

# Spatial and Temporal Analysis of Bike-Sharing Demand: A Case Study from Munich

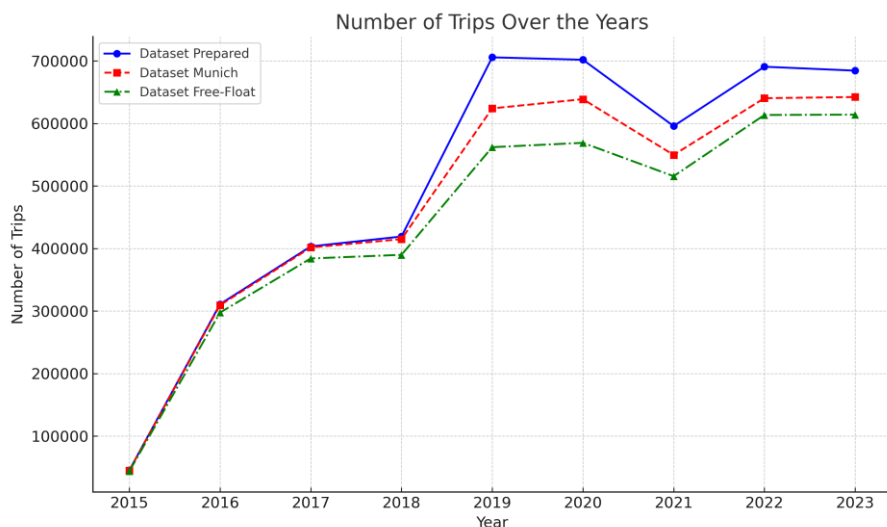
## Master's Thesis of Elias Bradl

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Bike-sharing has become an established mode of transport in most major cities and in many medium and small cities as well. It can help reduce emissions and promote a healthier lifestyle among citizens.

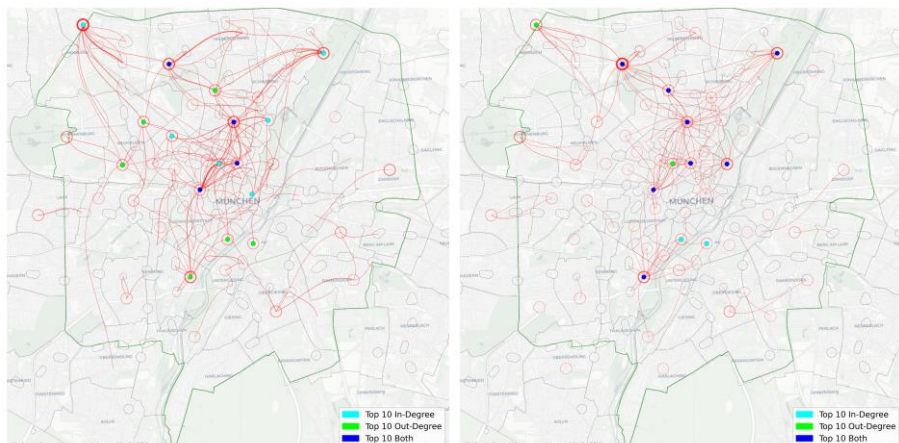
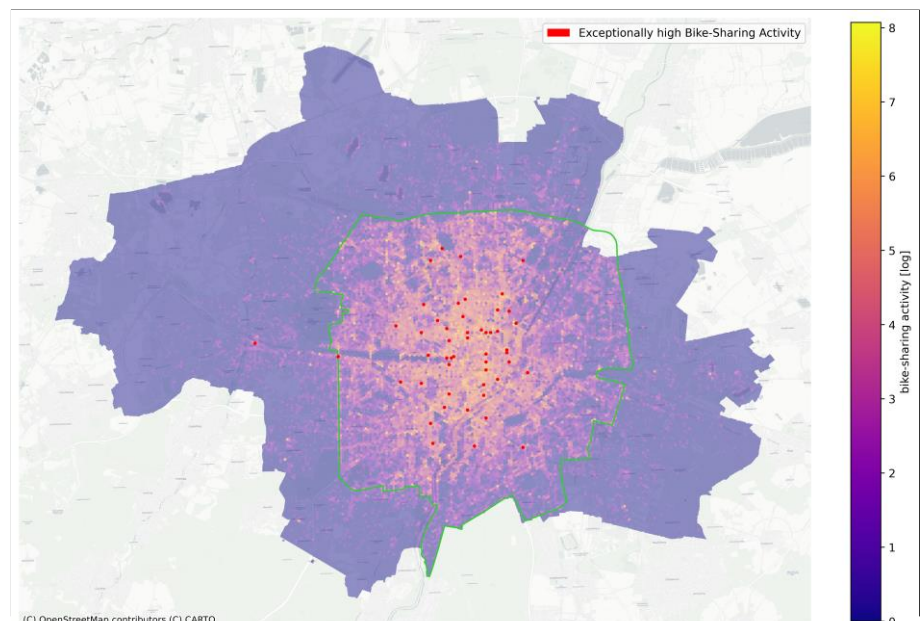
This thesis investigates the dynamics of bike-sharing demand in Munich, focusing on the spatial and temporal patterns that influence usage. It aims to understand how bike-sharing interacts with other forms of public transport and identify the factors that motivate or decrease usage. For this Trip data sets from the MVG-Rad system and additional geodata and weather and social-demographic data for Munich is used. Based on previous studies from other cities, the study employs regression modelling and network analysis on usage data provided by MVG-Rad system to explore these dynamics, offering a comprehensive overview of the factors that drive bike-sharing demand in an urban context.

For the regression modelling two different approaches were used: Random Forest Regression and Negative Binomial Regression. Furthermore, two models were created: one with spatial variables and one with temporal variables.

The results showed that the most influential factors are:

- Air temperature
- Rush hour traffic
- Distance to the nearest MVG-Rad station
- Distance to nearest railway station
- and Distance to the nearest university facility

Interestingly, variables like precipitation, or the distance to nearest metro station do not seem to influence usage significantly. However, the results can be influenced by multicollinearity between variables.



The network analysis showed that most trips are taken within a city district or its neighbors. The main railway corridor and the river Isar have a dividing effect on usage. Furthermore, different usage patterns can be observed based on the weekday and/or time of the day. On working days clear commuting patterns are visible. Central transportation hubs like the main railway station or the “Münchner Freiheit” have higher in- and outflow than usual during morning and evening rush hour. In the afternoon/evening more trips end near leisure and recreational areas.

The dataset for 2023 showed two interesting outliers in daily bike-sharing usage. The two days with by far the highest bike-sharing usage were in March and May. A possible explanation for this phenomenon could be disruptions in the public transportation system due to strikes. Further research on the influence of isolated events like these on sharing-systems could provide deeper insights into the usage and demand.