

MSc. Thesis Project

Where Should a City Measure?

Designing Sensor Networks with Active Inference



Photo: Chris Barbalis

Problem description

Cities increasingly rely on sensors to monitor pedestrian and cyclist flows, but sensors are scarce and expensive. Where you measure—and with what type of sensor—strongly affects the information available for predictions and decisions. Today, sensor placement is largely based on expert judgement.

Two goals compete: *measuring to steer*, where information helps manage flows, and *measuring to learn*, where sensors are placed where uncertainty is greatest. **Active Inference** makes this trade-off explicit by balancing these two goals when selecting where to measure.

This project will explore whether this AI-based approach can improve sensor network design in real-world mobility.

Assignment

You will investigate whether **Active Inference** can outperform expert-based sensor placement. You will:

- Formulate sensor placement and sensor type as an Active Inference problem, balancing steering and learning
- Compare AI-based designs with the existing expert configuration and with purely utility- or information-driven approaches
- Evaluate the different designs in the XCARCITY simulation environment

The testbed is real: Siemens Mobility is deploying **CCTV and stereoscopic counting sensors** at five locations around Amsterdam Zuidooost to monitor flows around the Johan Cruijff Arena for the City of Amsterdam and its safety partners.

Candidate

- MSc student in Transport, Infrastructure & Logistics, Civil Engineering (T&P), or a related programme
- Experience with Python programming
- Interest in AI, Bayesian methods, experimental design, or complex systems

An **internship at Siemens Mobility** (Zoetermeer) is possible; design sessions with Siemens engineers and the City of Amsterdam are part of the project.

Research group

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

Contact

Serge Hoogendoorn
s.p.hoogendoorn@tudelft.nl

Marco Hennipman
marco.hennipman@siemens.com