If we figure out the location
where **crashes** and **speedings** usually occur,
wouldn't we be able to
deploy the police more **preemptively**?

Crashes and Speeding Analysis with Traffic Big Data

Sanghoon Ji[1], Jeong Seong[2], Yubin Lee[1], Ana Stanescu[2], Chul Sue Hwang[1]
[1] Kyunghee University, Seoul, South Korea; [2] University of West Georgia, Carrollton, GA, U.S.A.

I. INTRODUCTION

- GIS technology for processing spatial big data is today's core spatial analysis method
- Researched trends in spatial phenomena and appropriate suggestions through GIS
- Using Traffic violation event data, identified spatial distribution for each violation type
- Figured out suggestions for supporting spatial decision making related to police deployment

II. DATA AND METHODOLOGY

A. Data

- Montgomery County's Traffic Violation data
  - Large-scale traffic violation ticket data containing coordinates provided by Maryland, US
  - 1.3 million records from 2012 to 2020
- Annual Average Daily Traffic(AADT) Data
  - Provided by MDOTSHA(Maryland Department of Transportation State Highway Administration)
  - Utilized GIS Shapefiles which includes road vector, road type, number of lanes, etc.

B. Methodology

- Traffic violence event type classification
  - Extracted specific type events – Crash and Speeding violation
  - Identified the feature of police deployment according to the type of violation
- Grid vector analysis
  - Constructed a vector grid network to sample crashes and speeding violations
  - The number of violation in each grid cell was calculated using the point-in-polygon analysis with QGIS
  - Road density was also calculated for each cell with the number of lanes considered
- Road(line) vector analysis
  - Segmented major arterial roads into multiple sections
  - Figured out the traffic congestion level for each section using AADT, lane and road design capacity values
  - The number of violation event in each road section was calculated
  - Spatial analyses were performed to analyze the distributions and correlations among violation types

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III. RESULTS

- Through this study, we were able to grasp some important suggestions. First of all, traffic accidents occur frequently not on expressways, but on the outskirts of the city or on downtowns, and in the case of speeding violations, traffic accidents occur on expressways and major roads. On the other hand, a factor analysis was attempted using traffic volume and road density data, but the correlation between the distribution of traffic accidents and speeding events could not be grasped.

The differences and characteristics of this spatial distribution can also be a reference to the establishment of a police deployment strategy for traffic management. This is because in the case of traffic accidents, the police tend to be passive after the occurrence because they cannot predict the exact location and timing, but in the case of speeding, the police can actively plan the location of the crackdown.

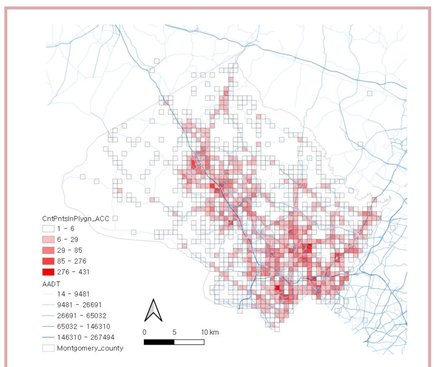

Figure 1. Accident events in each grid

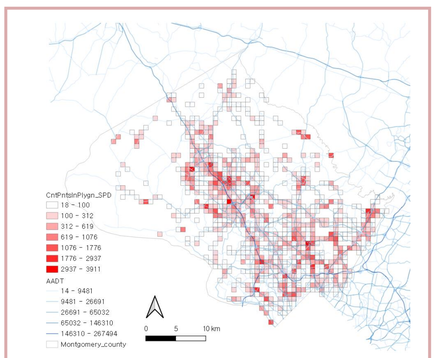

Figure 2. Speeding events in each grid

Grid Vector Analysis

- Figure 1 shows the distribution of accident events within each grid. Accidents are concentrated in the southeastern part of the research area. Meanwhile, the distribution differs from Figure 2, which shows the distribution of speeding events. The distribution of Speeding events are not concentrated but scattered in the outer regions. This also reflects the structural characteristic that speeding is difficult in urban areas with many traffic lights and complicated roads.

Road Vector Analysis

- After Identifying the feature of distribution through the grid analysis, the research was conducted by considering the traffic volume variables for each section of the road.

Figure 3 shows the congested road. It shows that most of the traffic is concentrated in highway and main roads. Figure 4 and 5 show that there is no correlation between the occurrence of an accident due to the large number of vehicles or congestion on the road.

Meanwhile Figure 5 shows that speeding control is concentrated in specific road sections(yellow circles)

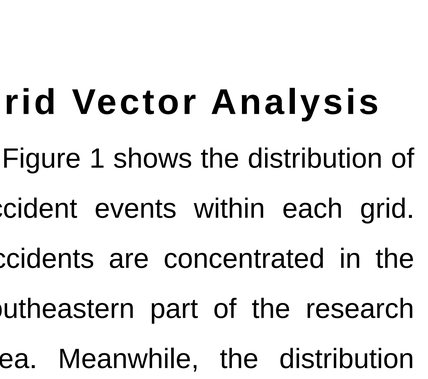

Figure 3. Traffic congestion road section

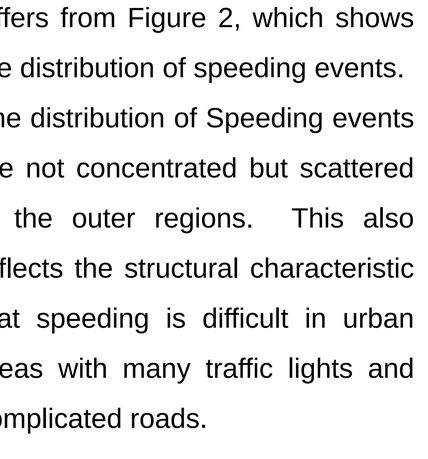

Figure 4. Accident events in each road section

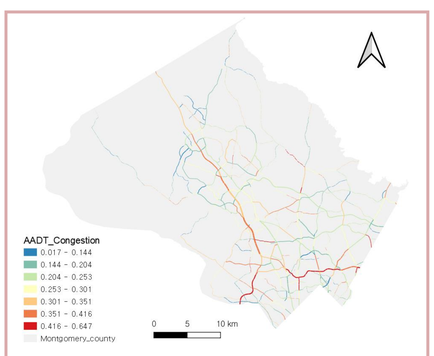

Figure 5. Speeding events in each road section

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More details in Webmap
Arcgis Online Map
https://arcg.is/5nSG8