Lehrstuhl für Fahrzeugtechnik
Fakultät für Maschinenwesen
Technische Universität München

Master's Thesis

Uncertainty-Aware Tracking for Autonomous Driving

Are you passionate about cutting-edge research in autonomous driving and enjoy diving deep into complex problems? Then this thesis opportunity might be for you!

🧠 The Challenge

Autonomous vehicles rely on their ability to **perceive and understand their surroundings**. A key component of this is **tracking** — the process of connecting object detections across time to form coherent trajectories and predict motion.

Traditionally, tracking frameworks operate by matching detected objects frame by frame and updating their memory. However, these systems often ignore one crucial factor: **uncertainty**.

At our institute, we've been advancing **uncertainty-aware object detection**, where instead of simple bounding boxes, detections carry spatial probability distributions that reflect their confidence — especially under challenging conditions like occlusion.

The next step? **Bringing this uncertainty into the tracking pipeline.**

🎯 Your Mission

This master's thesis will focus on one of the most critical and often overlooked aspects of tracking:
Data association — matching new detections to existing object tracks.

Your goal will be to:

- 🔁 Integrate an existing uncertainty-aware object detector into a Kalman Filter-based tracking framework.
- 🧩 Explore and adapt (or even invent!) **data association algorithms** that make use of uncertainty from both detection and tracking.
- 🛠️ Implement your approach in a real tracking system.
- 📊 Evaluate its performance against traditional, uncertainty-unaware methods.

Cornelius Schröder, M.Sc. | cornelius.schroeder@tum.de

Chair of Automotive Technology | Prof. Dr. Markus Lienkamp

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🌟 Why You?

You're the ideal candidate if:

- You love thinking deeply and rigorously about algorithms and theory.
- You're not afraid of math and enjoy reading and dissecting academic papers.
- Turning ideas into working code excites you.
- You want your work to have **real-world impact**—your algorithm could be deployed on our research vehicle **EDGAR**, driving on public roads!

If you are interested in this thesis project, please introduce yourself by sending your CV and a transcript of records to cornelius.schroeder@tum.de.

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