

# Determination of Demand Hotspots for the MVG Rad Bike Sharing Service - Comparison of the Inner-City Areas with the District of Munich

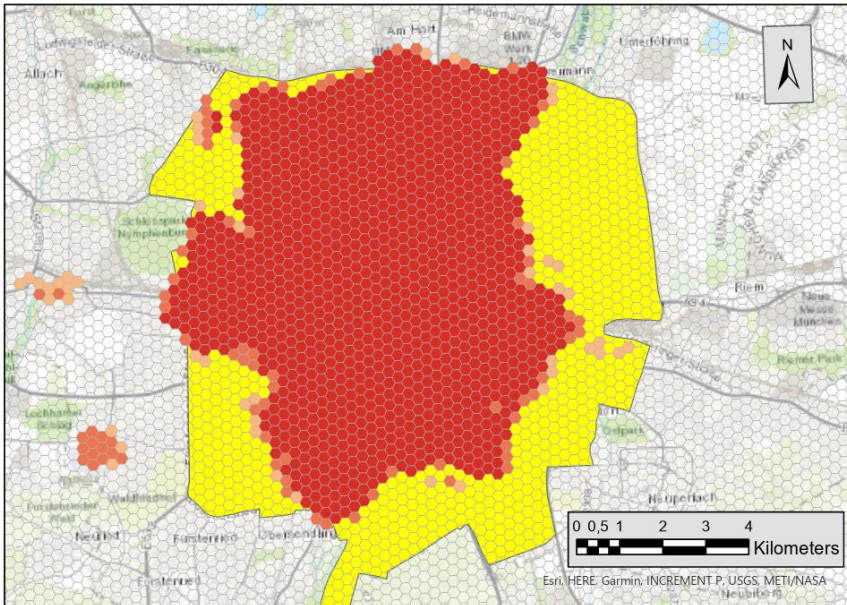
## Bachelor's Thesis of Magnus Doberenz

### Mentoring:

Dr. rer. nat. Andreas Keler  
M. Sc. Georgios Grigoropoulos  
M. Sc. Patrick Malcolm

### External Mentoring:

M. Sc. Johannes Götz (SWM)  
Dipl.-Geogr. Florian Zimmermann (SWM)



Hotspots (in shades of red) of 2019 bicycle returns, free return area (yellow)

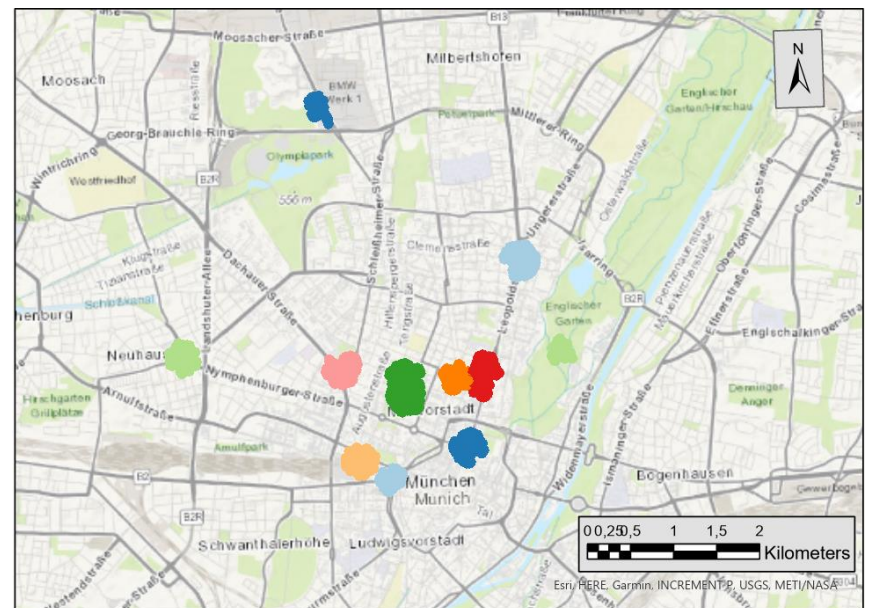
The proposed density-based clustering approach in ArcGIS Pro provides information on the location and manner of demand hotspots. Additionally, origin-destination links are created, and the most frequently used routes to a selection of hotspots are detected.

The literature review shows that modern bicycle sharing systems are affected by the quality of cycling infrastructure, weather conditions and population density. The statement that trip activities are higher in zones with university campuses or public transit stations is confirmed by the density-based clustering approach of this thesis. Inner-city hotspots are found to be located at the main campuses of both Munich universities, the LMU and the TUM. In the suburbs, hotspots are also strongly linked to public transit stops and stations.

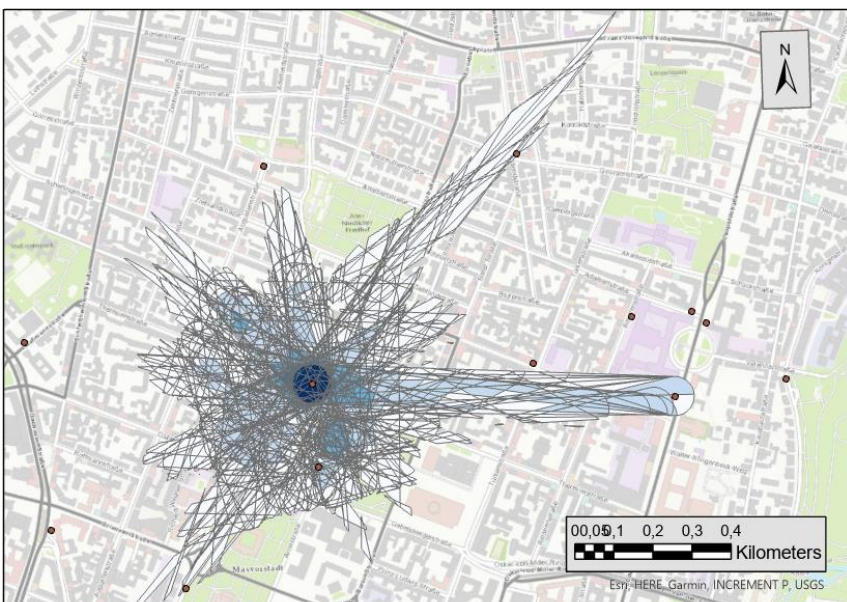
Environmental challenges such as rapid climate change and the ongoing global trend of urbanization necessitate alternatives to the privately owned automobile. Here, public bicycle sharing systems can play a relevant part.

This thesis aims to determine demand hotspots for the Munich bicycle sharing system MVG Rad with a special focus on comparing the inner city to the suburbs in the district of Munich. Since the MVG Rad does not only offer stations to return the rental bikes, but also allows its users to return the bikes freely anywhere inside of a specified return area, the effect of this free return area is also examined.

A literature review on bike sharing systems contains factors promoting or discouraging their use and presenting algorithms and approaches to analyze the available data.



Density-based clustering of 2019 bike returns



Overlap of journeys (2016) toward TUM main campus, red dots: bicycle stations

The influence of the free return area can be seen in the fact that the resulting hotspot area strongly overlapped the return area. Additionally, no cluster outside the return area is equal to inner-city hotspots with regard to the density of data points.

In conclusion, the usage of the MVG Rad in the district of Munich differs significantly from that in the inner city, which is not only caused by a lower demand due to lower population densities, but also by the much smaller supply of rental bikes.