Title: MAPPING PATTERNS OF PEDESTRIAN FATAL ACCIDENTS IN ISRAEL

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Abstract:
Yearly, over 400 people are killed and thousands more are injured on Israeli roads, with foreseeable costs to society in terms of human lives, property damages, delays for roadway users, etc. Around 150 victims are pedestrians, a staggering number in terms of fatality rates in comparison with other developed countries.

This study intends to provide a broad picture of pedestrian traffic accidents in Israel by uncovering their patterns and underlying their recurrent characteristics. As the literature in accident analysis shows, there is a growing interest in the individuation of accident patterns and characteristics in order to design preventive measures, to address specific situations and to target specific population groups with the ultimate objective of reducing the number of fatalities and accidents.

This study analyzes 603 pedestrian fatal accidents occurred in Israel during the four-year period between 2003 and 2006. The analysis focuses on fatal accidents since, without discarding the relevance of road crash injuries, the number of fatalities is clearly the indicator that represents the most the country situation over the years. The four-year period is long enough to limit random fluctuations in the accident counts and short enough to control for changes in road and traffic conditions. Data contain details about modality, location, infrastructure conditions, environment conditions, vehicles and persons involved in each pedestrian fatal accident, as reported by the Israeli police and coded by the Israeli Central Bureau of Statistics.

This study applies Kohonen neural networks for pattern recognition purposes, after discarding three alternative approaches used frequently in the literature. A priori determination of the clusters, factorial analysis of correspondence and rough set theory require a large amount of assumptions prior to the data analysis, a practice that did not seem suitable to uncover accident patterns from a large database and a large set of accident characteristics. Kohonen neural networks are unsupervised self-organizing maps, namely the networks are presented with data and the correct output that corresponds to that data is not pre-specified. Kohonen neural networks are very practical because they are relatively simple to construct, can be trained very rapidly and can be applied to linearly separable problems. Their structure consists only of an input and an output layer of neurons without any connecting hidden layer. Categories of the pedestrian accident characteristics constitute the input neurons and clusters constitute the map of output neurons. As the algorithm connects each of the input neurons to each of the output neurons and weighs each connection in order to choose a single output neuron as the "winner" output for each case, the result is the assignment of each accident to one output neuron cluster.

Results show the existence of five major clusters of fatal pedestrian accidents. The first cluster includes accidents where elderly pedestrians crossed on zebras far from intersections in urban areas, mainly in the Tel Aviv metropolitan area. The second cluster contains crashes where pedestrians crossed the road suddenly or from hidden places and collided mainly with two-wheel vehicles in urban sections, prevalently inside one of the three main metropolitan areas. Similar modality of collision, even though with cars and not motorcycles or bicycles, is observed for the third cluster, where mostly male pedestrians crossed rural sections at night, and the fourth cluster, where mainly young male pedestrians crossed large road sections in both urban

and rural areas at night. The fifth cluster consists of accidents where mostly young children and teenagers crossed narrow roads in small villages in the north of Israel.

The most important variables uncovered by the Kohonen networks are accident location, width and presence of median barrier in road sections, modality of the crash, period of the crash, and age and population group of the victims. In particular, specific population groups in specific areas appear subject to be involved in fatal pedestrian accidents. From a policy perspective, these results could suggest the necessity to target these groups and these areas with campaigns that increase the public awareness of the problem and interventions that improve for example crossing conditions for elderly and youngsters in specific areas of the country.