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Analysis of pedestrian-vehicle interactions using extreme value theory

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Background
Studies on pedestrian-vehicle interactions have been generating interest among researchers, government and local entities, whose purpose is to analyze and develop safety measures that mitigate road accidents.

The use of non-crash events is becoming more and more popular thanks to the rapid improvement in video-based vehicle trajectory processing. Various traffic conflict studies presented a number of Surrogate Measures of Safety (SMoS) that can be used to analyze interactions. The most widely used temporal indicators are Time-To-Collision (TTC) and Post Encroachment Time (PET) which capture how close in time the road users involved are to the potential collision point.

Recently, the Extreme Value Theory (EVT) to estimate crash probabilities using SMoS has been applied in traffic safety related studies. This theory offers two approaches to sample extreme events, in this case near crashes, the block maxima (or minima using Generalized Extreme Value distribution) and the peak over threshold (using Generalized Pareto distribution). In the former case the maximum (in this case the minimum) values over time are considered, whereas in the latter case values over a certain threshold are used.

Aim
As for pedestrian-vehicle interactions EVT has not been applied and tested, yet. This research aims to address this gap by using video recordings and field measurements at an unsignalized pedestrian crossing.

Methodology
To observe pedestrian-vehicle interactions A pedestrian crossing with a refuge island on a two-lane road in front of a primary school was selected in Győr, Hungary. A Hikvision camera with 180° wide field of view was mounted on a light pole above the pedestrian crossing making it possible that both traffic lanes are visible. The video camera was installed on the site for a period of two and a half months, from mid-May to the end of July. Peak hours from 6:00 to 9:00 in the morning and from 14:00 to 17:00 in the afternoon on weekdays were observed. The camera was set to a motion detection mode. Approximately 4,000 videos in total were obtained. The videos with no interaction between pedestrians and vehicles were filtered out.

In this study, 594 videos (of approximately 85 hours and 48 minutes) are analyzed using a software TrafxSAFE developed by Transoft Solutions. The software uses Machine Learning to

detect, track and analyze interactions between road users. It reports data on road user classification, turning movement directions, speed and conflict events. Videos are being analyzed at the time of writing.

Results expected

Interactions will be analyzed using two temporal indicators, TTC and PET. Interactions will be further classified considering in which traffic lane the vehicle was approaching the pedestrian crossing while the pedestrian was crossing the road (i.e. whether the two road users on the same side of the refuge island or not). Both approaches of EVT will be applied to the same sample.

This is an ongoing research, it is expected that we can make conclusions on the applicability of surrogate indicators for pedestrian-vehicle interactions by testing the efficiency of both EVT approaches.