CHAPTER

4

MOVING VEHICLE COUNTING BASED ON THE TRIANGLE THRESHOLD METHOD

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4.1 INTRODUCTION

The development of Intelligent Transportation Systems (ITS) which extracts information from traffic surveillance systems plays an important role in traffic management. Inadvertently, a robust and reliable traffic surveillance system is crucial in ensuring better safety, directing smoother traffic flow, improving better traffic control in congested urban areas, and maintaining law and order of traffic and traffic signals (Asaidi et al., 2014; Raghtate & Tiwari, 2014).

In an ITS, reliable vehicle detection is the first step to be achieved (Dedeoglu, 2004). Subsequent applications such as vehicle counting, speed estimation and traffic flow depend on this first step. Hence, increasing the accuracy of the vehicle detection process will result in enhancing the efficiency of traffic control. Additionally, this will lead to improving the accuracy of other processes following it such as vehicle tracking, vehicle trajectory, and behaviour understanding which is common in traffic surveillance systems (Wang, 2010).

Different approaches have been proposed for vehicle detection such as frame differencing, background subtraction, optical flow, and feature-based methods (the details of the previous methods will be discussed in Section 4.2). This chapter proposes a new adaptive threshold for the background subtraction algorithm, i.e., the triangle threshold method. The entire process consists of four stages (background modelling, difference histogram, thresholding, and post-processing). The approximate median filter is used to model the background due to its simplicity and low processing time. The triangle threshold is applied over the difference histogram between the background model and the current frame. Finally, some morphological operations are applied to increase the efficiency of the detection. The technique has shown better performance when compared to the Adaptive Local Threshold (ALT) method (Zhou et al., 2007) and three-frame differencing method (Lin et al., 2015) for detecting and counting vehicles under different complex weather.

4.2 RELATED WORKS

Different vehicle detection methods using video cameras were discussed by Sivaraman and Trivedi (2013). Currently, vehicle detection is performed by using the background subtraction method, a technique that takes the difference between the current frame and the reference frame.

Parks and Sidney (2008) evaluated some popular background subtraction methods and examined the effect of post-processing techniques over these methods. It is clear from this study that setting an appropriate threshold has a big effect on the performance of vehicle detection results. Zhou et al. (2007) applied a static threshold to decide if each block of the subtracted image is a moving object or not. Also Lipton et al. (1998) used a static threshold to differentiate between the foreground and background. Nunes et al. (2011) applied a threshold using the first local significant minimum over the difference histogram to extract the moving object region. This method gives inaccurate results

when the difference histogram shows a non-monotonically decreasing behaviour. Mithun et al. (2012) used a range to specify the threshold parameters for vehicle extraction.

4.3 ALGORITHM DESCRIPTION

In this chapter, we propose an alternative method for thresholding the outcome from the background subtraction technique. The background subtraction method has been one of the standard methods for segmenting moving objects. In a nutshell, this is achieved by subtracting the current frame from the background model. From this difference, any stationary object or scene will be deleted and what remains will be those objects that have moved within these two frames. As shown in Figure 4.1, the proposed method block diagram consists of four stages. The first two stages are the same as in Nunes et al. (2011). The first stage is the background modelling, which is based on the Approximate Median Filter (AMF), the second stage is creating the corresponding difference histogram between each frame and the background model, the third stage is computing the threshold for each histogram for objects detection, finally, post-processing stage is applied to remove the noise using morphological operation.

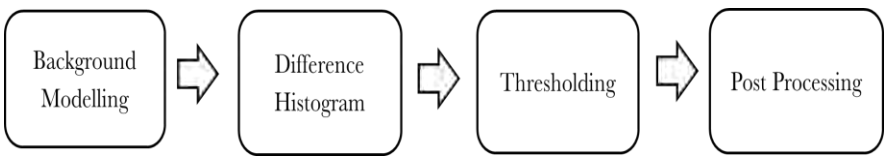

Figure 4.1 Block diagram of the proposed method

4.3.1 Background Modelling

AMF has been used to model the background due to its effectiveness and efficiency (Nunes et al., 2011). It compares the brightness value of the current frame with the brightness value of the background. If the brightness is larger or smaller than the background, the technique will