

Enabling Autonomous Driving Simulations through Virtual Worlds

Markus Huber

XR EXPO
06/26/2020

to create reality



MACKEVISION AT A GLANCE



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Part of Accenture Interactive

Mackevision Medien Design GmbH is a global market leader in Computer Generated Imagery (CGI).

We design and produce high-end 3D visualizations, animations and visual effects (VFX) for images, films and interactive applications.

With innovative technologies and over 20 years experience in the automotive sector, we develop turnkey solutions for leading OEMs and suppliers worldwide.



13 LOCATIONS
AROUND THE GLOBE



WORLD
WIDE

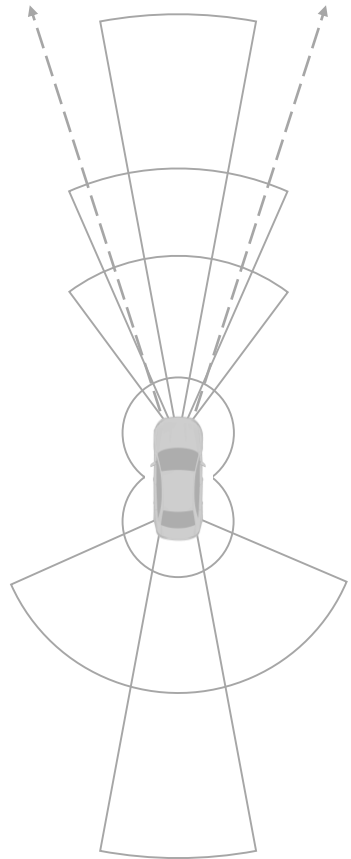
600+ EMPLOYEES 



WORLD LEADING
CGI COMPANY

WE ARE PART OF
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Virtual Environments for Autonomous Driving Simulations



Challenges

- Complex interaction of different sensor systems (camera, lidar, radar, ...)
- AI algorithms need lots of data with high variance and additional meta data (ground truth)

Our approach: platform based on real-time engines for

Virtual Validation

Validation of

- Sensor systems
- AI-based functions

Generation of Training and Test Data Sets

- Fast generation of huge data sets
- Automated generation of ground truth data
- Parameter variations (environment, lighting, conditions, ...)
- Create specific and rare events

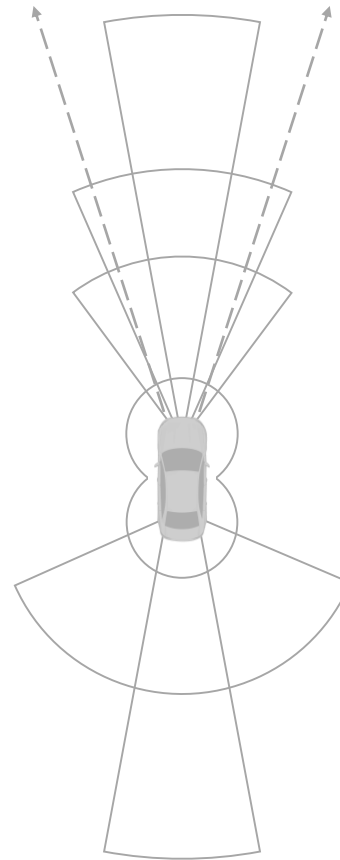
Virtual Environments for Autonomous Driving Simulations



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Real environments

- Validation and testing only of recorded environments
- No variation of parameters
- Difficult or impossible to create risky or rare events („corner cases“)
- High manual effort creating ground truth data
- Expensive and time consuming approach
- Possible legal restrictions of publicly available data sets



Virtual environments using real-time engine

- **Different environments** (variable content, situation, location)
- **Variation** of parameters (weather, season, lighting, positions/speed, ...)
- **Creation of specific, risky, and rare events** possible („corner cases“)
- Automated generation of **ground truth** data
- Fast generation of huge data sets
- **Unrestricted** usage

KI Absicherung



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Safe AI for Automated Driving



Gefördert durch:



Bundesministerium
für Wirtschaft
und Energie

aufgrund eines Beschlusses
des Deutschen Bundestages

Ein Projekt entwickelt von der
VDA Leitinitiative
autonomes und vernetztes Fahren



KI Absicherung

KI Absicherung



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Joint research project (07/2019 – 06/2022)

<https://www.ki-absicherung.vdali.de>

- **Funding authority:** Bundesministerium für Wirtschaft und Energie (BMWi)
- **Project executing organization:** TÜV Rheinland

- **Total budget:** €41 M
- **Funding:** €19 M

Consortium (25 + X project partners)

- **Consortium lead:** Volkswagen AG (Dr. Stephan Scholz)
- **Consortium Co-lead:** Fraunhofer IAIS (PD Dr. Michael Mock)
- **Consortium:** manufacturers, suppliers, **technology providers**, and academic research partners

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Consortium

OEMs	 VOLKSWAGEN AKTIENGESELLSCHAFT		 BMW GROUP					
Suppliers	 BOSCH Invented for life							
Technology providers	 AID autonomous intelligent driving	 ASTech Automotive Safety Technologies		 Luxoft A DXC Technology Company	 MACKEVISION Part of Accenture Interactive	 MERANTIX	 qualityminds	 umlaut
Research institutions	 DFK Deutsches Forschungszentrum für Künstliche Intelligenz GmbH	 DLR	 Fraunhofer IAIS	 FZI				
Universities	 BERGISCHE UNIVERSITÄT WUPPERTAL	 Technische Universität München	 UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386					
External partners	 BIT TECHNOLOGY SOLUTIONS	 neurocat	 understand.ai	 eict European Center for Information and Communication Technologies EICT GmbH				
			Technology providers	Project management				

KI Absicherung

KI Absicherung



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Overall Vision Statement

KI Absicherung makes the safety of AI-based function modules for highly automated driving provable.





Goals of KI Absicherung

1. **Train and test methods for AI systems**

Development, implementation and evaluation of methods and measures to determine and improve the properties of AI modules relevant to safety and reliability.

2. **Safety argumentation**

Building a convincing strategy for a stringent safety argumentation.

3. **Communication with respect to AI certification**

Exchange with normative committees, standardization and certification bodies in order to reach an industry consensus.



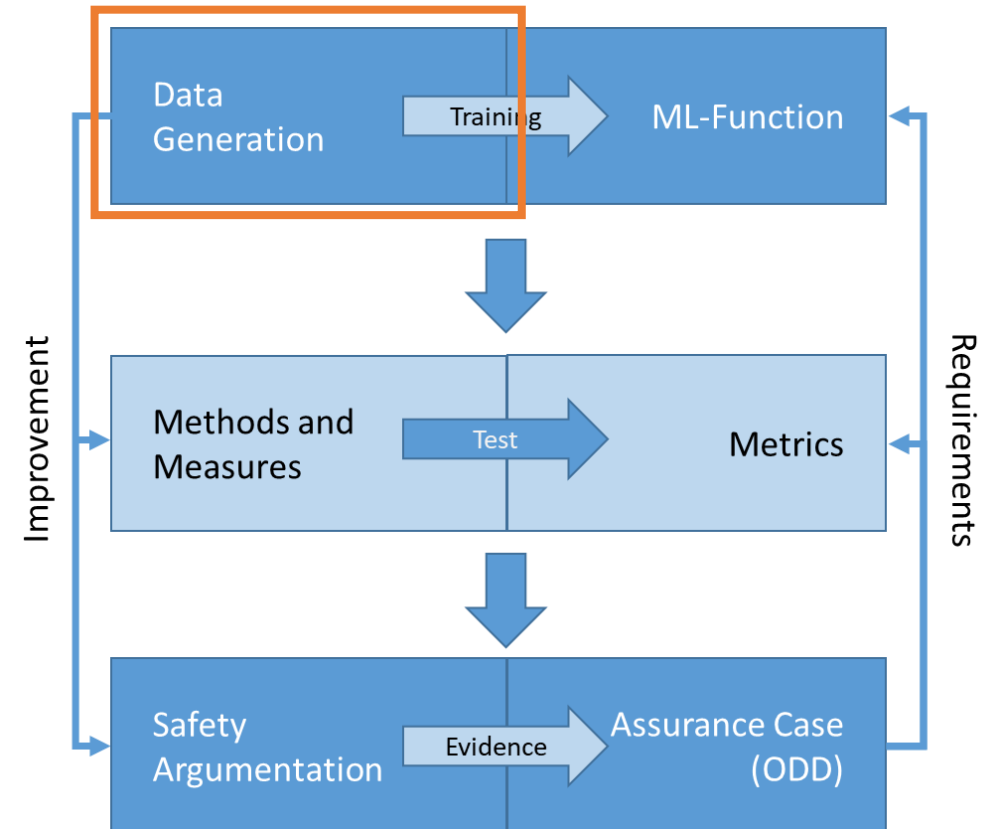
Methodology and approach

Approach:

- From data driven AI to an Assurance Case for the use case pedestrian detection

Methodology:

1. Process-related generation of synthetic learning, testing and validation data
2. Development of methods and measures to improve the AI in a wide variety of metrics
3. Development and validation of testing methods for these metrics
4. Stringent argumentation and process chain for the AI function and its Operational Design Domain (ODD)





Synthetic learning, testing, and validation data

We want to enable scalable and flexible generation of synthetic learning, testing, and validation data.





Synthetic data generation

- Innovative approach to generate synthetic data to meet diverse requirements
- Continuous and scalable data generation as needed
- Based on open file formats and interfaces for effective cooperation within project
- Unrestricted usage of generated data



Synthetic data generation with real-time engines (Mackevision)

- Continuous generation of sensor data and ground truth by given requirements
 - Camera sensor
 - Ground truth: group and instance segmentation, depth, bounding boxes
 - Additional meta data
- Variable environments and light conditions
- Generation of variations
- Variation of animations and integration of motion capture data for pedestrians

Synthetic data generation with real-time engines

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Synthetic data generation with real-time engines

Automated generation of ground truth data

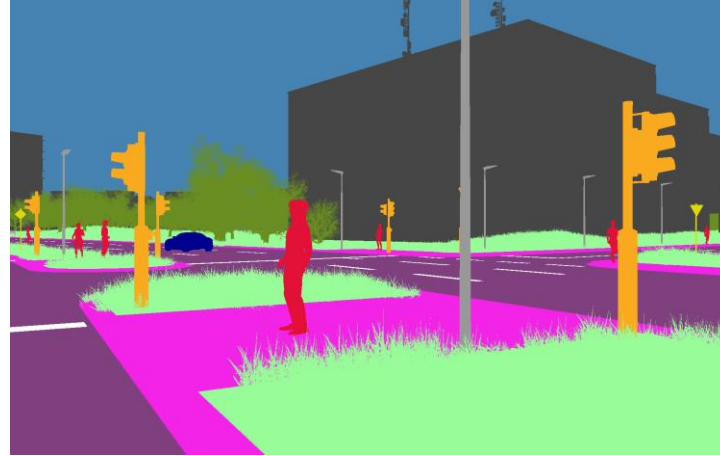
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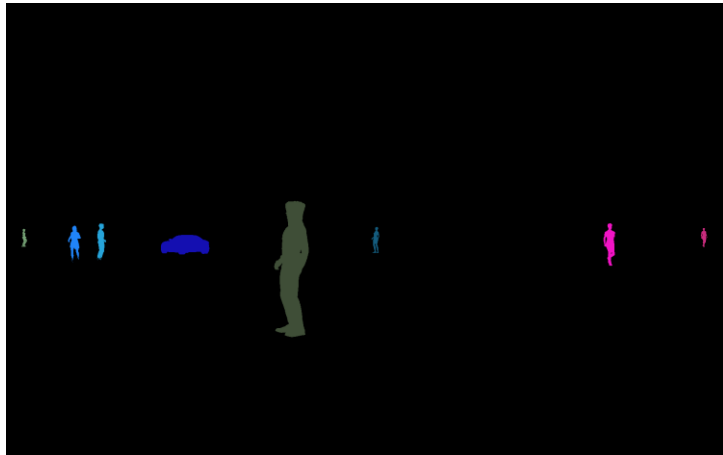
RGB Sensor



Group Segmentation



Bounding Boxes



Instance Segmentation



Depth Values

Synthetic data generation with real-time engines

Automated generation of ground truth data

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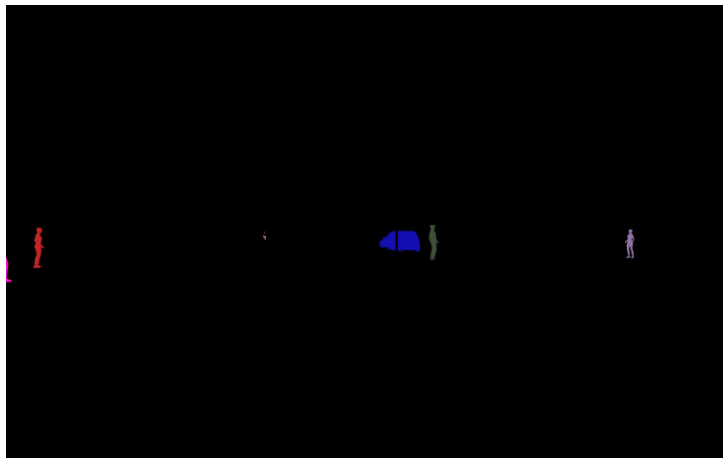
RGB Sensor



Group Segmentation



Bounding Boxes



Instance Segmentation



Depth Values

Real-time engines for Safe AI for Autonomous Driving



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- Generation of large synthetic data sets for training, testing, and validating AI functions
- Automated generation of ground truth data
- Arbitrary variations of locations, situations, environments, lighting and weather conditions, and more
- Systematically reproducible scenarios
- Allows for system changes (e.g., sensor setup)
- Creation of corner cases





Contact



**Dr. Markus
Huber**

markus.huber@mackevision.com