



An Alternative Vehicle Counting Tool Using the Kalman Filter within MATLAB

Daphne Espejel-García ^{a*}, Luis Ricardo Ortíz-Anchondo ^a, Cornelio Alvarez-Herrera ^a,
Alfonso Hernandez-López ^a, Vanessa Verónica Espejel-García ^a, Alejandro
Villalobos-Aragón ^a

^a Facultad de Ingeniería, Universidad Autónoma de Chihuahua, Circuito Universitario SN, Chihuahua, Chih., CP 31000, Mexico.

Received 16 October 2017; Accepted 25 December 2017

Abstract

This study proposes an alternative and economical tool to estimate traffic densities, via video-image processing adapting the Kalman filter included in the Matlab code. Traffic information involves acquiring data for long periods of time at stationary points. Vehicle counting is vital in modern transport studies, and can be achieved by using different techniques, such as manual counts, use of pneumatic tubes, magnetic sensors, etc. In this research however, automatic vehicle detection was achieved using image processing, because it is an economical and sometimes even faster option. Commercial automatic vehicle detection and tracking programs/applications already exist, but their use is typically prohibitive due to their high cost. Large cities can obtain traffic recordings from surveillance cameras and process the information, but it is difficult for smaller towns without such infrastructure or even assigned budget. The proposed tool was developed taking into consideration these difficult situations, and it only requires users to have access to a fixed video camera placed at an elevated point (e.g. a pedestrian bridge or a light pole) and a computer with a powerful processor; the images are processed automatically through the Kalman filter code within Matlab. The Kalman filter predicts random signals, separates signals from random noise or detects signals with the presence of noise, minimizing the estimated error. It needs nevertheless some adjustments to focus it for vehicle counting. The proposed algorithm can thus be adapted to fit the users' necessities and even the camera's position. The use of this algorithm allows to obtain traffic data and may help small cities' decision makers dealing with present and future urban planning and the design or installment of transportation systems.

Keywords: Image Processing; Kalman Filter; Automated vehicle Detection; Traffic Densities Counting; MATLAB.

1. Introduction

An accurate estimation of vehicle densities is considered as a significant factor for managing traffic operations in urban zones. Traffic information includes vehicle counting, speed measurements, determination of peak hours, number of pedestrians, etc. [1]. Large cities usually do not have problems acquiring such information, because they have an adequate infrastructure to obtain it such as surveillance cameras throughout the city, speed check points and continuous vehicle counting. However, in smaller cities, without such infrastructure or even an assigned budget, traffic data should be attained in a manual manner or by adapting available technology.

Typically, vehicle counting is achieved by using different techniques, such as manual counts, pneumatic tubes, magnetic sensors, inductive loops, piezoelectric sensors, acoustic detectors, passive infrared, doppler and radar microwave sensors [2, 3]. However, sensor measurements exhibit estimation errors, and sometimes, present difficulties to install and/or remain fixed. For optimizing vehicle counting, automatic video-based tracking systems are

* Corresponding author: despejel@uach.mx

 <http://dx.doi.org/10.28991/cej-030935>

➤ This is an open access article under the CC-BY license (<https://creativecommons.org/licenses/by/4.0/>).

© Authors retain all copyrights.