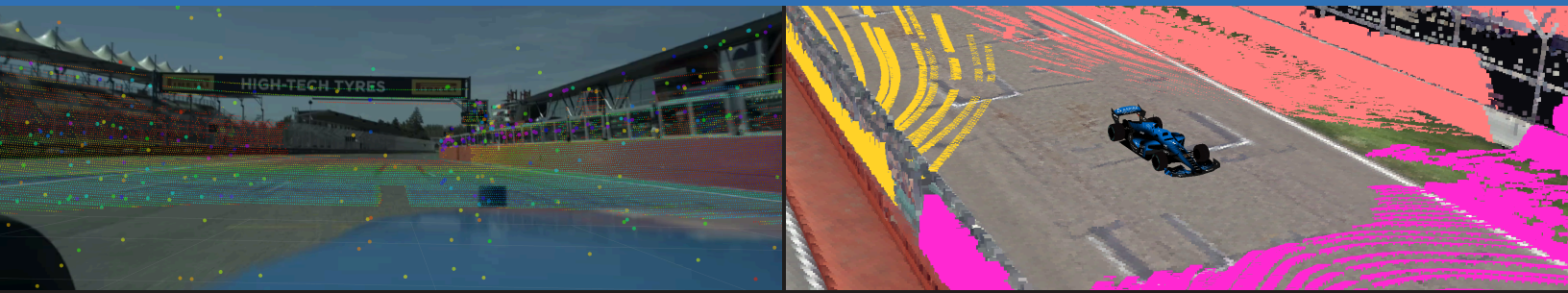


OPEN THESES — BACHELOR · MASTER · SEMESTER · IDP

# Online Calibration

Multiple LiDARs, 4D radars and cameras — with overlapping and non-overlapping fields of view — calibrated to each other and to the vehicle, while racing at over 200 km/h.



The TUM Autonomous Motorsport team made history by winning the Abu Dhabi Autonomous Racing League (A2RL) in 2025 at the Yas Marina Circuit. A2RL is a premier competition where teams develop software for identical autonomous vehicles that compete at speeds exceeding 200 km/h.

Every perception and localization module depends on precisely known sensor extrinsics. However, vibrations, aerodynamic load, and other changes to the car shift sensor mounts over a race weekend. These theses develop targetless methods that estimate and continuously refine the calibration *online*, developed and validated on real A2RL racetrack data.

01

## LiDAR ↔ LiDAR

Calibrating multiple LiDARs with non-overlapping fields of view.

02

## Radar ↔ Radar

Aligning multiple 4D radars from sparse, Doppler-rich returns.

03

## Camera ↔ LiDAR

Aligning image content and point clouds from natural scene structure.

04

## Sensor ↔ Vehicle

Motion-based calibration of every sensor to the vehicle frame.

### WORK PACKAGES

- Literature research and familiarization with the TAM software stack
- Implementation of calibration methods for the chosen sensor setup
- Adaptation to high-speed dynamics and (non-)overlapping FOV
- Evaluation and benchmarking on TAM A2RL data
- Documentation and visualization of the results

### WHAT YOU BRING

- Enthusiasm for perception, autonomous driving and racing
- Very good coding skills
- The ability to collaborate in a team

APPLY

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Send your CV, transcript of records and a short motivation.