Spatial analysis of driver safety behaviour using data from smartphones

Paper ID: 336 - Ilias Parmaksizoglou, Dimitrios I. Tselentis, George Yannis
National Technical University of Athens

Objectives
The aim of this research is to conduct a spatial analysis of driver safety behavior using data from smartphones. It investigates how the number of harsh accelerations and decelerations per day, which are key elements of everyday driving, is influenced with both the road environment and road users’ behaviour.

Data collection
The recorded driving behavior data originate from the various sensors of smartphones and data fusion algorithms developed by OSeven Telematics. OSeven uses an integrated system for recording, collecting, storing driving behaviour data and data processing using advanced machine learning algorithms.

The anonymized data received from OSeven are in the form of databases that contain a total of 194,850 observations from 319 users. The datasets exploited included information about the harsh events of each user’s trip, such as the:

- type of the event (braking, acceleration)
- time of the event
- coordinates (latitude & longitude)
- driving speed at the beginning of the event
- speed difference between the start and end of the event
- accelerometer value
- type of road network

The events occurred at the examined road arterial (Leoforos Mesogeion) were projected on a map using a GIS software and the road was divided into node areas and sections considering specific parameters to define these areas.

Methodology

Data pre-processing & visualization
Data were processed and transformed in a GIS computer software, so they can be processed thereafter. Additionally, analytic maps were developed that aimed to indicate patterns of the accumulation and ranking of the harsh events in the selected road segments.

Variable correlation
The correlation between dependent and independent variables is examined and all independent variables with high correlation are included in the model development.

Statistical analysis
In order to achieve the goals of the study, regression analysis was conducted through linear regression as the nature of the depended variables. Four linear regression models are developed:

- Harsh braking events on nodes
- Harsh acceleration events on nodes
- Harsh braking events on sections
- Harsh acceleration events on sections

The degree of influence of the independent variables on the dependent variable is quantified through the magnitude of the relative variables. The most influencing factors found are the typical deviation of event speed, the maximum speed difference and the number of right exits from the for both node models and the section’s length, the existence of bus lanes and the minimum distance of event for both section models.

Results
After numerous tests, the best models describing the number of harsh events in node and section areas feature the independent variables shown in Table 1.

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Future research
Future research should:

- Exploit real-time information for dynamic road network monitoring and assessment
- Deep dive into the areas identified as blackspots and analysis of their characteristics
- Analyze a larger and more diverse driving sample and include drivers’ characteristics in the analysis

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