

MSc. Thesis Project Driving with Limited Information: What Can Drivers Really See?



Problem description

Most traffic models assume that drivers have access to accurate and sufficient information. In reality, however, driving involves acting under uncertainty. Drivers never see the full picture: they observe only a limited part of the traffic around them—the car in front, a glimpse of vehicles further ahead, or delayed information about what is happening downstream. Based on this partial view, they must continuously make decisions.

Active Inference provides a framework in which agents explicitly deal with this uncertainty by forming internal beliefs about the hidden state of the environment. This leads to a fundamental question: **How does limited and uncertain information shape driving behaviour and traffic flow?**

Assignment

In this project, you will explore how different types and levels of information influence driver behaviour and traffic dynamics. You will work with a microscopic traffic simulation as a flexible environment to **design and test assumptions** about what drivers know. For example, you may:

- Explore different observation settings (e.g. local vs. extended perception, perfect vs. noisy information, immediate vs. delayed feedback)
- Design how drivers interpret incomplete information and form internal expectations
- Experiment with simple belief-based or predictive mechanisms (inspired by Active Inference or your own ideas)

You are encouraged to **compare different information structures and modelling choices**, and investigate how they affect driving behaviour and traffic patterns, and develop insights into the role of information and uncertainty in traffic systems.

Candidate

- Experience with Python programming
- Interest in AI, perception, or uncertainty
- Curious about how limited information affects decision-making

Research group

AiMTT Project, DAIMoND Lab at TU Delft's Department of Transport & Planning

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