

Analysis of Criminal Behaviors for Suspect Vehicle Detection

Ubong Thongsatapornwatana*[†], Woraphon Lilakiatsakun*, Akkarach Kawbunjun[‡], and
Tossapon Boongoen[§]

*Faculty of Information Science and Technology, Mahanakorn University of Technology, Thailand
Email: ubon.t@dti.or.th, woraphon@mut.ac.th

[†]Defence Technology Institute, Ministry of Defence, Thailand

[‡]Department of Fisheries, Ministry of Agriculture and Cooperatives, Thailand
Email: akkarachk@fisheries.go.th

[§]School of Information Technology, Mae Fah Luang University, Thailand
Email: tossapon.b@mfu.ac.th

Abstract—The crime problems become critical issues for national security especially the security of border and intelligent transportation systems (ITSs). These affect the economy, investment, tourism, and society. As a result, the automatic suspect vehicle detection emerges as one of effective tools to tackle the problems. However, the traditional process normally uses criminal vehicle data in blacklist comparing with vehicle data gathering from various sensors. This comparison is not effective and accurate that might be from not up-to-date data in the blacklist. Sometimes the blacklist is not available. This paper proposes the criminal behavior analysis method to detect suspect vehicles that are potentially involved in criminal activity. It must not rely on the blacklist. The analysis is conditional on journey path and the involvement of criminal activities. In addition, public officials believe that the suspect vehicle will choose the journey path without a checkpoint. Therefore, we used the journey path analysis techniques together with the association rule mining to analyze such criminal behavior. From extensive experiments, the results show that the proposed method can increase the suspect detection accuracy rate 17.24% beyond the traditional counterpart.

Index Terms—Suspect Vehicle Detection; Crime Pattern Analysis; Transportation Safety;

I. Introduction

Criminal and illegal incidents become the critical issues in national security. These affect the safety of life and property of the officers as well as the people living in the areas. Furthermore, it can impact on economy, investment and tourism negatively, and lead to damages to the country. Despite governmental resolutions, there are still many crime events and frequent attacks. As a consequence, the automatic suspect vehicle detection becomes an important trend in the security of border and intelligent transportation systems (ITSs).

At present, there are many varieties of techniques commonly exploited for detecting vehicles such as automobile license plate recognition (ALPR), vehicle color recognition, vehicle type recognition, vehicle brand recognition, and vehicle model recognition. These techniques rely mostly on smart camera sensors to collect and recognize different identities of vehicle. Data obtained from sensor can be used to identify location (latitude, longitude, name of installed area, and checkpoint's name), passing timestamp, and passing direction. Besides that, criminal vehicle data in a blacklist together with criminal activity information are normally employed to yield the capability of suspect vehicle detection.

However, the blacklist may be not up-to-date due to that fact that crime is an ongoing process and changes over time. To this end, significant information can simply not be available for the aforementioned detection scheme. Such events can lead to errors in detecting suspect vehicles. Therefore, modeling such an approach to overcome this limitation becomes an emerging research subject.

To this end, the criminal behaviors analysis can be used to solve the problems previously mentioned. It provides the capability of detecting suspect vehicles without having to consult with the blacklist. In particular, public officials strongly believe that the suspect vehicle will choose the journey path without a checkpoint and use that vehicle to commit a crime. For such a cause, this paper presents a framework for criminal behavior analysis based on the journey path analysis techniques. Additionally, association rule mining is also used to analyze the vehicle that may be involved in criminal activities. Therefore, when a vehicle appears on the journey path as to avoid the checkpoint and get