Analyzing the impact of fare-free public transport policies on crowding patterns at stations using crowdsensing data
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Introduction
- Understanding the potential impact of fully or partially fare-free PT (FFPT) policies on crowding patterns
- Heterogeneous impacts of PT pricing policies among PT stations
- Emerging crowding data have wide coverage and fine resolution in spatial and temporal dimensions

Contributions
- Methodological framework leveraging wide-coverage PT station busyness data for demand pattern analysis
- Evaluating the 9-Euro ticket experiment in Germany using opportunistic data

Three-step busyness-based evaluation

Step 1: Feature engineering
- Latent variables identification
- Model selection
- Extract factors from station features
- Transform to histogram features
- Estimate probability density

Factors

Step 2: Station clustering
- Model selection
- Busyness-based station type characterization

Step 3: Station classification
- Latent variables identification
- Significant factors analysis
- Misclassification analysis

Case study and data
German federal government introduced “9-EUR Ticket”:
- Partially FFPT
- From June 1 to August 31, 2022
- Nationwide policy (natural experiment)
- Valid on all regional, local, and urban PT services

Google’s Popular time (GPT) data is collected (every two hours) for 2,134 railway stations at different phases of the policy.

Station clusters characterization
- Cluster 1: unaffected stations (146).
- Cluster 2: mildly stimulated (92). Increase ⇒ recover slowly
- Cluster 3: intensely stimulated (55). Increase significantly ⇒ reduce immediately

Conclusions
- Three business-based station categories are identified
- Station location, nearby activities, population in the station vicinity and neighbors, and demand patterns play a significant role in the crowding pattern changes