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A Study on Development of Driver Protection System Based on Artificial Intelligence

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Abstract
Traffic volume, speed, occupancy, vehicle length, etc. are collected through Vehicle Detection System. This makes it possible to distinguish the speed difference at each point by VDS. It is possible to judge the section where the traffic flow is quite different as the danger zone. By combining this with artificial intelligence technology, it is possible to develop traffic prediction service and automatic classification of traffic risk. As a result, it is judged that a traffic accident can be prevented in advance. We have classified the overspeed interval and the deceleration interval automatically by vector data analysis. And, We have studied the method of estimating the traffic danger zone sequentially. In this paper, we propose a method for daily analysis of the rapid deceleration section and a method for the automatic classification of traffic risk by scientific analysis using the big data analysis of the vector method.

Keywords*: VDS, Vector method, Traffic risk, Over-Speeding, AI*

1. INTRODUCTION

The social and economic losses incurred in recent traffic accidents are enormous, and related research and policy research using state-of-the-art ICT is being carried out to address them. Transportation system that uses artificial intelligence and transportation infrastructure that fits with the times are expanding and efficient. In other words, advanced intelligent transportation systems are effectively analyzed and various methods are being created to utilize the results. It is also a time when a driver's protection system is needed on roads that fit the time when self-driving is being prepared. As such, the collection, statistics, and utilization of VDS equipment, which is a vehicle detector installed on the road, can be proposed. If predicted information such as signs of speeding at the expected point of accident and signs of accidents between rapid and slow sections can be identified in light of the characteristics of traffic accidents, the predicted prevention of accidents, traffic congestion response and death accidents can be prevented in advance. And if the accident analysis method is used as a basis for upgrading the future, it can also be used to determine the efficiency of financial investments.

If this data-based traffic accident analysis is attempted with artificial intelligence and the results are developed with a safe driver protection system, the need to establish an artificial intelligence-based driver protection system will further increase. In the future, the risk on the road will be reduced gradually if the artificial intelligence-based big data analysis system is combined with traffic accidents, traffic jams and driver's licenses and administrative disposals. In this connection, this paper analyzed VDS data into the initial model as the basis for converging various data, and based on it, basic ideas and results on how to build and utilize it as an information system were derived. The conclusions drawn from this paper suggested the use and introduction of the installation of traffic-controlled equipment for future hazardous areas. In other words, it can also be developed into a study of the adequacy of the installation location to continuously reduce and efficiently operate traffic accidents. This study attempted quantitative analysis through the collected VDS vehicle detector data, and after considering the methods of artificial intelligence analysis to protect rural areas and high-risk drivers, it was intended to draw assistance in making decisions and plans related to future traffic accidents.

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2. NECESSITY OF AI DRIVER SAFETY SYSTEM

A. High traffic accidents in rural areas

Among all traffic accidents, traffic accidents among senior citizens in rural areas are increasing. In response to this trend, text-mapping was conducted based on accident data. The most frequently seen words were keywords related to traffic violations, centerline intrusion, and pedestrian crossing, and in particular, many keywords for special longevity, such as markets, were derived. This, when put together, shows that older pedestrians and drivers in special areas have positions that require particular attention. In other words, it was believed that the analysis of past data could predict the model of the future occurrence of traffic accidents in rural areas and outlying areas.

B. High-Risk Drivers

This can be useful information if certain violations of the law are related to human characteristics, such as the sex, age and driving experience of a car accident. It is possible to select a group of high-risk drivers who are more likely to violate the applicable laws and to design customized driver training programs based on them.

Based on the results, an automated AI-type driver safety system model can distinguish high-risk groups with high probability of signal violation after drawing a correlation between human characteristics and legal violations. [1]

Table 1. Comparison of High-Risk Group

Type of violation	High-risk group	percentage
signal violation	Women driving passenger cars and corporate taxis among drivers aged 31 and over 37 years of age	23.8%
central line offender	Under 51 years of age among men who drive cars	35.8%
Violation of pedestrian protection obligations	woman driver	27.0%

In addition, it can be effective to identify the points where traffic accidents occur frequently and to adjust the number of places where traffic accidents occur more frequently through artificial intelligence data analysis by comparing the degree of matching with speeding control points.

3. ANALYZE COLLECTED TRAFFIC DATA

A. Analysis of VDS Data

Vehicle detection systems (VDS) are equipment that gathers data on traffic conditions such as speed, traffic volume and market share of a driving vehicle.[2] A system that is the basis of vehicle operation management since the position of the vehicle in motion is identifiable, using a detector installed on the roadside light road to collect traffic information on the vehicle. The information collection system consists of the sensor part that detects vehicle signals, the control unit that converts the detected signals into traffic information, and the communication department that is responsible for communication with the control and the traffic information center, which, when used, can be classified for dangerous areas by analyzing the increase and decrease in speed difference for VDS in upstream and downstream areas. By analyzing the increase and decrease of speed difference for VDS in upstream and downstream VDS in downstream areas, the effects on risk control points can be found by finding hazardous areas, i.e. speeding areas and fast-speed zones. Table 2 below is an analysis hypothesis through VDS data. [3]

Table 2. VDS Data Analysis Hypothesis

Type	Description	
Definition	Speed difference (incremental) analysis of the front-to-back VDS with a focus on the 1km reference point	
Method	Speed difference = point VDS - upstream VDS	
	An Analysis on the Velocity of Loop2 Parts	
Analysis details	Need to be analyzed based on speed during column	
Data	Analysis	By line, directional, unit time (30 seconds,5 minutes,15 minutes,60 minutes), average speed
	Input	Individual vehicle speed collected by route, direction and unit time at VDS point
	output	Rapid Deceleration Intervals by Route, Direction, Unit Time, and Standard Deviation at VDS Point

B. *Frame of Analysis*

There is a method to measure the deceleration rate using vehicle speed data measured at each VDS point and a data processing process for obtaining the speed at each point can be presented. A method of calculating average speed for the entire vehicle is applicable. [4] The process in Figure 1 shows the results of finding the hazardous section through a normal distribution analysis of the speeding section and the validity analysis of the rapid and deceleration sections. The first step was to specify the hazard section for the speed section, which was calculated by calculating the average of the speed values and then calculating the effective value with the standard

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deviation, after which the high risk interval can be identified using the frequency analysis.

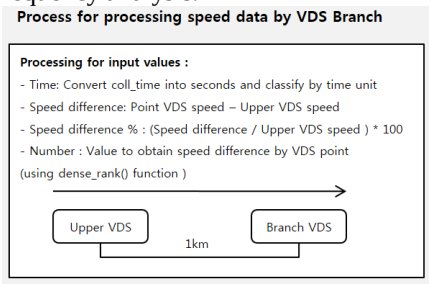

Figure 1. VDS Data Analysis Frame

4. VERIFICATION OF ANALYSIS RESULTS

The analysis was attempted with approximately 400 million data collected, and the layout of the table layout is shown in variety of type. The mean speed calculation is outputted with the VDS_ID and the average speed by direction. It was done by dense- rank() function. The result was possible to specify the area of increase and decrease as shown in Figure 2.

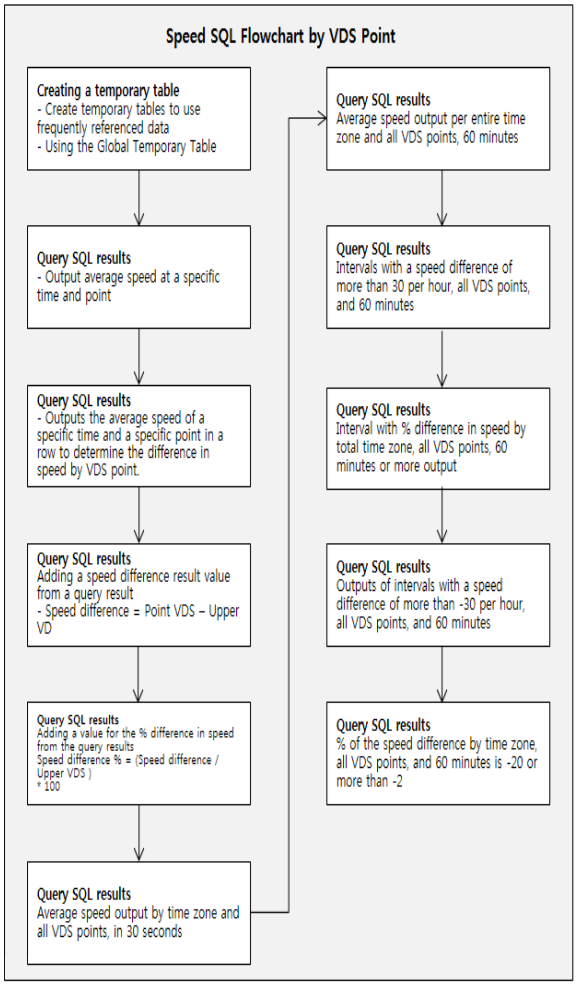

Figure 2. VDS Data Analysis FlowChart

5. CONCLUSION

In order to establish an artificial intelligence driver protection system, a big data platform that can fuse various data is needed. In order to introduce this, multiple analyses, which require and precede the design of how to configure software, including hardware and operating systems, including storage space or servers.

In this paper, various data analysis was attempted using VDS data, and in the case of data that could be fused with this result, the design was intended to take into account the scale of big data or the scalability of the platform. It is hoped that the policy suggestions will lead to the establishment of an analysis platform for the exchange and use of various information by the police and various information by the Korea Highway Corporation as a starting point. Minds through the prevention of traffic accidents and elimination of dangerous sections, the common purpose of the two agencies, can highlight the efforts of the two agencies and the purpose of their existence. [5][6]

In particular, this study recognized the need for close interaction between the National Police Agency and the Korea Highway Corporation's public data portal on the traffic information and the need for information to be mediated. Public data on the roads had various vehicle detection information, but there were difficulties in using information on the areas of police traffic. And in the case of police traffic, analysis of data and access and analysis of various initially generated vehicle detection information was difficult.[7-13]

Thus, if a system is deployed using artificial intelligence to automate the collection of raw data collected from future VDS, the expected point of accident can be analyzed in light of the nature of the traffic accident, and the sequential management of the risk intervals will be possible [14-15]. In addition, it is believed that identifying statistical information in rapid and slow sections that can be analyzed for signs of speeding accidents and automating the linkage of other information will greatly affect the mitigation of traffic accidents in remote areas, such as rural areas. As a result, it is expected to reduce the social costs of traffic accidents and prevent traffic accidents. If AI-type automatic analysis system and hardware infrastructure are continuously invested, and the relevant weather environment, insurance statistics, and police accident statistics data are analyzed in a fusion and composite manner, it is believed that more correlation analysis will enable prevention of traffic accidents.

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