

**Topic:** Contactless real-time road condition estimation during winters using suitable sensors for safe travel of an autonomous vehicle

**Summary:** Deployment of autonomous vehicles (AVs) on streets during winters brings forth a safety issue due to the possibility of presence of elements like snow, ice or black ice, subsequently leading to reduction in friction between the road surface and AV's tires. This could further lead to unpredictable dynamical behaviour of the AV, if it was not designed to function in such a situation. The specifications of an AV are listed out in a document called Operational Design Domain (ODD) (SAE J3016), and encountering a situation like above is example of an ODD exit.

It is crucial for the safety of the AV to detect these kinds of ODD exits in real-time and before the AV comes in contact with the affected part on the streets. This work aims in researching about such contactless road condition estimation algorithms and subsequently planning the possible behaviour of the AV according to the criticalness. This topic for a Research/Bachelor/Master thesis can also be offered and carried out in German language.

**Tasks:**

- Literature research on real-time contactless road condition estimation
- Algorithm development and implementation on Automated Driving (AD) Stack
- Evaluation and optimization of the algorithm
- Report and presentation

**Recommended requirements:**

- Basic proficiency in a programming language (C++, Python, MATLAB)
- Good understanding of classical mathematical and ML algorithms
- Basic knowledge about processing of camera image, 3D LiDAR point clouds and RADAR sensor data
- Knowledge on simulation softwares like CARLA

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