Lehrstuhl für Fahrzeugtechnik
Fakultät für Maschinenwesen
Technische Universität München

Interdisciplinary Project | Term Project | Master's Thesis

Learning-based Predictive Quality of Service for Teleoperation

Motivation:

As the fallback solution of autonomous driving, teleoperation provides the bridging technology for level 4 autonomous driving, [1] which enables the operator to control the vehicle remotely. However, the safe operation highly relies on many key performance indicators (KPIs) of the network connection between the vehicle and the remote operator. Therefore, predictive quality of service (pQoS) provides the possibilities of predicting the network condition and hence allows the teleoperation to adapt to dynamic network condition.

Description:

To predict the intrinsic features of the dynamic network condition of teleoperation, a learning-based method needs to develop. On one hand, to cope with the high dimension of the measurements of the network condition, classic machine learning approaches, e.g., linear regression, should be investigated for physical-layer measurements, e.g., signal strength. On the other hand, deep learning methods, e.g., RNN, LSTM [2], should be investigated as how well they perform w.r.t. temporal features of the network condition.

This project can be divided into the following sub-tasks:

- Literature research on the topic learning-based pQoS for teleoperation.
- Develop and implement a proof of concept (PoC) for learning-based pQoS with the existing software stack for teleoperation.
- Experiment and analyze the performance of the developed PoC.

Requirements:

- General interest in research topics of teleoperation and autonomous driving.
- Basic knowledge of network communication and OSI model [3].
- Knowledge of classic machine learning as well as deep learning methods.
- Programming skills with object-oriented programming (OOP) languages, e.g., Python, C++.
- Self-motivated working style.
- Good English and/or German communication.

Reference:

1. Society of Automotive Engineers (2021) - Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles (J3016_202104)
2. Barmpounakis, et al., (2021) - LSTM-based QoS prediction for 5G-enabled Connected and Automated Mobility applications
3. Wikipedia – OSI model

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