Traffic Volume Survey Using Image Processing Technology

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1. Introduction

The primary method for measuring traffic volume on arterial roads in Indonesia is the combined use of an inductive loop and a piezoelectric sensor (LPS) as shown in Figure 1. However, this method lacks accuracy. Obviously, an LPS device cannot detect motorbikes that do not pass over it. Also, when several motorbikes are on the LPS device at the same time, they are counted as one vehicle or are not counted at all. In terms of durability, the LPS device often fails due to damage caused by overloaded vehicles. The labor and cost for monitoring and maintaining the sensors are considerable.

In this context, the Institute of Road Engineering (IRE) in Indonesia and the National Institute for Land and Infrastructure Management (NILIM) in Japan launched in 2010 a joint study to devise an optimal method for measuring traffic volume in Indonesia by using image processing technology (IPT). This is one of the activities based on a memorandum concerning cooperative activities that was concluded between the IRE and the NILIM in 2009.

2.Traffic measurement using IPT

We used an IPT device that involves the spatio temporal Markov random field model (S-T MRF model), which was proposed by Kamijo *et al.* [1]. As shown in Figure 2, when the device detects a moving object within the analysis area in the image, the device starts following it. If the object passes the first check line and the second check line in this order, it is counted as a vehicle. The device also measures the size of the moving object when it reaches the first check line, and can thus classify vehicle types.

3. Analyses and Results

By analyzing the traffic images obtained from field surveys on an arterial road in Bandung, Indonesia under several traffic conditions and camera settings (Figure 3), we verified the applicability of the IPT device to traffic volume survey in Indonesia and gained the following knowledge:

- The error ratio of traffic volume measured by the IPT device was on average 5.3% for cars and 13.1% for motorbikes.
- The error ratio for motorbikes tends to increase by 10.8% in congested traffic.
- Installing the camera at a greater height (up to 8 m) makes it possible to capture a longer movement of vehicles in an image, which helps reduce the error ratio.
- An angle of 60 degrees from the vertical is optimum to measure traffic volume accurately under conditions where the camera is 8 m from the ground and the traffic is not congested (Figure 4).

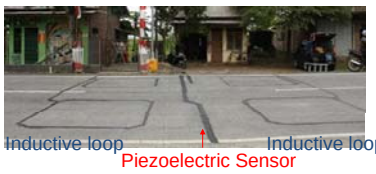

Figure 1 Configuration of LPS

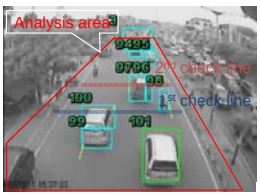

Figure 2 IPT

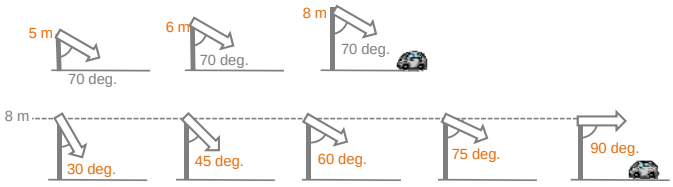

Figure 3 Camera settings

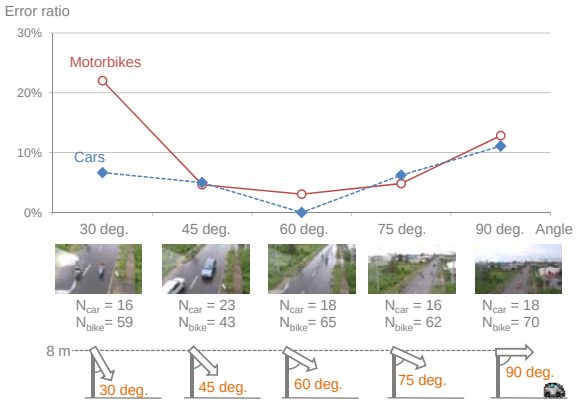

Figure 4 Error ratios with different camera angles

Reference

1) Kamijo, S., Matsushita, Y., Ikeuchi, K., Sakauchi, M. (2000) Occlusion robust vehicle tracking utilizing the spatio-temporal Markov random field model. Proceeding of Proceedings 15th International Conference on Pattern Recognition, vol.1, pp.140-144.