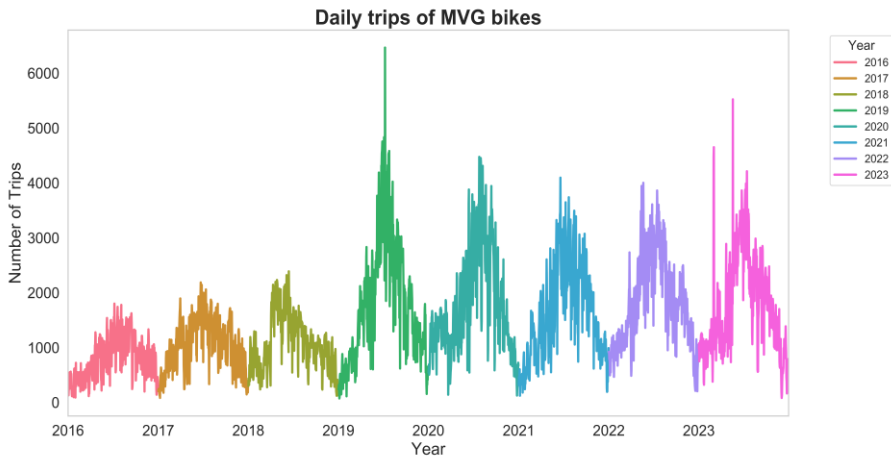


# Estimation of environmental impacts of bike sharing based on MVG data in Munich.

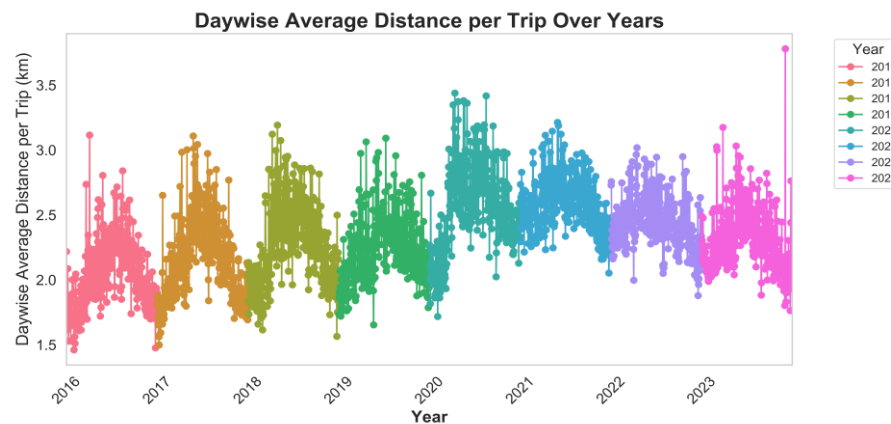
**Master's Thesis of Muntasir Mamun, Matriculation number: 03742030**

**Mentoring:**

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**Figure 1:** Number of yearly MVG bike trips



**Figure 2:** Daily average distance per trip

**Objectives of the study:**

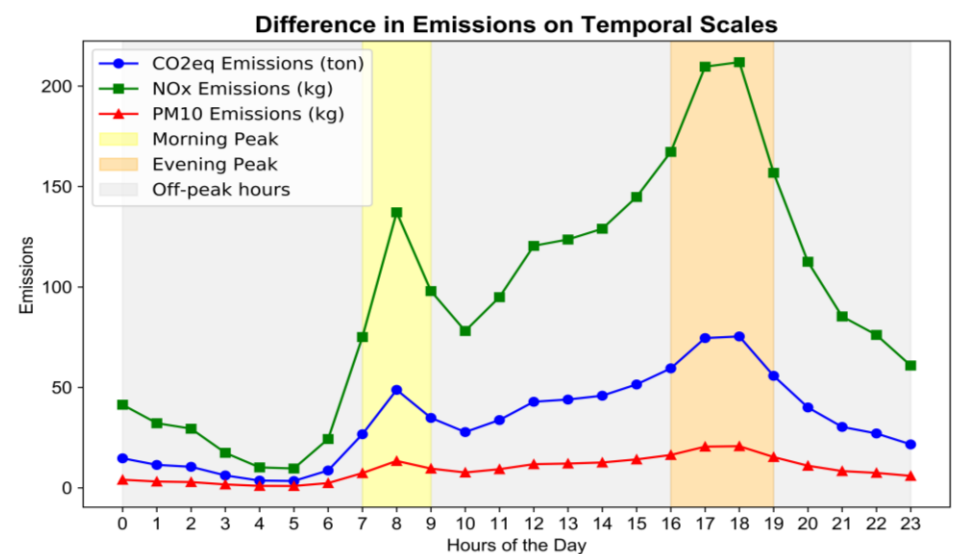
- Estimate the environment impacts of MVG bike-sharing system (difference in CO<sub>2</sub>e, NO<sub>x</sub> and PM<sub>10</sub> emissions in Munich city) using a multi-mode substitution process.
- Visualization of the emission differences in the temporal and spatial perspective
- Evaluating the impacts of attributes on MVG bike users.

**Methodology:**

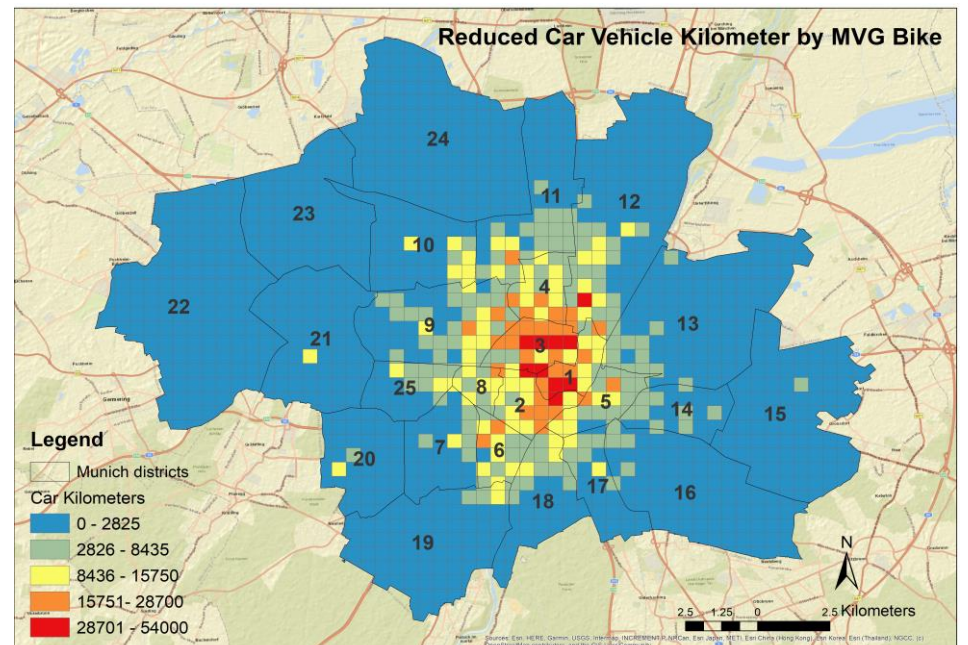
- The data analysis on the MVG bike trip data (2016 to 2023) based on the trip attributes (distance, spatial distribution, time of the day, travel purpose, seasons and weather conditions) was done to understand the usage patterns. A detailed analysis of the Mobilität.leben study shows the mode share or multi-modal trip substitution rate based on identified attributes and defined categories.
- The MVG bike trips (vehicle kilometer) was replaced with walk, bike, car and public transport modes based on the mode substitution rates from the Mobilität.leben study. Emissions from the MVG bikes and attributes were calculated using the emission factors. Critical weights of the attributes were evaluated using analytical hierarchy process and later sensitivity analysis on the attributes reforms the weights factor.
- The difference in emissions between the total emissions and the MVG bikes were calculated for CO<sub>2</sub>e, NO<sub>x</sub> and PM<sub>10</sub> emissions. The emissions was later visualized on the spatial and temporal perspectives.



**Figure 3:** Emission difference resulting from MVG bikes



**Figure 4:** Emission differences in temporal perspectives



**Figure 5:** Reduction in car vehicle kilometers in Munich

**Key findings:**

Most of the emission differences observed in central areas and peak hours. Population density, urban structure, proximity to public amenities, the bicycle lane network, and connectivity significantly affect the performance of bike-share programs. Bike-sharing is adversely affected by heavy rain and strong winds, whereas higher temperatures have a positive impact on bike-sharing usage. The highest trip demand occurring in summer and the lowest in winter. For all travel purposes, cars and public transportation modes remain predominant, with bicycles holding a minimal share.