Hi-Drive 1ST SUMMER SCHOOL

AGENDA DAY 1
06 September 2023

08:45 – 09:15 Hall	**REGISTRATION**
09:15– 09:30 Auditorium	**OPENING - Welcome note by Hi-Drive** Aria Etemad, Hi-Drive Project Coordinator, Volkswagen Group Innovation - Germany Angelos Amditis, R&D Director at ICCS/NTUA, Chairman of ERTICO - Greece
	SESSION 1 Robust all-weather perception
09:30– 10:15 Auditorium	**Corner Cases and Occlusions in Environment Perception for Automated Driving** Jasmin Breitenstein, PhD Student Computer Vision, Technische Universität Braunschweig - Germany
10:15 – 11:00 Auditorium	**Artificial intelligence to improve vehicle vision for automated driving in poor visibility conditions – Overview and latest results from the AI-SEE project** Werner Ritter, Researcher and Senior Expert at Mercedes-Benz GA - Germany
11:00 – 11.30 Hall	SUN & COFFEE BREAK
11:30 – 12:15 Auditorium	**Robust Local and Collective Perception under Varying Weather Conditions** Georg Volk, Researcher at University of Tübingen, Dpt. of Computer Science, Embedded Systems – Germany
12:15 - 13:00 Auditorium	**All-weather capable and ODD defragmenting fine resolution radar for automated driving** Marc-Michael Meinecke, Senior Researcher at Volkswagen – Germany
13.00 – 14:15 Restaurant	LUNCH BREAK
	SESSION 2 Testing and evaluation methodologies I
14:15 – 15:00 Auditorium	**Evaluating Causal Effects of SOTIF Triggering Conditions** Christian Neurohr, Researcher at DLR, Systems Engineering for Future Mobility Institute – Germany
15:00 – 15:45 Auditorium	**The Hi-Drive Driving Scenario Database** Marcel Sonntag, Institute for Automotive Engineering, RWTH Aachen University – Germany
15:45 – 16.00 Auditorium	**DAY 1 Wrap-up** Anastasia Bolovinou, ICCS - Greece
16:00 – 16:45 Hall	**Get together** at the “Invited speakers” corners + **Poster session visit**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006664

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AGENDA DAY 2
07 September 2023

SESSION 3
Testing and evaluation methodologies II

09:30– 10:15 Auditorium	**Towards a quantitative SOTIF validation of Automated Driving Systems** Lina Putze, Researcher at DLR, Systems Engineering for Future Mobility Institute – Germany
10:15 – 11:00 Auditorium	**Recent advances on testing autonomous vehicle systems: an industry perspective** Jon Sadeghi, Senior Research Engineer at Five AI – UK
11:00 – 11.30 Hall	SUN & COFFEE BREAK
11:30 – 12:15 Auditorium	**Safety Verification of Autonomous Vehicles via Edge Case Testing** Felix Feng - Research Associate & Manager of the Intelligent Infrastructure and Transport Systems Laboratory at Imperial College London – UK
12:15 - 13:00 Auditorium	**Simulating the Future of Automated Driving: Unveiling Human Factors Issues and Providing HCI Insights** Andreas Riener, Prof. for Human-Machine Interface and Virtual Reality, Technische Hochschule Ingolstadt – Germany
13.00 – 14:15 Restaurant	LUNCH BREAK

SESSION 4
CCAM deployment in Europe: Applications and the emerging regulation landscape

14:15 – 15:00 Auditorium	**Cooperative connected and automated mobility for Day-2-and-beyond services** Claudio Ettore Casetti, Full Professor at Politecnico di Torino, Department of Control and Computer Engineering – Italy
15:00 – 15:45 Auditorium	**Regulations on Automated Driving Systems: The current state and some important challenges** Konstantinos Mattas, Joint Research Centre (JRC), European Commission Ispra
15:45 – 16.00 Auditorium	**Summer school Wrap-up** Angelos Amditis, R&D Development Director at ICCS/NTUA, Chairman of ERTICO - Greece
16:00 – 16:45 Hall	**Get together** at the “Invited speakers” corners + **Poster session visit**

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Jasmin Breitenstein
PhD Student Computer Vision, Technische Universität Braunschweig

Jasmin Breitenstein received the B.Sc. degree and the M.Sc. degree in mathematics from Technische Universität Berlin, Germany, in 2016 and 2019, respectively. She is currently pursuing the Ph.D. degree with the Faculty of Electrical Engineering, Information Technology and Physics, Technische Universität Braunschweig, Germany. Her research interests lie in corner case concepts and detection methods, as well as amodal segmentation methods in perception in automated driving.

Corner Cases and Occlusions in Environment Perception for Automated Driving

This presentation delves into the multifaceted research field of corner cases. We will explore various existing definitions and corner case categories. Moreover, we will consider other applications of corner case definitions such as descriptions and relevance estimation. Focusing on corner cases arising from occlusions in both single images and videos, we will look into the research field of amodal segmentation to treat such corner case types and offer insights into the challenges and solutions within this critical aspect of computer vision and image analysis.

Werner Ritter
Researcher and Senior Expert at Mercedes-Benz GA

Dr. Werner Ritter, with an M.Sc. in Computer Science (1988) and a PhD from the University of Koblenz (1996), joined Daimler-Benz AG in 1988. Post-corporate split in 2021, he continued with Mercedes-Benz AG. His roles spanned developing traffic sign recognition and leading the DAIMLER night vision system. Since 2012, he's been a senior expert at Mercedes-Benz, overseeing adverse weather perception research. Notably, he managed projects like RobustSENSE, DENSE, and AI-SEE.

Artificial intelligence to improve vehicle vision for automated driving in poor visibility conditions – Overview and latest results from the AI-SEE project

AI-SEE addresses a critical challenge in automated driving – the inability to sense surroundings in various weather conditions. Harsh weather, like snow and heavy rain, poses a major obstacle for self-driving cars. The project aims to overcome this by developing a reliable environment perception technology. AI-SEE focuses on creating robust and fault-tolerant sensing technology and AI for driving in adverse weather and lighting conditions. After two years of work, promising approaches have been developed to enhance automated driving systems' perceptual capability in challenging weather conditions. These will be discussed in the presentation.

Georg Volk,
Researcher at University of Tübingen, Dpt. of Computer Science, Embedded Systems

Georg Volk, a graduate research assistant at the University of Tübingen's Chair for Embedded Systems, earned his B.S. in applied computer science from DHBW Stuttgart in 2013. He completed his M.S. in computer science at the University of Tübingen in 2016 and is currently pursuing a Ph.D. in computer science. His research focuses on vision-based local perception, collective perception, and improving robustness in various environmental conditions like rain, snow, or fog.

Robust Local and Collective Perception under Varying Weather Conditions

Environmental influences have an impact on both local and collective perception. To establish a resilient perception, it is crucial to incorporate environmental influences into a sophisticated processing approach, which focuses not only on statistical perception models. Our processing pipeline includes realistic synthetic weather simulations which is used to evaluate and optimize perception. Employing synthetic weather simulations provides optimal control over environmental influences and accurate knowledge regarding intensity. For evalution purposes, a comprehensive safety metric will be employed. This metric enables the incorporation of detection capabilities, timing constraints, and objects' relevance into a single, easily interpretable score

Marc-Michael Meinecke
Senior Researcher at Volkswagen

Marc-Michael Meinecke studied electrical engineering at Technical University Braunschweig and received his Diploma degree in 1997. In his PhD thesis he focused on automotive radar waveform design at Institute of Telecommunications/ Technical University of Hamburg-Harburg. Since 2001 he is with Volkswagen Group Research in Wolfsburg. His research interests are in the domain of innovative radar technology for automated driving for cars as well as commercial vehicles.

All-weather capable and ODD defragmenting fine resolution radar for automated driving

Finding the right perception technology for automated vehicles is a very important topic. Different sensor technologies namely cameras, lidar and radar are well known for this task. In HiDrive a special focus is put on closing gaps in ODD. Some of these gaps are due to adverse weather and limited detection capabilities in this kind of conditions. The presented radar system comes up with a concept for robust detection capability in adverse weather. The interesting highlight of this concept is the very fine angular resolution what is comparable with today's lidar systems.

Christian Neurohr, Researcher at DLR, Systems Engineering for Future Mobility Institute

Christian Neurohr holds B.Sc. and M.Sc. degrees in mathematics from Technische Universität Kaiserslautern (2011, 2013) and a Ph.D. from Carl von Ossietzky Universität Oldenburg (2018). Following a stint as a Visiting Researcher at the University of Sydney, he became a Postdoctoral Researcher at the German Aerospace Center (DLR) e.V. His research focuses on scenario-based verification and validation of automated driving systems, with specific interests in criticality analysis, safety applications of causal theory, and hazard analysis. Additionally, he coordinates the ‚criticality analysis' sub-project in the VVM project.

Evaluating Causal Effects of SOTIF Triggering Conditions

The ISO 21448 provides guidance on achieving safety of the intended functionality (SOTIF) for road vehicles with driving automation. Among other measures, it requests the identification and evaluation of so-called triggering conditions. In this presentation, we explore how the mathematical framework of causal theory can be leveraged to quantify causal effects of triggering conditions on measured criticality for a given automated driving system (ADS). Provided that sufficient data are available, the proposed approach constructively enables the causal evaluation of such triggering conditions, delivering a solid argument for a safety case.

Marcel Sonntag
Institute for Automotive Engineering, RWTH Aachen University

Studied Mechanical Engineering (M.Sc.) with focus on Automotive Engineering at RWTH Aachen University. He is currently doing his PhD at the Institute for Automotive Engineering (ika) of RWTH Aachen University. Leading the competence network for automated and connected mobility (innocam.NRW) of the state North Rhine-Westphalia. Focus of own studies on safety assessment of automated driving. Leading SP7 of Hi-Drive.

The Hi-Drive Driving Scenario Database

In the Hi-Drive project, diverse operational data from various use cases are gathered and harmonized for research purposes. A driving scenario-based evaluation approach, utilizing the Hi-Drive Common Data Format, is devised. Driving scenarios are identified, assessed, and stored in the Hi-Drive driving scenario database. Edge cases are also detected and included in the database. This resource serves for model calibration and deriving test cases within the project.

Lina Putze
Researcher at DLR, Systems Engineering for Future Mobility Institute

Lina Putze received B.Sc. and M.Sc. degrees in mathematics from the University of Münster in 2016 and 2019, specializing on the topics of stochastic processes, probability theory and its applications. She currently works at the German Aerospace Center (DLR) e.V. Institute of Systems Engineering for Future Mobility. Her research focuses on methods to ensure safety of highly automated vehicles, in particular identification of hazards, causal modelling and risk assessment.

Towards a quantitative SOTIF validation of Automated Driving Systems

Automated driving systems are safety-critical cyber-physical systems whose safety of the intended functionality (SOTIF) cannot be assumed without proper argumentation based on appropriate evidences. Recent advances in standards and regulations on the safety of driving automation are therefore intensely concerned with demonstrating that the intended functionality of these systems does not introduce unreasonable risks to stakeholders. In today's presentation, we will critically analyze and discuss the ISO 21448 standard which contains requirements and guidance on how the SOTIF can be provably validated. Our overarching goal is to derive a well-defined risk decomposition that enables rigorous, quantitative validation approaches for the SOTIF of automated driving systems.

Jon Sadeghi
Senior Research Engineer at Five AI

Dr. Jonathan Sadeghi is a Research Engineer based in Bristol, one of the offices of a startup called Five (recently acquired by Bosch) that is focused towards developing AI systems to help build driverless cars. He obtained his PhD in Engineering from the University of Liverpool (2020), focusing on uncertainty quantification and machine learning. His current research interests span the intersection of computer vision and probabilistic machine learning with applications to autonomous vehicles.

Recent advances on testing autonomous vehicle systems: an industry perspective

How should we test autonomous vehicles to ensure they are safe to deploy? The answer to this simple question is surprisingly complex. For practical deployment scenarios, real world testing alone will not be sufficient to prove that these systems are safe. Therefore, we advocate a multifaceted computational simulation approach, with both open and closed loop testing, using both recorded data and scenario-based testing. We will discuss different simulation approaches whilst describing how to exploit the structure of the autonomous vehicle stack for a more effective testing strategy. Then we will describe the challenges of performing simulation in a way that is useful, realistic and efficient, with reference to relevant current research which could offer a compelling solution.

Felix Feng
Research Associate & Manager of the Intelligent Infrastructure and Transport Systems Laboratory at Imperial College London

Dr. Yuxiang (Felix) Feng is a Research Associate and Manager at Imperial College London's Intelligent Infrastructure and Transport Systems Lab. His expertise includes enhancing safety validation for Autonomous Vehicles, particularly in edge case generation and human interaction modeling. Additionally, he works on alternative Positioning, Navigation, and Timing (PNT) solutions during GNSS outages. His research interests cover environment perception, sensor fusion, and AI for robotics and Autonomous Vehicles.

Safety Verification of Autonomous Vehicles via Edge Case Testing

Dr. Felix Feng addresses the urgent concern of ensuring the safety of autonomous vehicles in the face of rapid technological advancements. The presentation will delve into the challenges of evaluating their safety, highlighting complexities at the intersection of technology and safety requirements. Emphasis will be placed on recent advancements in safety verification, specifically in edge case testing. Through real-world examples and innovative approaches, Dr. Feng will illustrate the expanding boundaries of autonomous vehicle safety assessment.

Andreas Riener
Prof. for Human-Machine Interface and Virtual Reality, TH Ingolstadt

Andreas Riener, a professor at Technische Hochschule Ingolstadt, heads the User Experience Design program and the „Human-Computer Interaction Group." With a Ph.D. in computer science, he joined THI in 2015, securing €5.5 million in third-party funds. His research centers on HCI, driver-vehicle interaction, and human-technology cooperation in automated driving. Actively engaged in IEEE and ACM, he serves as the ACM AutomotiveUI steering committee co-chair and chairs the German ACM SIGCHI.

Simulating the Future of AD: Unveiling Human Factors Issues and Providing HCI Insights

This speech examines the convergence of human factors, HCI, and the evaluation of automated driving systems. Using research projects as examples, we'll explore the use of simulations for studying automated driving, discussing setup in driving simulators and mixed reality environments to address the sim-real domain gap. Topics include Wizard-of-Oz studies, explainability of automated driving systems, and the vital role of driver-vehicle cooperation. Confidence and trust in these systems, and their impact on user experience, will also be explored.

Claudio Ettore Casetti
Full Professor at Politecnico di Torino, Department of Control and Computer Engineering

Claudio Casetti, a Full Professor at Politecnico di Torino, specializes in vehicular networks, Intelligent Transportation Systems, 5G/6G networks, and IoT systems. With 250+ papers and an H-index of 42, he's a Senior Member of IEEE. He led the Master in „Electrified and Connected Vehicle" and chaired the Turin Urban Digital Mobility group. Providing tutorials at major IEEE conferences, he serves as Senior Editor for Mobile Radio at IEEE Vehicular Technology Magazine.

Cooperative connected and automated mobility for Day-2-and-beyond services

The presentation provides an overview of the status of standardisation of C-ITS and its services for Connected and Automated Vehicles, with a focus on ETSI standards for Day-2 and beyond. The areas that will be covered will include: Collective perception, i.e., the sharing of the perceived driving environment of a vehicle based on its on-board sensors; Protection of Vulnerable road user (i.e., two-wheelers, pedestrians…); and, finally, manoeuver coordination between vehicles around specific areas (i.e., intersections, highway merging…).

Konstantinos Mattas
Joint Research Centre (JRC), European Commission Ispra

Konstantinos Mattas received the B.Eng. degree in civil engineering (specialized in transportation), the M.Sc. degree in applied mathematics, and the Ph.D. degree in fuzzy logic applications in transportation engineering from the Democritus University of Thrace, Xanthi, Greece, in 2014, 2017, and 2021, respectively. Since 2017, he has been working with the European Commission–Joint Research Centre, Ispra, Italy. His research interests include automated driving systems, intelligent transportation systems, simulation of vehicle dynamics and driver behavior, microscopic simulation of traffic networks and network control, optimization, and traffic safety.

Regulations on Automated Driving Systems: The current state and some important challenges

Konstantinos's presentation is about new regulations relevant to automated driving systems on international levels. There is the will to regulate systems of high levels of automation, to ensure, first and foremost safety. However, ensuring safety is not a trivial task. Moreover, unnecessary strict requirements have to be avoided, as they can result in negative effects on the efficiency of traffic networks. Recent regulations and upcoming ones will be outlined. The approach will be explained to ensure safety, while not overdesigning and avoiding systems developed to fit the tests. Finally, the main challenges and opportunities will be discussed.