AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Mechatronics Department

Toward a Real Time Vehicle Detection System

A Thesis submitted in partial fulfillment of the requirements of
Master of Science (M.Sc.) Degree in Mechanical Engineering
(Mechatronics Engineering Department)

by

Mohamed Ashraf Ali Yousuf

Bachelor of Science
(Mechatronics Engineering)
Faculty of Engineering, Ain Shams University, 2015

Supervised By

Prof. Sherif Ali Mohamed Hammad
Prof. Ahmed H. Yousef
Dr. Hossam Eldin Hassan Abdelmunim

Cairo, May 2019

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Examiners' Committee

Name and affiliation	Signature
Dr. Mohamed Abdallah Gaber Computer Science Department Faculty of computer science, Nile University.	.....
Prof. Hazem Mahmoud Abbas Computer Engineering and Systems Department Faculty of Engineering, Ain Shams University.	.....
Prof. Sherif Ali Hammad Mechatronics Department Faculty of Engineering, Ain Shams University.	.....
Dr. Hossam Eldin Hassan Abdelmunim Computer Engineering and Systems Department Faculty of Engineering, University.	.....

Date:

Statement

This thesis is submitted as a partial fulfillment of Choose Degree in Mechanical Engineering, Faculty of Engineering, Ain shams University. The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

Mohamed Ashraf Ali Yousuf

Signature

.....

Date:

Researcher Data

Name: Mohamed Ashraf Ali Yousuf
Date of Birth: 28/3/1992
Place of Birth: Giza, Egypt
Last academic degree: Bachelor of Science
Field of specialization: Mechatronics Engineering
University issued the degree : Ain Shams University
Date of issued degree : July 2015
Current job : Demonstrator at Mechatronics Department, Faculty of Engineering, AIN SHAMS University

Thesis Summary

Autonomous vehicles are one of the international future goals. Streets that have autonomous vehicles lead with efficiently developed software, can reduce the number of accidents caused by human factors. An efficient vision system that can identify the vehicle surrounding environments (Such as vehicles, traffic signs, road signs, etc.) is essential for the success of autonomous vehicles. Vehicle detection is one of the basic elements in the autonomous vehicle vision system. A lot of attention has been paid for this topic, but optimization is needed to reach a reliable detection system.

The objective of this thesis is to develop and implement a reliable vehicle detection system using computer vision techniques on Graphical Processing Units (GPUs), making a comparison between a classic vehicle detection system "Compass HOG" and a modern vehicle detection system "YOLO V2", making a comparison between vehicle detection systems on CPU and on GPU , implementing a GPU-based computer vision approach for vehicle detection by studying different techniques based on deep learning to make image classifications, in order to choose the best one that fits inside the different vehicle detection techniques that based on deep learning. These CNN architectures for vehicle classifications are ResNet, InceptionResnetV2, InceptionV3, NASNet, MobileNetV2, and PNASNet architectures. Also, there are two different datasets have been trained in these architectures to evaluate them. These datasets are Kitti dataset to train on car detection only, in additions to MIO-TCD dataset to detect various types of vehicles. For vehicle detection based on deep learning, Faster R-CNN, YOLO "You Only Look Once", and SSD "Single Shot Detector" have been compared in this thesis in speed an accuracy perspectives, in order to choose the best suitable one among the others.

Keywords: Deep-learning; CNN; ResNet; InceptionV3; Inception-ResnetV; MobileNetV2; NASNet; PNASNet; Vehicle-detection; classication; Kitti; MIO-TCD dataset; Faster R-CNN; YOLO; SSD.

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