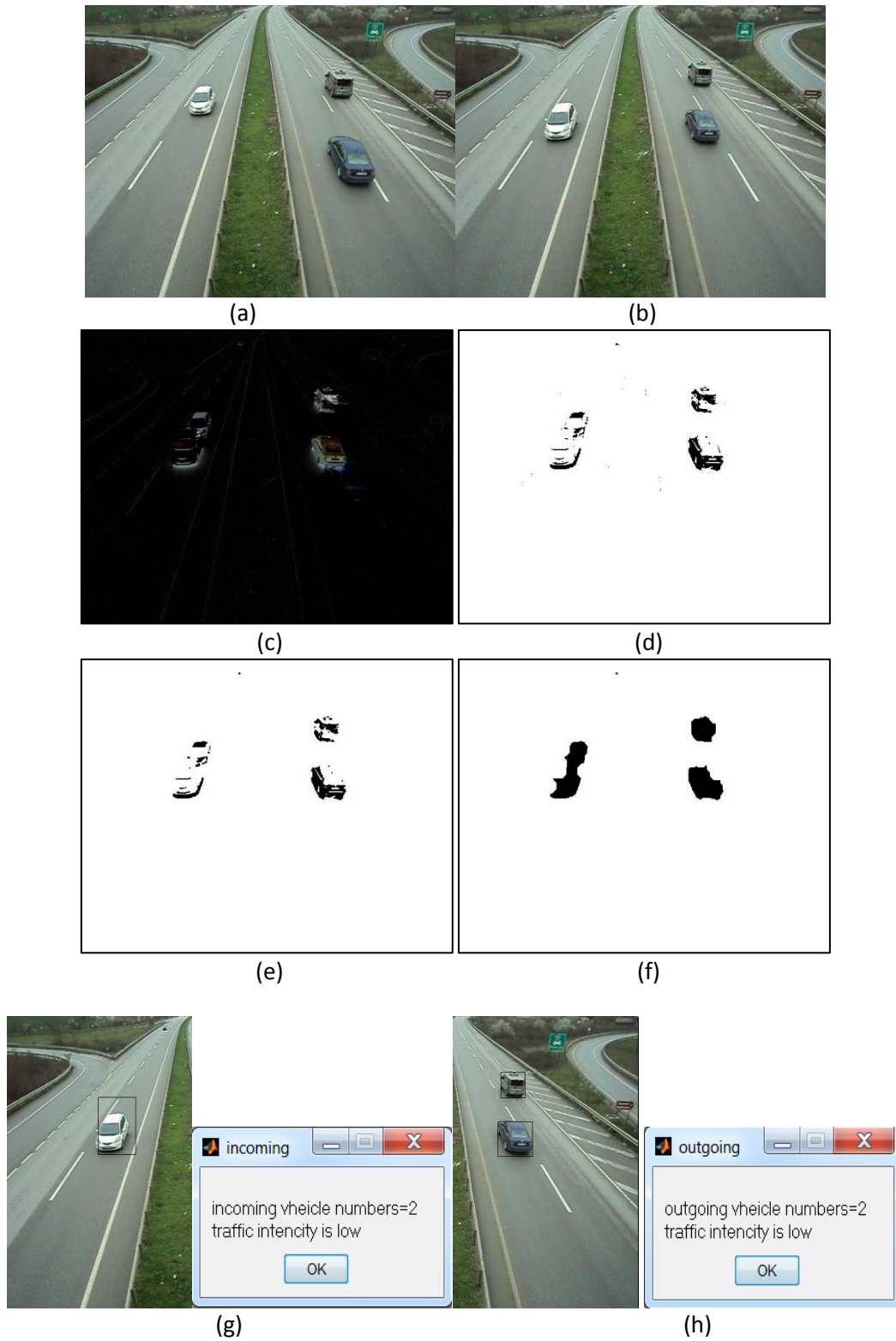


Figure 1. Image processing steps of calculating traffic density.

3. Conclusion

This work focused on traffic intensity depiction for each direction of two-way multilane road. Developed application fundamentally computes traffic density of the inputted video for a given time frame. After computing step, system provides conclusion to users in three different categories including low, medium and high density. Here, camera location is another key issue as well. The more pulled up taken videos will give more accurate results. In other case, vehicles could be visualized closer than they are and wrong estimation may occur during the counting process. As a future work, in order to reduce wrong estimation due to camera positioning deep counting techniques could be study.

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