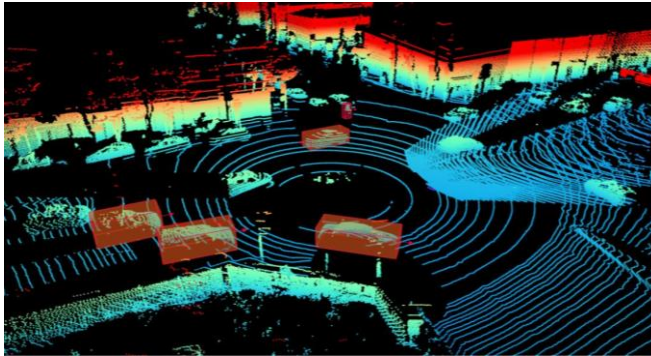


Master's Thesis

Uncertainty-Aware 3D Object Detection for Autonomous Driving (Transformer-Based)



Autonomous vehicles live or die by their perception stack. Transformer-based 3D detectors are the new state of the art—but great mAP alone isn't enough on the road. We also need **well-calibrated uncertainty** so downstream modules (tracking, motion prediction, planning) can make safer, smarter decisions.

In this thesis, you'll bring **epistemic** and **aleatoric** uncertainty estimation to modern **transformer-based 3D detectors**, and investigate how the **attention mechanism** itself can be leveraged to improve calibration. Your work helps pave the way for deploying a more capable, uncertainty-aware detector on our research vehicle **EDGAR** (deployment is a mid-term goal and outside this thesis scope).

What you'll do

- **Survey the field:** Review and compare leading transformer-based 3D object detectors.
- **Build & evaluate:** Implement epistemic and aleatoric uncertainty estimation by transferring our existing techniques to a selected transformer architecture.
- **Leverage attention:** Explore how transformer attention can be exploited for better-calibrated uncertainty (and rigorously evaluate the effect).

What you bring

- **Curiosity** for autonomous driving and machine learning.
- **Hands-on skills** with Python and PyTorch (experience helps).
- **Drive and ownership** to work independently and push ideas from concept to evaluation.

Why this is exciting

- **Impactful topic:** Uncertainty estimation is a fast-growing, high-impact area in autonomous driving.
- **Real-world relevance:** We already use aleatoric uncertainty in our research vehicle; your work extends this to cutting-edge transformer models.
- **Publishable potential:** Strong results can lead to a **publication**.
- **Supportive environment:** Access to prior codebases for uncertainty estimation and mentoring from an experienced research team.

How to apply

Send **(1) your CV**, **(2) transcript of records**, and **(3) a short motivation (max 5 lines)** to:
cornelius.schroeder@tum.de

If you're excited about making autonomy not just accurate but **reliably confident**, I'd love to hear from you.