VEHICLE DETECTION AND COUNTING FROM UNMANNED AERIAL VEHICLE (UAV)

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VEHICLE DETECTION AND COUNTING FROM UNMANNED AERIAL VEHICLE (UAV)

ANG KUAN KEE

This report is submitted in partial fulfilment of the requirements for the Bachelor of Computer Science (Artificial Intelligence)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2015

DECLARATION

I hereby declare that this project report entitled

VEHICLE DETECTION AND COUNTING FROM UNMANNED AERIAL VEHICLE (UAV)

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT :_____ Date:_____

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SUPERVISOR :_____ Date:_____

(DR. ASMALA BIN AHMAD)

DEDICATION

I would like to dedicate my final year project report to my beloved family, friends and my lecturers. For my supervisor, Dr. Asmala Ahmad and my evaluator, Dr Sharifah Sakinah, always guiding, comment and helping me to complete up this project. Besides that, family is the one always give me spirit support and life-long love to me. They have been very supportive and encouraging in completion of my thesis and throughout the years of my studies. Furthermore I also would like to dedicate to the friends who have been supportive and helpings throughout the project development.

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ABSTRACT

Efficiency traffic management is important in order to manage the traffic efficiently especially during unexpected situations. To do so, continuous and reliable information on traffic situation is important to users so that they can plan their route by avoiding traffic congestion. UAV images are an important means by which detection and classification of vehicle can be carried out to assist the traffic management. This is done by capturing the latest information of the road situation and reporting it to road users. In this study, I develop a procedure to detect and count the number of vehicles from three different height categories of UAV images. Initially, two unsupervised classification methods, ISODATA and K-Mean, are considered to separate vehicle and non-vehicle pixels from the UAV images. The study were conducted in two phase; phase one is classifying the objects within the image and phase two, determining the total number of vehicles within the image. Firstly, the unsupervised classifications were implemented and analysed to cluster similar pixels within the selected region. Secondly, region resizing is carried out to reduce the portion which is non-relevant from an image. In order to get the total amount of vehicles in an image, a standard amount of pixels for a single vehicle is computed. The accuracy assessment in this study is measured by means of accuracy and error percentage. This is done by comparing between the actual numbers of vehicle with the number of vehicles computed from UAV images. For both classifiers, low category images are found to have the highest accuracies. Further study needs to focus on an automated technique of resizing the region to reduce the non-relevant portion from an image in order to get the exact regions of vehicles.

ABSTRAK

Pengurusan trafik yang cekap adalah penting bagi menguruskan lalu lintas dengan cekap terutama semasa dalam keadaan yang tidak dijangka. Untuk berbuat demikian, maklumat keadaan trafik yang berterusan dan boleh dipercayai adalah penting kepada pengguna supaya mereka dapat merancang laluan mereka dengan mengelak kesesakan lalu lintas. Imej UAV adalah penting yang mana pengesanan dan pengkelasan kenderaan boleh dilakukan untuk membantu pihak pengurusan lalu lintas. Ini dilakukan dengan menangkap maklumat terkini keadaan jalan dan melaporkan kepada pengguna jalan raya. Dalam kajian ini, saya membangunkan prosedur untuk mengesan dan mengira bilangan kenderaan dari tiga kategori ketinggian yang berbeza imej UAV. Pada mulanya, dua kaedah klasifikasi tanpa pengawasan, ISODATA dan K-Min, digunakan untuk memisahkan piksel kenderaan dan bukan kenderaan dari imej UAV. Kajian ini telah dijalankan dalam dua fasa; fasa pertama mengklasifikasikan objek dalam imej dan fasa kedua menentukan jumlah bilangan kenderaan dalam gambar. Dalam fasa pertama, klasifikasi tanpa pengawasan telah dilaksanakan dan dianalisis untuk kelompok piksel yang sama di dalam rantau yang dipilih. Dalam fasa kedua, pensaizan rantau dijalankan semula untuk mengurangkan bahagian yang tidak berkaitan daripada imej. Dalam usaha untuk mendapatkan jumlah kenderaan dalam imej, jumlah piksel piawan bagi kenderaan tunggal dihitung. Penilaian ketepatan dalam kajian ini diukur berdasarkan peratusan ketepatan dan kesilapan. Ini dilakukan dengan membandingkan antara jumlah sebenar kenderaan dengan bilangan kenderaan yang dihitung dari imej UAV. Bagi kedua-dua pengkelas, imej kategori rendah didapati mempunyai ketepatan tinggi. Kajian lanjut perlu memberi tumpuan kepada teknik pensaizan rantau secara automatik bagi mengurangkan bahagian yang tidak berkaitan daripada imej untuk mendapatkan kawasan sebenar kenderaan.

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CHAPTER I

INTRODUCTION

1.1. Introduction

Transportation has long become an essential means for people to travel from one place to another. Among all modes of transportation, land transportations have been known to have the most users due to their practicality and affordable cost. With the increase in the world population, the number of land transportations particularly car, bus and truck are also increasing drastically in all parts of the world. Although giving good impact to economy, failing to manage the traffic of these vehicles properly may cause a negative consequence, especially for developing countries like Malaysia.

Nowadays, people start to have concern on traffic situation at their living and working areas. Traffic situation already is as a part of daily life of people. This is because no matter where they want either to go to school study, working, playing or anywhere, they still need vehicle to send them going to the right destination. Heavy

traffic situation, undeniably, will bring the negative effects to them such as those in terms of emotional, punctually attending, driving attitude and others.

Besides that, vehicle theft cases are rapidly increasing. Therefore, we need a system which can help us to detect stolen vehicles so finding back stolen can be carried out more effective. Therefore we need a more up-to-date approach to detect vehicles on the earth surface so that searching tasks can be done immediately and effectively.

This project aims to detect and count vehicles from unmanned aerial vehicle (UAV) imagery. The result obtainedcan greatly help authorised agencies in traffic management. By knowing the amount and location of vehicles, the relevant authorised agencies can can update the latest and accurate information to motorists so that they can plan their journey in a more efficient way. They will have more alternative way to prevent situations such as traffic jam, accident and other. Besides that, the traffic information enable motorists to plan their road trip and arrive the destination on the right time and safety to prevent being trapped in heavy traffic.

In carrying this project, image processing techniques are used to detect and count the number of vehicles, which include classification, enhancement and thresholding.

UAV image is the source to be processing in this project. UAV also named as unmanned aerial vehicle. It is a aircraft without human pilot. It is also act a remote sensing to get more information or detail toward the object by detecting and classify the objects on Earth. Therefore, it will through this aircraft to collect the source or situation on the road. Therefore, i will use the source to done the processing of detection and classification to identify the result.

Shi et al. (2012) reported that, UAVs are better than traditional manned aircraft or other remote sensing operator. The reason they stated that is UAVs are no require any high cost platform and it can reduce the error or effect come by human instead of automate to remote it and sensing control itself. Besides that, UAVs also enable produce high resolution images and given accurate data result by the navigation sensor. Therefore, it can give an effective supplement work. So that, it have the strength to detect alter between object of image over the time.

1.2. Problem statement

Traffic information is nowadays being more concerned by a motorists using the road to travel to different places. However, the amount of vehicle is increasing day by day. Road traffic needs to be efficiently managed to prevent road accident, serious traffic jam and others. Such situations can cause negative effects not only to motorists but also others. The convensional approaches of managing traffic is by police patrol and CCTV. Nevertheless, such approaches are logistically expensive and not practical for large areas because the need to place a large number of police patrol and CCTV in order to manage traffic. Therefore an improved way for traffic management is critically needed especially to provide motorists with the latest traffic condition and to help detecting stolen vehicles.

1.3. Objective

This project embarks on the following objectives:

1. To identify methods for car detection and counting from UAV.
2. To propose suitable framework of image processing techniques for car detection and counting from UAV.
3. To evaluate the performance of the techniques.

1.4. Scope

In the study, I divide the scopes into four parts which are software scope, data scope, area of study scope and user scope.

i. Software Scope

In this project, it will mainly use two software tools to complete it. There are ENVI 4.5 toolbox and Matlab R2010a. ENVI toolbox is for purpose to process the image, classified the object and analysis the imagery. However for the Matlab toolbox just as an assistance tool to complete the task after generate the output from ENVI toolbox. Besides that, it also will useful in analysis part the result.

ii. Data Scope

The data that will be used in this project is collect from Unmanned Aerial Vehicle. It will collect the image from certain area. It also enables collect movement image with support more clearly image to be done analysis. Therefore, it can be done detection and segmentation directly and effective. However, in this project, there are just focuses on certain type vehicle such as car, lorry and bus. The reason there are just focuses on this few type of vehicle is because this type of vehicle only always get the more spacing on the road and affect the traffic situation. Besides that, their size is bigger, this will cause the detection done in smooth and result

will be more precious. Furthermore, our data scope only had done the detection on certain intensity value only. Due to UAVs image is RBG, therefore in this project it will focusing on certain colour of vehicle.

iii. Area of Study Scope

Malacca was chosen as my focus area of study scope. Malacca is a famous state which also named as historical state. Therefore every year, season, they also successful attract thousands of visitor come from everywhere. So that, traffic jam will be always happen especially on certain peak hour or festival such as working hour or public holiday. Therefore, the traffic situations on Malacca state are requires more emphasize than other place.

iv. User Scope

The significance will be bring out from this project is useful for the researcher. The researcher can through the output as a reference material for them to further this project and enhance it to be better.

1.5. Project Significance

This project will be benefit toward government traffic management particularly to determine the amount of vehicle using certain road. Therefore, it can help toward reporting the traffic situation to the motorists. In this way the motorists can have alternative travel planning in advance in order reach journey in a faster and safer way. Besides that, government also can get to know the requiring of motorists to make the adjustment to improve the situation such as enlarging the road size to suit the capacity of vehicles using a particular road. In addition, this project can decrease the number of stolen vehicles by providing information regarding the location of the stolen vehicles in a shorter time. .

1.6. Expected Output

The expected result from this project is a processed image can provide the information regarding vehicle location and amount. This will greatly assist authorized parties in getting information regarding traffic situation on particular road and convey it to traffic management to do some improvement work or update latest news to the motorists. In addition, it also brings a lot of convenience for the particular relevant unit to identify or track certain vehicle on the particular road. This will be very useful especially for the police when they are requiring tracing somebody or some cases.

1.7. Conclusion

This chapter are just brief on this project idea and direction. I have provided the rationale for carrying this project and highlighted the problems long faced by motorists. I believe this project will have significant impact to the societies upon its completion.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter reviews studies and information related to vehicle detection and counting. Literature review acts as a primary reference towards completion of this project. Discussion on previous research which is related to the project topic is discussed in detail. Literature review also is an important to prove that project is possible to be carried out. In my project, literature review are as a reference for me to ensure my project are work in the scope without go to digress. Besides that, through the review, it brings out a background for my project to propose a suitable technique in my project. Therefore, it assisted me in writing the analysis to get the right view when developing the project.

Literature reviews from journal and research papers are more emphasize on several part which are result and discussion. Through the result we can identify the outcome from their research and for the discussion it help us to determine the

significance of project and problem for further future research. Therefore, from the result and discussion of paper, it can carry out the abstract of that project. Trusted or pure original sources are important. That is because it will be as a guidance of my project, therefore in my project I just will reference the most recently paper to avoid some conflict.

2.2 Type of vehicle

This project concerns on detection of few certain types of vehicle only. In general, vehicles can be categorised as below.

Heavy vehicle are differentiate into many class, there are:

For a normal rigid truck size dimension is: