CHAPTER I
INTRODUCTION

1.1 Background

Nowadays, the rapid growth of vehicles is a common problem in Indonesia. This situation is affected by people's lifestyles, especially in urban areas, where people need a fast movement from one place to another. It causes inevitable traffic problems such as traffic congestion, traffic accidents, delayed departure schedules, and greater vehicle emissions. Several solutions were offered to overcome these problems, one of them is the safety system implementations such as airbags, safety belt, and the constant improvement of road and highway construction. However, building roads is not the right solution to cut traffic congestion, because it is very expensive and requires a very large space which becomes the urban area's limitations. On the other hand, transportation infrastructure is very important for economic growth. Therefore, this thesis will try to figure out a compromise solution to reduce the traffic crimes.

Intelligent Transportation System (ITS) is a global topic that attracts worldwide attention from transportation professionals, automotive industries, and politics. ITS combines the transportation system with information and communication technology (ICT) systems to carry out advanced communication, information, and electronic technology that can solve the traffic problems. By utilizing ITS technology, vehicles become more efficient, environmentally friendly, and certainly safer. While conventional vehicles rely on drivers only, modern vehicles will merge artificial intelligence system technology to support the drivers, as explained in Figure 1.1 [1]. Because ITS combines drivers and artificial intelligence, ITS is expected to be able to overcome the mentioned traffic problems.

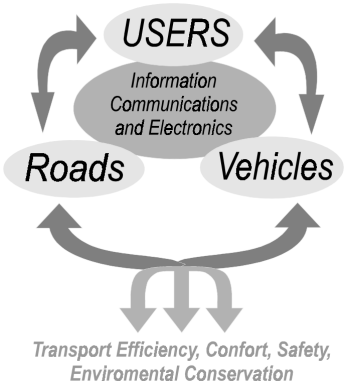

Figure 1.1: ITS in General

ITS utilizes several fields of technology to support traffic functions, one of them is surveillance system technology that utilizes object detection feature. A surveillance system is an important technology that must be implemented in traffic because it can prevent and overcome traffic crimes such as hit-and-run, robbery, theft, etc. A large number of cases and the amount of time needed to solve caused many cases to be delayed and even dismissed. Therefore, a computer vision-based traffic surveillance system is needed with expectations to help to prevent and resolve traffic crimes.

In terms of object re-identification, most previous works focus on a human face or person identification. Different from the face or person re-identification, vehicle re-identification is more challenging as it is very difficult to discriminate vehicles with a similar visual appearance which belong to the same model. In other words, the inter-class (inter-ID) difference can be very subtle. There even exist newly produced vehicles which look the same. Usually, vehicle re-identification can be done by detecting and reading the vehicle plat number, but in any case, the plate number can be faked or not recognizable due to the image resolution.

Based on the explanation above, an object detection-based method to do the vehicle re-identification task should be proposed by analyzing the vehicle attributes like the front glasses, an object that sticks on the front glasses, etc. To do its job properly, the detection system that applied to the traffic control system must be able to work quickly and accurately [2]. This thesis will also modify the loss function of the method so it can increase the accuracy of the detector.

1.2 Problem Identification and Objective

To perform an object detection task to a real-life traffic vehicle, we must provide a good quality of image to detect a small object. On the contrary, almost of detection

system focuses on speed/accuracy trade-off only, not the image quality. Therefore, this thesis will modify an object detection on its loss function and the architecture. The proposed loss function gives the system more weight of positive samples than the negative samples. The loss function is expected to increase the accuracy of the object detection system. This thesis also combine an architecture and detector to do a vehicle detection in the high quality image resolution.

1.3 Scope of Work

The assumptions and limitations of the problem in this thesis are:

1. This thesis performs an object detection-based image re-identification on a non-modification vehicle image using Open Image Dataset.
2. This thesis will do a detection simulation using HRNet and FCOS to detect vehicle.
3. To improve the detection system accuracy, this thesis modifies an algorithm in a layer called a fully connected layer in the detection architecture.

1.4 Hypothesis

By modifying the loss function of the one-stage detector method, the modification will increase the weight of the positive sample so it does not lose out to the weight of the negative sample. The author conducts a simple error calculation from the classification probability produced from back-propagation in the fully connected layer. Table 1.1 shows that the error from the proposed function with the focal weight of two is the smallest compared to the other error function. It means that the weight of the positive samples not overwhelmed by the negative sample weight. So, the author expects that the proposed function will increase the accuracy of the system.

Table 1.1: The comparison of loss function error

p_t	CE	MSE	$ProposedFunction, \gamma = 2$
0.7	0.154	0.09	0.014
0.6	0.221	0.16	0.035
0.5	0.301	0.25	0.075

1.5 Research Methodology

The methodology in the process of completing this research consists of several stages, namely:

1. Conduct literature studies by searching and understanding journals, articles, and the web as well as other sources related to the final project.
2. Design a system with a structural approach in the form of flowcharts.
3. Implement the system using simulation software.
4. Conduct an experiment on each changed parameter and evaluate the work of the system.
5. Analyze the system results by comparing all the results of previous experiments and drawing conclusions.

1.6 Structure of Thesis

The rest of this thesis proposal is organized as follows:

- CHAPTER II: BASIC CONCEPT
  This chapter will describes the basic concept of Neural Network including the general explanation about images pre-processing, data collection, and object detection.
- CHAPTER III: SYSTEM MODEL AND METHOD
  This chapter will discuss the Neural Network model and the parameters used in this thesis.
- CHAPTER IV: EXPERIMENT AND ANALYSIS
  This chapter will discuss the experiment of the modified method and the result of the experiment.
- CHAPTER V: CONCLUSIONS
  This chapter contain the conclusion of the thesis.