

## Master's Thesis of Nouman Dar

### Mentoring:

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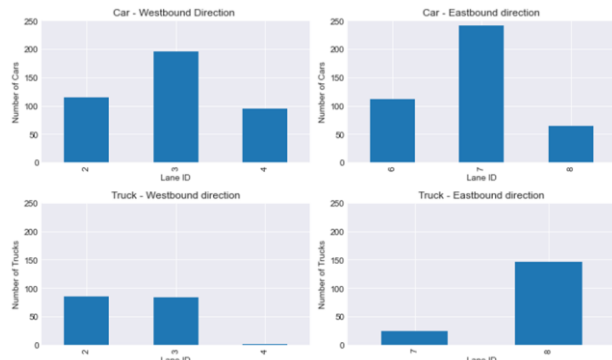


Fig 3 Number of lanes in each direction

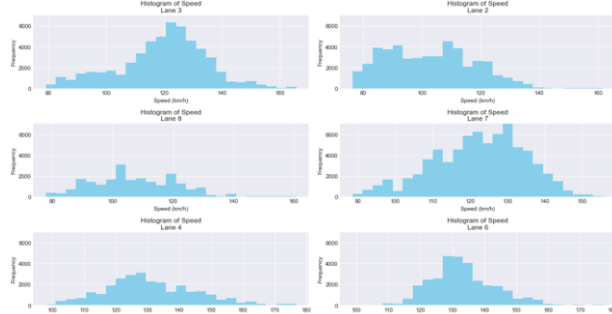


Fig 4 Histogram for car Speed

### Analysis of the Data

A comprehensive spatio-temporal analysis was undertaken to extract meaningful insights from the drone data. This multifaceted analysis encompassed traffic flow analysis, providing a dynamic understanding of vehicular movement; infrastructure condition analysis, revealing critical insights into the state of the infrastructure; and spatial analysis, unveiling patterns and relationships in the geographical distribution of features. Visual aids, such as speed and flow plots, were employed to enhance the presentation of these complex findings.

The features extracted from the drone data, including geometric parameters and structural conditions, provided a comprehensive characterization of the highway infrastructure under consideration. These characteristics serve as crucial indicators for assessing overall system performance.

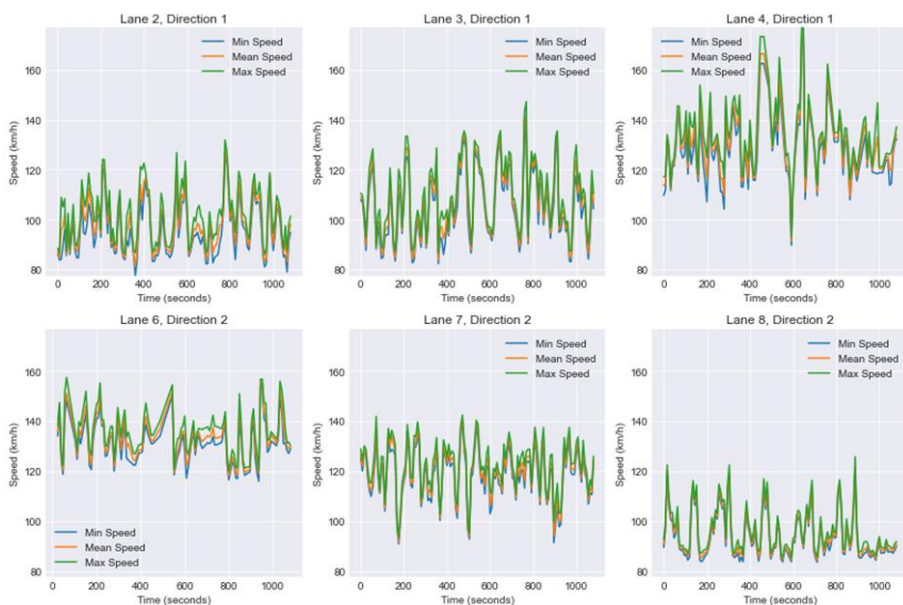


Fig 5 Speed for lane 2, 3, 4, 6, 7, 8

### Background and Goal

In recent years, drones have become vital tools in traffic management, offering a cost-effective and versatile solution for monitoring traffic, conducting infrastructure inspections, and aiding post-accident investigations. Their popularity is driven by efficiency, cost-effectiveness, and the potential to enhance safety. As technology evolves, drones are poised to play an increasingly significant role in shaping the future of traffic analysis and infrastructure assessment. This study focuses on utilizing drone data, specifically from highD, to estimate key highway infrastructure characteristics. Through a thorough literature review and data analysis, the research aims to provide transportation authorities with data-driven insights into the geometric features of the highway system, empowering decision-makers to enhance safety, efficiency, and sustainability through informed infrastructure maintenance choices.



Fig 1 Locations of recordings included in highD. Highways near Cologne were selected by typical traffic density and number of lanes (Krajewski, Bock, Kloeker, & Eckstein, 2018).

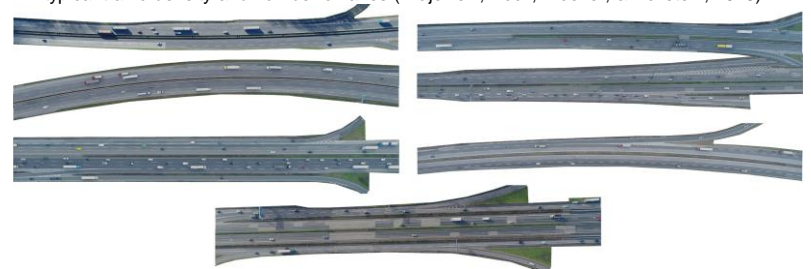


Fig 2 A single frame for each location extracted from the videos showing the different types of road types (T. Moers, et al., 2022)

### Result

This study extensively analyzed the impact of various highway characteristics on traffic flow, considering factors such as time of day, volume of vehicles, driver behavior, and diverse infrastructure elements. The interconnectedness of these factors in influencing traffic dynamics was established. The findings highlight the intricate relationship between highway features and traffic patterns, emphasizing the importance of optimizing traffic flow for enhanced road safety and sustainable transportation systems. Key insights include temporal variations in traffic flow, the significant influence of infrastructure state on disruptions, the role of driver behavior, and the interconnectedness of lanes affecting overall traffic speed. The study provides essential insights for transportation authorities and urban planners, aiding informed decision-making. It holds the potential to enhance traffic management, alleviate congestion, and improve the overall driving experience in urban areas.