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Automobile Sensor Data as a Database for the Investigation of Traffic Conflicts

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Introduction, including research aim and objectives

In recent decades, urban and traffic planners in Germany have developed intersections for the car-friendly city. In particular, they should handle motor vehicle traffic efficiently. However, especially in urban areas, the number of private cars is high, resulting in many traffic congestions and high CO2 emissions. At the same time, the importance of and demand for sustainable mobility is increasing. More people are walking and cycling (Gerike 2020). At the same time, pedestrians and cyclists, as the weakest (vulnerable) road users, take particular risks. The aim of transport policy is to achieve "Vision Zero", i.e. there should be no more serious injuries or fatalities in road traffic (BMDV 2020). Many accidents occur at intersections in urban areas in particular. Road safety can improve by reducing critical situations. Road authorities generally use accident data as the basis for assessing the road safety of intersections. In addition, an intensive study of the development of conflicts as a precursor to accidents can provide further insights (Gerstenberger, 2015). The investigations in our research project show that such data on near misses and traffic conflicts is often not available to the German road traffic authorities. As part of the project "Risk assessment at selected intersection types using automobile sensor data (RisiSens)" at Frankfurt University of Applied Sciences, we are investigating which and how many conflicts between pedestrian, bicycle and motor vehicle traffic frequently occur at selected intersection types, such as signalized intersections or traffic circles. The aim of the project is to develop a survey concept that will enable traffic planners to quickly identify risks for pedestrians and cyclists at selected intersection types in the future. In addition to the manual survey, aggregated automobile sensor data (e.g. from emergency brake assistants) from a German car manufacturer is also available. In "RisiSens", we are investigating whether this data is suitable as the basis for a risk assessment procedure for pedestrian and bicycle traffic. The risk assessment procedure developed for pedestrians and cyclists will later serve as a monitoring tool for transport policy and planning. It can enable road authorities, for example, to check road safety at their intersections and ensure it with suitable measures. The monitoring tool thus promotes walking and cycling in urban areas.

Research method

In order to test whether sensor data from the automobile sector is suitable for the risk assessment of pedestrians and cyclists, we had to evaluate it. To do this, we first had to collect ground truth data ourselves. We developed a survey concept for this purpose. As a basis for this, we identified influencing factors that cause and describe conflicts. Through prioritization, we

determined influencing factors that we could collect with the (technical) means available to us. We tested and optimized the survey concept at various intersections. We organized a workshop with representatives of the local authorities. We asked them what requirements they had for such a survey concept. We used the results to optimize the survey concept. The manual survey took place in Stuttgart. We used two video cameras and an observer to record the frequency, location, process and, to some extent, the cause of the traffic conflict. Since the video cameras have a low image resolution (data protection), the observer spoke the information that the cameras could not capture into a voice recorder. This applied in particular to the sociodemographic characteristics of the parties involved in the conflict.
We analyzed the data from the survey with regard to the frequency, course and cause of conflicts. We compared the results with the accident data. We then analyzed the automobile sensor data based on the results of the manual survey. We compared the location of the hotspots with our manual data. The automobile sensor data includes, among other things, information on the average time-to-collision and braking intensity. We were unable to measure this information in the manual survey.

Results
The manual survey is time-intensive, but provides a lot of information on the causes and processes of conflicts. This method is suitable for the investigation of traffic conflicts and for the evaluation of automobile sensor data. The road safety assessment using automobile sensors promises a faster procedure. Automobile sensor data is currently only available in aggregated form. The hotspots show the critical locations identified by the automobile sensor data in a map-based dashboard. Users can also read further information about the hotspots in the dashboard based on the hotspots displayed. They can see whether the hotspot developed based on manoeuvres by fleet vehicles with pedestrians or with other vehicles. The dashboard also shows the particularly critical times of the week and day as well as a risk score. The risk score reflects, among other things, the braking intensity of the vehicles. However, our investigation also shows that the automobile sensor data is still too insufficient now. We need more precise information to determine the cause and course of a traffic conflict.

Discussion and conclusions
The automobile sensor data is only available in aggregated form. The automobile producer does not provide any raw data. We are therefore unable to track the number of conflicts in a specific period. We also do not know how many of the detected conflicts were actually conflicts or how many conflicts the sensors did not detect. Nevertheless, they can provide initial indications of critical areas. You can then collect further information on the conflicts with a manual survey. The company is currently developing the automobile sensors and the dashboard further. With the new features, it promises more information for traffic conflict analysis. The new features were not published until after our project ended, so unfortunately we were unable to examine them. . However, if the automobile sensor data can provide more information, e.g. conflict flow, the effort required for manual collection will be less.

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