Detecting and Classifying Vehicles in Video Streams of Homogeneous and Heterogeneous Traffic Environments Using Gaussian Mixture Model

M.V.M. Jayathilake (viginimekala@yahoo.com)[1], S.G.V.S Jayalal[2], R.A.C.P Rajapakse[2]
[1] Sri Lanka Institute of Advanced Technological Education, Sri Lanka.
[2] University of Kelaniya, Sri Lanka.

Abstract

Traffic and transportation play an important part in modern national economics. Efficient use of transportation infrastructure leads to huge economic benefits. Traffic can be classified into two main categories as homogeneous traffic and heterogeneous traffic. In transportation engineering, sufficient, reliable, and diverse traffic data is necessary for effective planning, operations, research, and professional practice. Even though, Intelligent Transport System are used to find answers for that issue still it is not yet fully successful.

Many technologies have been developed to collect different types of traffic data. Traditional data collection technologies have several drawbacks. On the other hand, video based traffic analyzing has become popular. Computer vision techniques are used for detecting and classifying data in traffic videos. Those technologies are highly beneficial as it can give us more information about the parameters, easy to install and maintain and has got wide-range operation. In Computer vision, vehicle detection process has two main steps as Hypothesis Generation (HG) and Hypothesis Verification (HV). Background Subtraction is a popular method used in HG. There are several algorithms used in Background Subtraction and Gaussian Mixture Model is one of them. These methods are used in homogenous traffic situations. The objective of this study is to detect and classify vehicles from a homogenous and heterogeneous traffic video stream using Gaussian Mixture model.

This study was conducted using an experimental method. Several set of road traffic videos were collected. One is collected at off peak time; i.e. 9.00am to 10.00am. At that time behavior of the traffic is similar to homogenous traffic environment. The other set of videos is collected from 7.00am to 8.30am. At that time, road traffic has no order and the traffic density is high. It is similar to heterogeneous traffic environment. After Gray Scaling and Noise reduction, the videos were submitted to algorithm based on Gaussian Mixture Model. The algorithm was implemented using Math Lab software. Vehicles are classified as large, medium and small. Manual observation results and experiment results were compared. Accurate results were observed from homogenous traffic conditions. But results in heterogeneous traffic conditions is less accurate. The Gaussian Mixture Model can be used to detect vehicles in homogenous traffic conditions successfully, but it is needed to be improved in heterogeneous traffic conditions.

Keywords: *Detecting of Vehicles, Homogeneous / Heterogeneous Traffic, Gaussian Mixture Model*