RESEARCH INTO TRAFFIC DYNAMICS IN PUBLIC TRANSPORT: CLUSTERING OF BUS SPEED PROFILES IN MUNICH

Master‘s Thesis of Asad Zulfiqar Ali

Mentoring:
Dr. sc. ETH Allister Loder (TUM)
M.Sc. Yamam Mohammad A. Kareem Alayasreih (TUM)

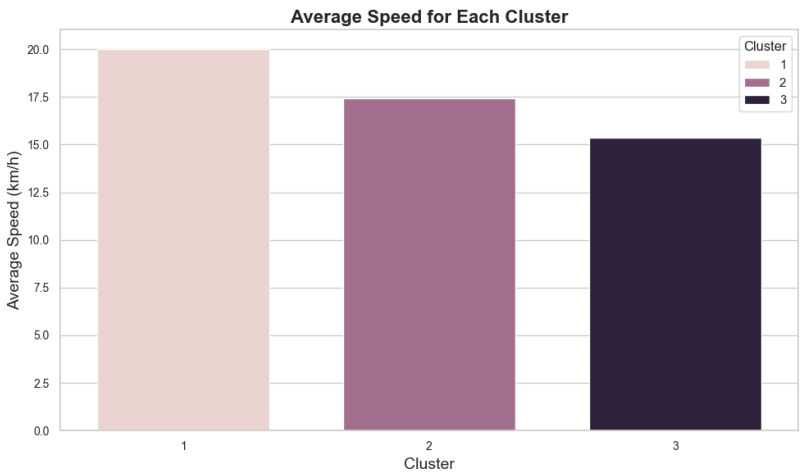
1- The Project

This study analyses traffic patterns in terms of **speed profiles** of MVG Bus Line 54, operating between Münchner Freiheit and Ostbahnhof, to identify congestion trends and operational efficiency.

The dataset, consisting of GPS coordinates with timestamps, is segmented into Morning Peak (M), Evening Peak (E), and Evening Off-Peak (O) periods. Time-series data and segment-wise average speeds are extracted to capture speed variations across the route.

Dynamic Time Warping (DTW) measures trajectory similarity, while the K-Medoid algorithm clusters speed profiles based on similarity distance metrics, revealing distinct traffic patterns.

3- Cluster Average Speeds

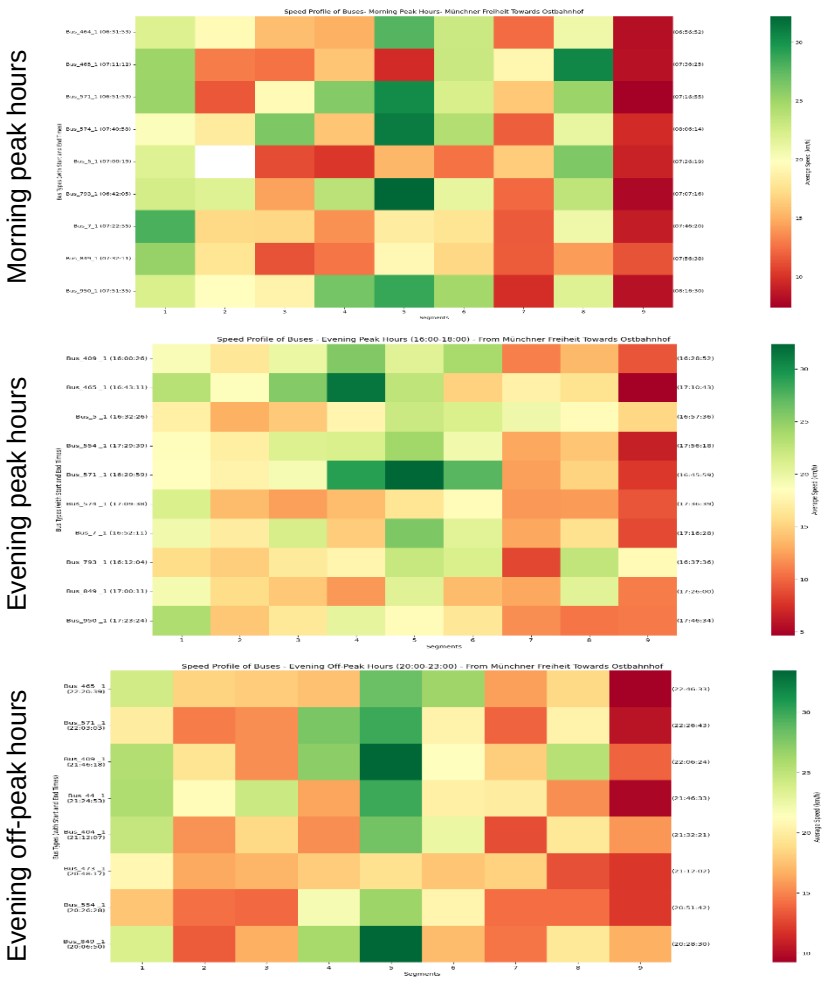


The time series data for all the time durations are grouped into three clusters based on their closeness of similarity distance matrix.

5- Conclusion

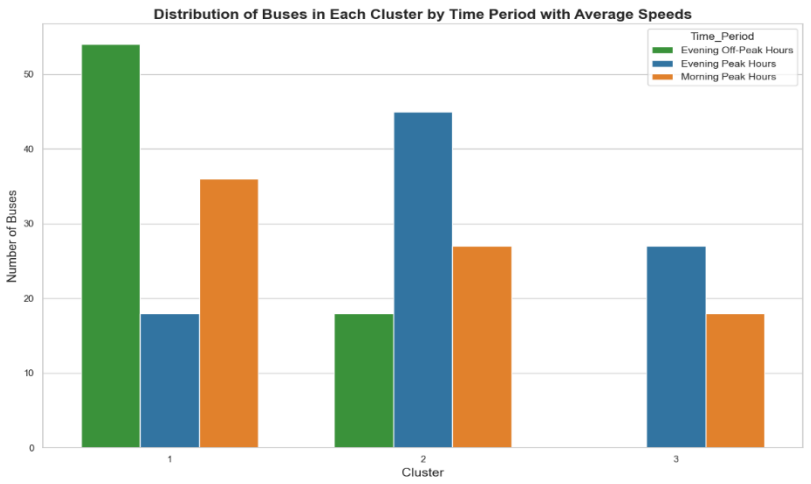
The study identifies the traffic patterns on MVG Bus line 54 by investigating the speed profiles of buses traversing across different time periods. Machine learning algorithm aided in grouping of time series data based on their similarity score calculated via DTW algorithm. The insights form this study can help in optimizing travelling behaviour of buses and enhancing operational efficiency with effective allocation of resources..

2- Speed Profiles



The speed profiles of buses are analysed across three time periods of the day to capture the variations in the speed of buses due to traffic flow.

4- The Clusters Characteristics



Clusters are analysed to determine bus distribution. Cluster #1, with the highest average speed, mostly includes late evening buses, while Cluster #3 with lowest speed consists only of morning and evening peak-hour buses.