

# Heatmapping and data analysis of traffic accidents

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## Introduction

One way to prevent and reduce the number of traffic accidents is to carry out an analysis on the recorded data. General information, such as age and gender of the participants, safety gear utilization, road and weather conditions, are often all associated with each accident but looking at each accident in isolation could be considered overwhelming. Instead, a descriptive and perceptible analysis on the whole dataset is required to make regulatory or executive decisions such as reconstructing dangerous parts or to lowering the speed limit in frequent accident locations. Our objectives were:

- Determine the most dangerous sections on Estonian highway roads and either confirm or prove rumours and myths about the location and condition of the accidents.
- Develop an interactive application to provide a visualized overview of the accidents based on set filters.
- Complement the visualization with descriptive statistics and deduced association rules.

## Preprocessing

The used dataset provided by Maanteemmet includes 43196 reported accidents in Estonia over the span of 1990-2014. As the reported accidents are associated with highway number and a kilometer data, a mapping to geographic coordinates was required to mark the accidents on a map. The data was found on the Flash version of Estonian map provider Maa-amet. Namely, the user interface allows a search which input highway number alongside start and end kilometer and return a list of EPSG:3301 coordinates which could be used to represent this section on the provided map. But unfortunately, this data service proved to be undocumented to be used programmatically. So, the resource location as well as protocol was studied by monitoring the network traffic when interacting with the map to finally deduce the coordinates necessary for each of the accident. Finally, after filtering and removal of lines without coordinates, 11122 accidents remained to be used on a heatmap.

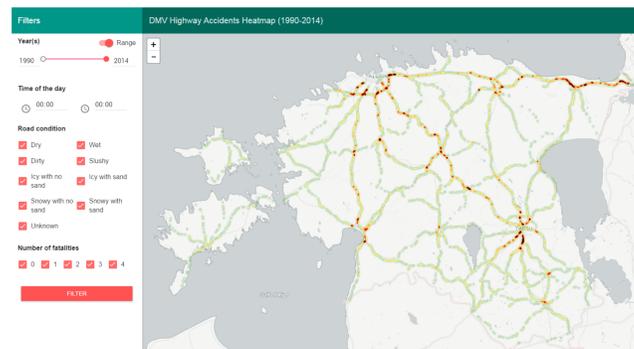


Figure 1: Heatmapping application on traffic accidents

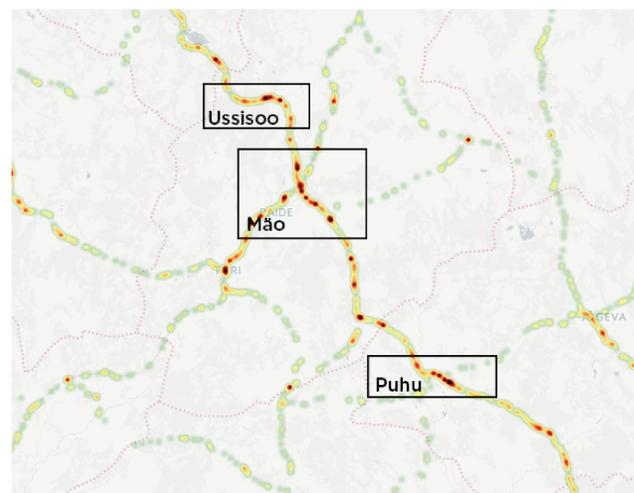


Figure 2: Dangerous sections on Tallinn-Tartu highway

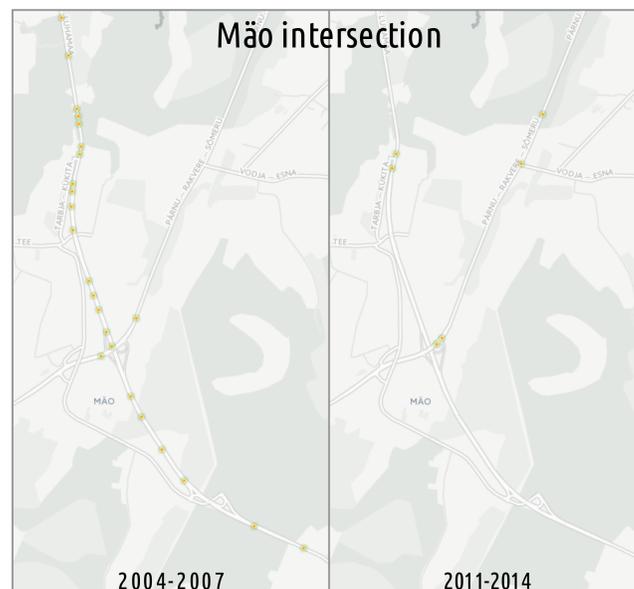


Figure 3: Mäo before and after rebuilding

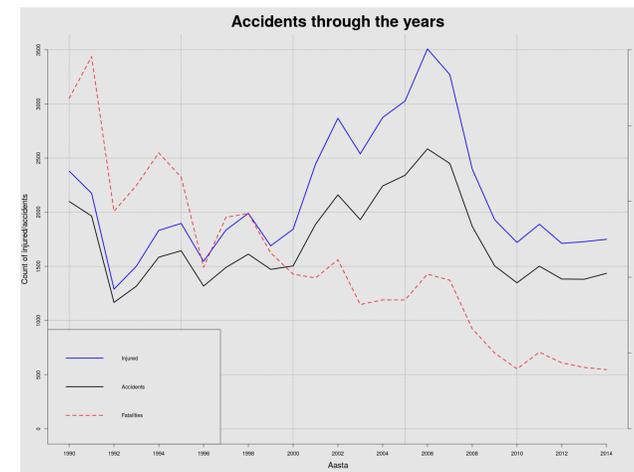


Figure 4: Yearly analysis

## Rules

Inter alia, the deduced rules significantly revealed the following:

- Whether road conditions are good or bad, the lethal accidents happen basically on same frequency.
- Accidents where pedestrians get injured are more frequently happening on daytime than at night. But accidents where pedestrians get killed are more frequently happening at night.
- Straight parts of the roads are much more dangerous than curves.
- Pedestrians get injured more frequently on road crossing than on other places of the road.
- Lethal accidents happen more frequently on roads that are repaired than on unrepaired roads.
- If the seatbelt/helmet/reflector is missing, it is more likely to just get injured than killed.

Check out the interactive heatmap!



<https://github.com/cryptotex/Est-dmv-analysis>

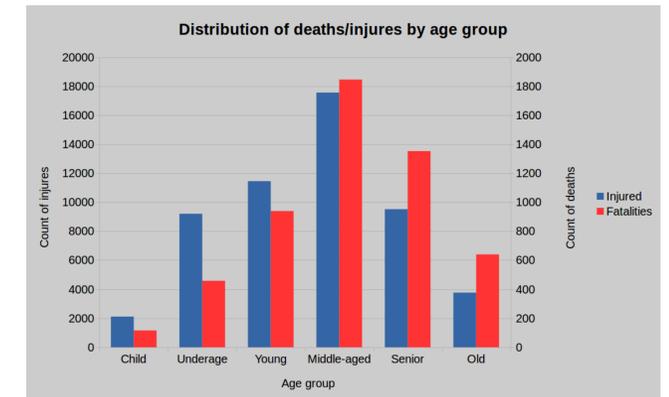


Figure 5: Distribution of fatalities/injured by age group  
Child (0-7), Underage (8-18), Young (19-25), Middle-aged (26-45), Senior (46-65), Old (66+)

## Results

By using the developed application (Fig. 1) and examining the un-filtered heatmap, it was visually determined that the most dangerous section in the Tallinn-Tartu highway is not Ussisoo section. Based on the heatmap, sections near Puhu and Mäo intersections could be considered to have even higher accident per kilometer ratio (Fig. 2). Heatmap shows the value of good road construction. For example at Mäo intersection before there were many more accidents than after (Fig. 3). Even though the number of cars has been increasing (300 in 1990 to 500 in 2014) number of fatalities has seen an overall decreasing trend. In recent years also the number of injured and accidents have gone down (Fig. 4). Surprisingly, underage people get injured the same amount as seniors (Fig. 5).

