Event Camera HIL Test Bench

Relevance to the Automotive and Autonomous Systems Industries:	Event cameras are sensors with high potential in future automated driving. In automated driving, perception is currently a bottleneck to avoid high latencies for subsequent processes while maintaining high quality. Faster perception algorithms, however, seem unattainable as even state-of-the-art algorithms do not come close to human perception quality. To achieve faster perception nevertheless, sensors with low latency and low data rate are coming into focus. Event cameras are one example of such sensors. In contrast to video cameras, they only consider changes in the lightning conditions in their pixels. These changes are then transmitted asynchronously.
Research Location:	Technische Universität Darmstadt Institute for Automotive Engineering (FZD)
Homepage (Engl.):	http://www.fzd.tu-darmstadt.de
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Project Description: May 22 - Jul 28, 2023 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute for Automotive Engineering (FZD) is participating in the *AUTOtech.agil* project that attempts to improve modular automated vehicles. This NSF REU project will be concerned with a hardware-in-the-loop (HIL) test bench for investigating environmental influences on event camera data. The objective for the NSF REU student is to describe the consequences of changing environmental influences (e.g., light, weather, adversarial attacks) and edge cases on event camera data. For this purpose, we want to experiment with artificial fog, laser beams, stroboscopic light, and mirrors. The successful outcome will be the realized HIL test bench, a recorded dataset, and a description of environmental influences on the sensor data. **PHASE A** (2 weeks): During this introduction phase, the NSF REU student will review relevant research; investigate existing software and hardware; and detail and distribute project responsibilities for the remainder of this NSF REU project. **PHASE B** (3 weeks): Next, the student will realize the event camera HIL test bench, record the first environmental effects, and document this work. The focus during this phase will be on the realization of the test bench. **PHASE C** (3 weeks): Then, the student will experiment with different environmental influences and record the resulting event camera data. This includes describing the consequences on the sensor data and subsequent algorithms. **PHASE D** (2 weeks): Finally, the NSF REU students will document the research performed, prepare a written report, and deliver an end-of-summer presentation on the research performed.
Target publications:	• **11. Tagung Automatisiertes Fahren**, *Eine Fachtagung der TU München und des TÜV SÜD*, Munich, Germany, December 7-8, 2023. Short papers (German) due June 16, 2023. Full papers (English) due later.
Necessary Skills/ Knowledge:	• Interest in sensors for fully automated driving
Desirable Skills/ Knowledge:	• Experience with Python, perception algorithms
Additional Online Resource(s):	https://papers.nips.cc/paper/2020/file/c213877427b46fa96cff6c39e837ccee-Paper.pdf https://youtu.be/MjX3z-6n3iA https://vitro-testing.com/cv-hazop/

NSF REU Students must have completed at least two semesters of engineering studies prior to the proposed summer research, and they must have at least one semester remaining before they can earn their BS in Engineering.