Modeling Crash Severity and Collision Types Using Machine Learning

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Principal Investigator(s):

Amit Kumar

University of Texas at San Antonio

amit.kumar@utsa.edu

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University of Texas at San Antonio

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$80,010

Classifying and correlating collision types and crash severity

Traffic crashes are a main source of non-recurrent congestion causing delays to travelers in a transportation network. 34,247 fatal motor vehicle crashes were reported in the United States in 2017 leading to over 37,000 deaths. In the same year, Texas recorded 1.38 death per 100 million miles traveled. The death rate per 100 million miles traveled ranged from 0.58 in Massachusetts to 1.80 in South Carolina. The United States' annual average cost of road crashes is about $230.6 billion or around $820 per person. Crash analyses are complex because human behavior is nearly impossible to model. Traffic safety analysis often contains categorization or classification problems. Literature in the traffic safety domain presents two classification systems. The first categorizes crash based on severity (of injuries). The second classifies crash based on collision type (rear end, side swipe, angular, opposite direction, or single motor vehicle crashes). Past studies have tried to model the collision type and crash severity type considering several explanatory variables affecting crash occurrence, injury severity and collision type.

Problem Statement

Past studies usually model the crashes for severity and collision types separately. However, these factors may be connected. Though past studies recognize these correlations and suggest the need to factor them in modeling crashes, little has happened to incorporate it in the modeling process. Modeling separately necessitates more complex model structure to account for cross-model correlations. This research is motivated to bridge this gap in literature and aims to model collision type and crash severity simultaneously recognizing that they may be correlated. This study aims to bridge these gaps in literature and proposes to analyze crash data using machine learning multi-label classification tools. The multi-label classification machine learning (ML) tool has not been used for traffic safety problems and so, this project can be a model for future research in traffic safety.

Objectives

This study aims at classifying the collision type and crash severity type together while noting their correlation. The study will review past literature to understand the latest practice of crash classification. The study will use past crash data from Texas cities for both crash and numerical analysis. The objectives of this study are as follows:

- Literature review of crash classification
- Identification of crash explanatory factors
- Data collection and processing
- Devising the crash analysis methodology
- Numerical Analysis

Intended Implementation of Research

Workforce Development: This will be achieved directly by training graduate, undergraduate, and high school students interested in pursuing a career in STEM or Transportation Engineering career.

Education and Outreach: For this research project, faculty will meet with traffic operators and managers from the city. The investigators have working relationships with local and regional personnel in transportation and traffic safety. The researchers will also bring the insights from this research into graduate and undergraduate courses. The researchers will report these activities as per their regular reporting periods. All inferences from the numerical analysis will be documented in a detailed project report. The inferences from the analysis will also be disseminated to wider audience through conference/journal papers/presentation etc. Multiple graduate students will be involved in this project. Students engaged in the research

programs will have the opportunity to learn both machine learning tools and traffic safety. This multi-disciplinary approach will train the students to achieve better career opportunities.

Anticipated Impacts/Benefits of Implementation

The inferences from these safety analysis and model outputs will help identify critical locations/links in a transportation network. The information about critical links can be used for optimal positioning of personnel, and in prioritizing the location for frequent surveillance by traffic management centers. In particular, the model can be used for predicting the probable locations of crashes and their severity. Main deliverables for this project are: (1) a final report, to include a complete description of the problem, approach, methodology, findings, conclusions, and recommendations and (2) presentations to be given at national conferences.

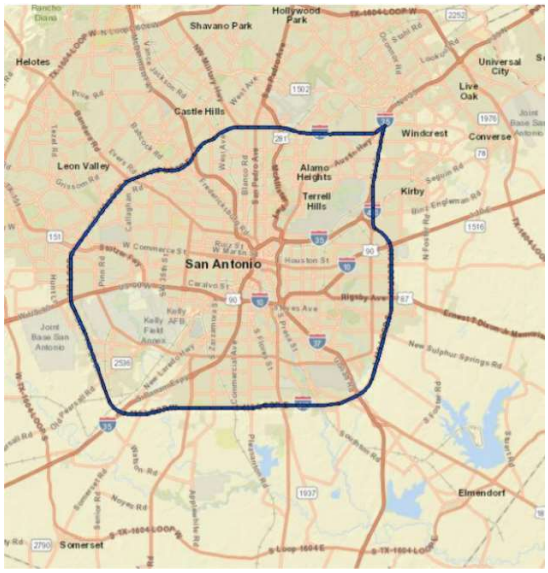

Figure 1: Study Area

Web links

- Tran-SET's website https://transet.lsu.edu/research-in-progress/

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November

Learn More

For more information about Tran-SET, please visit our website, LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.