LiangDao

Master's Thesis

Subjective evaluation of the critical level of cut-ins using virtual reality

Cut-in, defined as the movement of a vehicle from the adjacent lane into the driving lane of the ego vehicle, is a common scenario in daily traffic. For highway auto piloting of an autonomous vehicle the cut-in scenarios are considered to be one of the most challanging situation accoding to the 2018 Euro NCAP automated driving tests report [1].
To test and validate the perception system for autonomous driving, LiangDao GmbH is working together with its customers to acquire Lidar-based real-world traffic data in Germany and in other European countries. Via Big data analysis and data mining, cut-in scenarios can be extracted out of the acquired traffic data and provided to the customer for function testing and development.

Figure 1: Left: Visualization of a real world cut in scenario using VTD. Right: VR glasses Star (VR)

Among all the cut-ins, the critical (dangerous) ones attract more attention during the development of autonomous vehicles to reduce the risk of a car crash and further to improve the ride experience of the passengers. The evaluation of the criticality of a cut-in can be categorized into two types, objective and subjective. Based on the mathematical modelling of a scenario the objective evaluation is mostly employed for improving driving safty, whereas the subjective evaluation, which relies fully on the judgement and feeling of the driving participants, targets at relieving passenger stress caused by critical cut-ins. With the current technology subjective evaluation of cut-ins in real traffic are performed by the engineers sitting in the test vehicle during the entire data acquisition [2]. The biggest disadvantages of this method lies in the long time, effort, and the non-reproducibility of the evaluations. One possibility of overcoming the disadvantages is to shift the online evaluation to a more compact offline evaluation by simulating the acquired scenarios and visualizing them using virtual reality glasses.

Hence the target of the master thesis is to simulate and export the acquired cut-in scenarios in virtual reality format (e.g. VRML) and to visualize the scenarios with respect to different viewing positions of the driver/passengers with VR glasses. Validation of the effectiveness of this method is in combination with another LiangDao project in cooperation with the FH Kempten.

References:

[1] 2018 Automated Driving Tests; https://www.euroncap.com/en/vehicle-safety/safety-campaigns/2018-automated-driving-tests/.

[2] Schick, Bernhard & Seidler, Corinna & Aydogdu, Seda & Kuo, Yu-Jeng. (2019). Driving Experience Versus Mental Stress at Assisted Lateral Guidance. ATZ worldwide. 121. 68-73. 10.1007/s38311-018-0210-9.

About LiangDao:
LiangDao is a fast-growing young startup since 2018 with 70 team members focusing on developing LiDAR based applications for autonomous driving as well as for smart cities in China and Germany. With the engineering knowledge of integrating multiple high precision sensors into vehicle and the permission to collect real world traffic data in China and Europe, LiangDao has built up a big data and software development center for ground truth generation using LiDAR algorithms, scenario detection and analysis as well as traffic simulation for development, testing and validation of autonomous driving.

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