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Metrics and validation criteria

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1 Summary

Automated driving is still a challenging task both in research and in industry. Advanced driver assistance systems are more and more taking over driving functions. Thus solutions exist for specific cases and conditions; a generic approach is still missing. The objective of RobustSENSE is the development of a platform that combines the information from several vehicle sensors and fuses them in a holistic understanding of the environment and planning automated driving manoeuvres based on this information.

A key challenge for automated driving is robust behaviour under adverse conditions, i.e. when due to internal or external reasons the perception of the environment is deteriorated. Hence a robust sensor platform must be able to cope with difficult environment conditions, such as harsh weather, poor illuminations, e.g. in tunnels. Additionally, failure of single sensors should not lead to a failure of the system, i.e. in the case of sensor malfunction other sensors should provide additional information so that the environment can still be perceived.

This report provides the metrics and validation criteria for the RobustSENSE platform. Thereby it builds up on the previous specification of the RobustSENSE architecture. For all components that have been identified in the architecture specification, this document defines metrics data that allows assessing the quality of the output of the component. The data definition comes along with meta-information and thresholds.

The validation criteria show how exceeding metrics affect the system and how the system can be validated in online and offline assessment. For validation three approaches are shown:

1. Offline closed loop validation
2. Offline open loop validation
3. Online real world validation

The offline validation is performed in a simulator environment. Virtual and recorded data can be used at different abstraction levels, i.e. raw sensor data, processed sensor data or the fused environment model is used to test the higher level components, i.e. sensor processing, data fusion or understanding and planning components. In closed loop testing the output of the components is fed back into the live input to the components, whereas in closed loop testing the output is merely analyzed.

The online validation is performed with automated cars in the real world. As the test vehicles are equipped with different sensor setups, various validation scenarios are explained. These scenarios are derived from use cases that are covered by the RobustSENSE platform.