

MSc. Thesis Project

How Busy Is the City?

Predicting Crowd Flows from Sparse Sensor Data



Photo: Robert Van T Hoenderdaal

Problem description

Amsterdam Zuidoost is a rapidly changing area, with new residential and office towers, a major mobility hub, and the Johan Cruijff Arena attracting tens of thousands of visitors on event days. The municipality, police, fire brigade, ProRail and the Arena need a reliable picture of pedestrian and cyclist flows for planning and real-time crowd management.

The challenge: this picture must be reconstructed from counts at only a handful of locations. Local measurements do not reveal what is happening across the entire area, let alone what will happen next. This project explores how **probabilistic models and context data**—such as public transport, events and weather—can reconstruct area-wide flows from sparse and imperfect measurements, while making uncertainty explicit.

Assignment

You will develop a model that turns sparse counts into an area-wide, uncertainty-aware picture of pedestrian and cyclist flows:

- Build a probabilistic spatio-temporal model, combining count data with public transport data, the event calendar and weather
- Reconstruct in- and outflows from a small number of counting locations and quantify the uncertainty
- Explore how well the model can predict crowd levels, particularly around events
- Test your approach in the XCARCITY simulation environment and, as data becomes available, against real-world counts

The project uses a **real-world counting network** being deployed by Siemens Mobility for the City of Amsterdam. The focus is on understanding what sparse sensor data can (and cannot) tell us about a city.

Candidate

- MSc student in Transport, Infrastructure & Logistics, Civil Engineering (T&P), or a related programme
- Experience with Python programming
- Interest in AI, probabilistic modelling, urban mobility, or crowd dynamics

An **internship at Siemens Mobility** (Zoetermeer) is part of the project: you will work within a real deployment for the City of Amsterdam.

Research group

AiMTT, DAIMoND Lab at TU Delft Transport & Planning, in collaboration with Siemens Mobility and the City of Amsterdam

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