



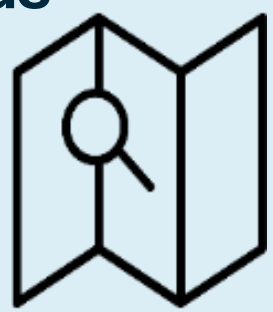
Monitoring population presence from satellite imagery

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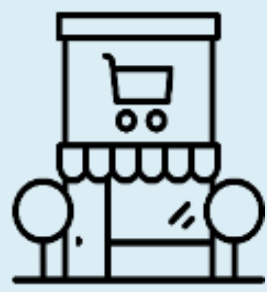
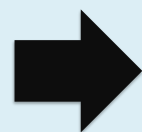
Introduction

People cross border to work almost every day or migrate over longer periods, and this reshapes the cities they live in, but tracking these movements at scale is challenging. Satellite imagery is one way to monitor this, but it requires near-daily image capture, which for now is reliably accessible for research at 3m ground resolution. At this resolution, individual objects are very difficult to detect. We use German Sunday shop closure law as a weak label to teach a model to detect presence of people from satellite imagery.

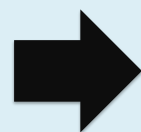
Methods



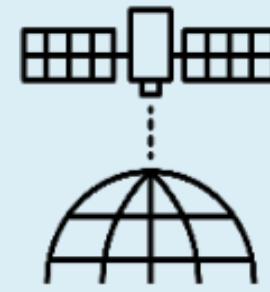
Map Search



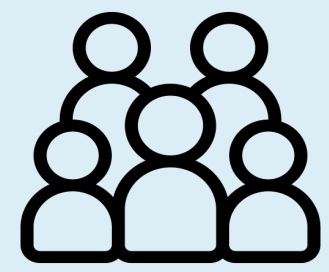
POI



Parking lot



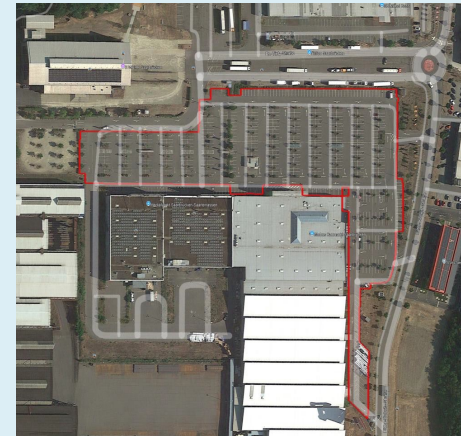
Satellite Imagery



Population
Presence /
Absence



Saturday
(shop open)

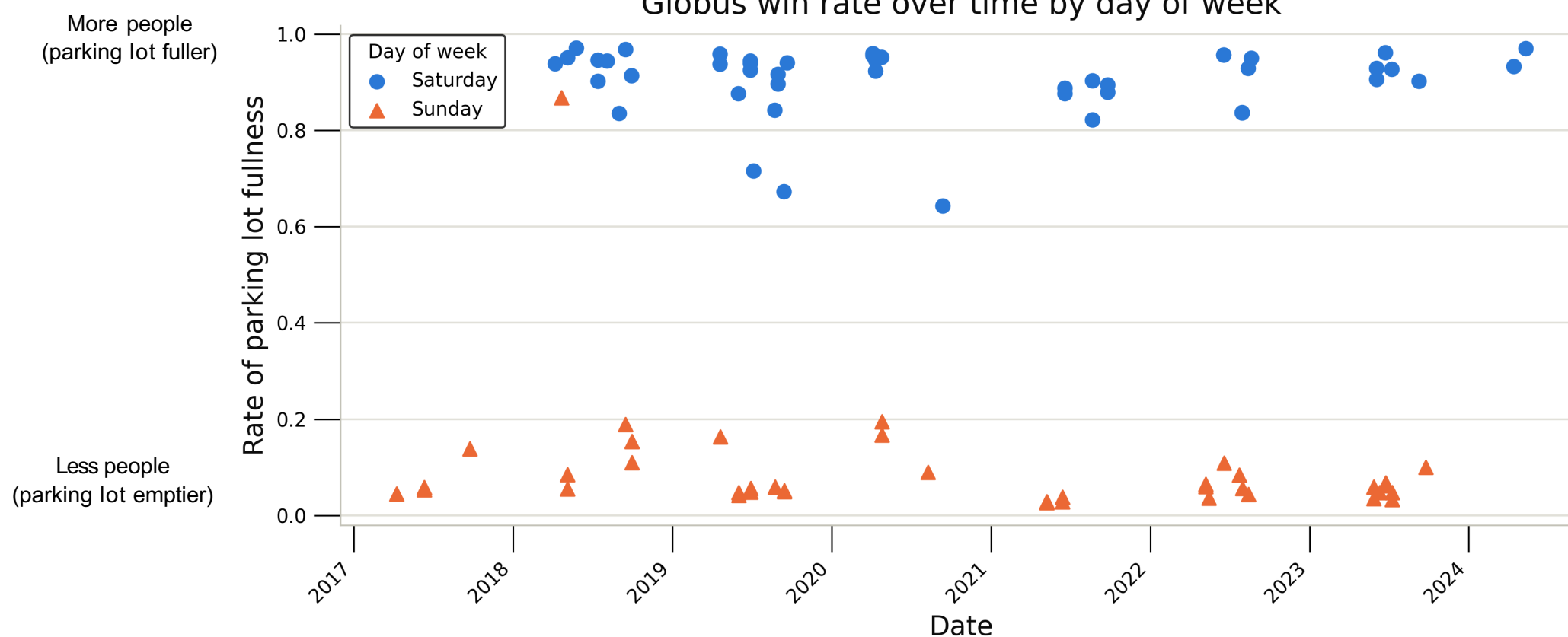


Sunday
(shop closed)

Results

We evaluate our trained model on comparing Saturday and Sunday satellite images of same location. We check how often Saturday images are ranked higher as busier and Sunday as emptier. At Globus Baumarkt, Saarbrücken, rate of parking lot fullness consistently stays above 0.6 for Saturday and below 0.3 for Sunday across 41 weekends from 2017 to 2024. The results shows a clear distinction between parking lot occupancy on weekends without any manual annotation.

Globus win rate over time by day of week



Theophilus Aidoo

Research Interests: Weak supervised learning, ranking from noisy labels



References

- Aidoo, Theophilus, et al. "A Weak Supervision Learning Approach Towards an Equitable Mobility Estimation." *ICWSM Workshop* (2025)
- Al-Emadi, Noora, et al. "VME: A satellite imagery dataset and benchmark for detecting vehicles in the Middle East and beyond." *Scientific data* 12.1 (2025): 500.