

MSc. Thesis Project From Reaction to Anticipation: How Can Drivers Predict the Future?



Problem description

Traffic jams can appear out of nowhere, even without accidents or bottlenecks. One key reason is that drivers react with delay. In reality, however, drivers do not only react—they also anticipate what might happen next.

Most traffic models include only simple forms of anticipation. But what if drivers could make richer, more informed predictions about the future? **Active Inference**, an emerging approach from AI and neuroscience, describes agents that continuously learn, predict, and act under uncertainty.

Using these ideas, this project explores a simple but powerful question: **Can better anticipation lead to smoother and more stable traffic?**

Assignment

In this project, you will explore how different forms of anticipation in driving behaviour influence traffic flow. You will work with a microscopic traffic simulation as a flexible environment to **design and test your ideas** about how drivers react and anticipate. For example, you may:

- Experiment with different ways of modelling driver behaviour, from delayed reaction to predictive or belief-based strategies
- Explore how drivers use current observations to form expectations about what might happen next
- Test these ideas under different traffic situations, such as disturbances or varying traffic densities

You will investigate how these behaviours influence traffic patterns such as stability, efficiency, and robustness, and develop your own insights into the role of anticipation in traffic systems.

Candidate

- Experience with Python programming
- Interest in AI, traffic, and simulation
- Curious about behaviour, prediction, and dynamic systems

Research group

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

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