

The importance of Machine Learning for the Future of Mobility

IG Metall Engineering Mobility Summit – Zukunft der Fortbewegung

Jan Zawadzki

Agenda

1. The importance of ML

AI investments and ROI rising across industries.



2. CARIAD SE & ML

Who are we, and why do we believe in ML?



3. Automotive ML Development

Safety-critical ML development, and what you can learn from it.



Artificial Intelligence (AI) has the potential to transform every product across industries.

Machine Learning
is **MORE** than just
another tool.

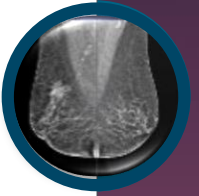
AI + Speech Assistants

“Speech Assistants can provide value in many future IoT devices.”



AI + Medical Software

“AI can make diagnostics cheaper, scalable, and more accurate around the world.”



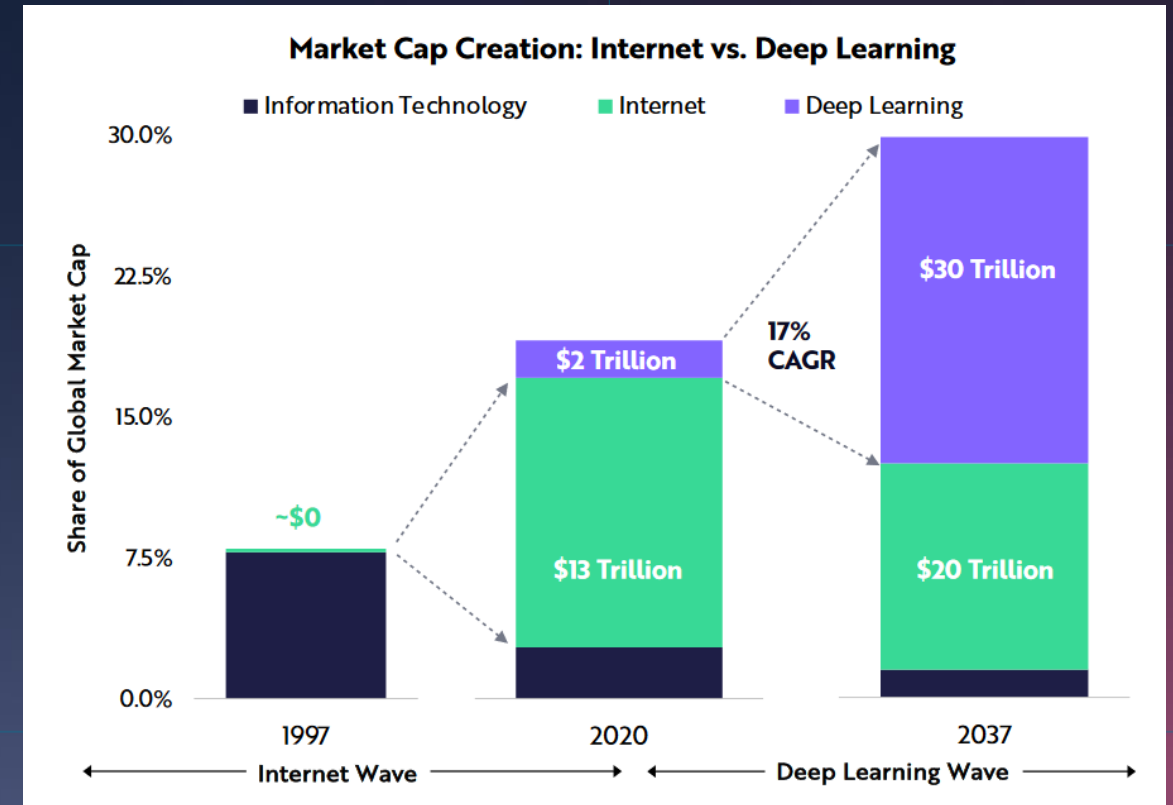
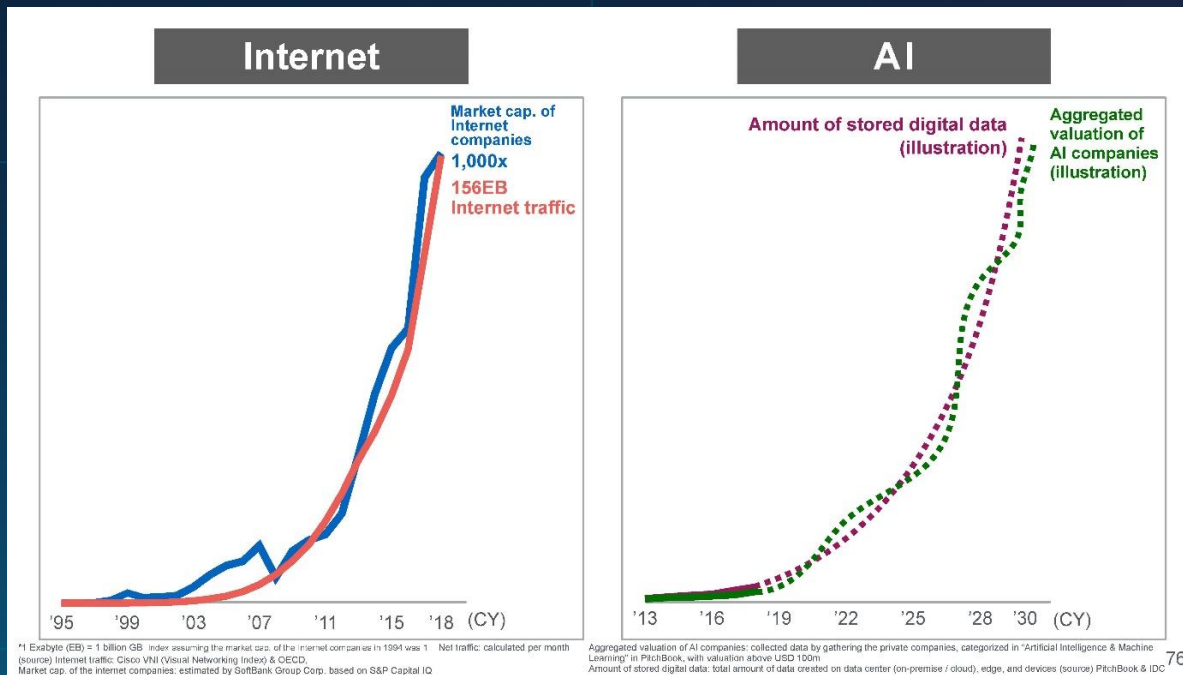
AI + Games

“I believe AlphaGo will be difficult to beat for humans.”

Lee Se-dol, Go-Champion who lost to Alpha Go in 2016



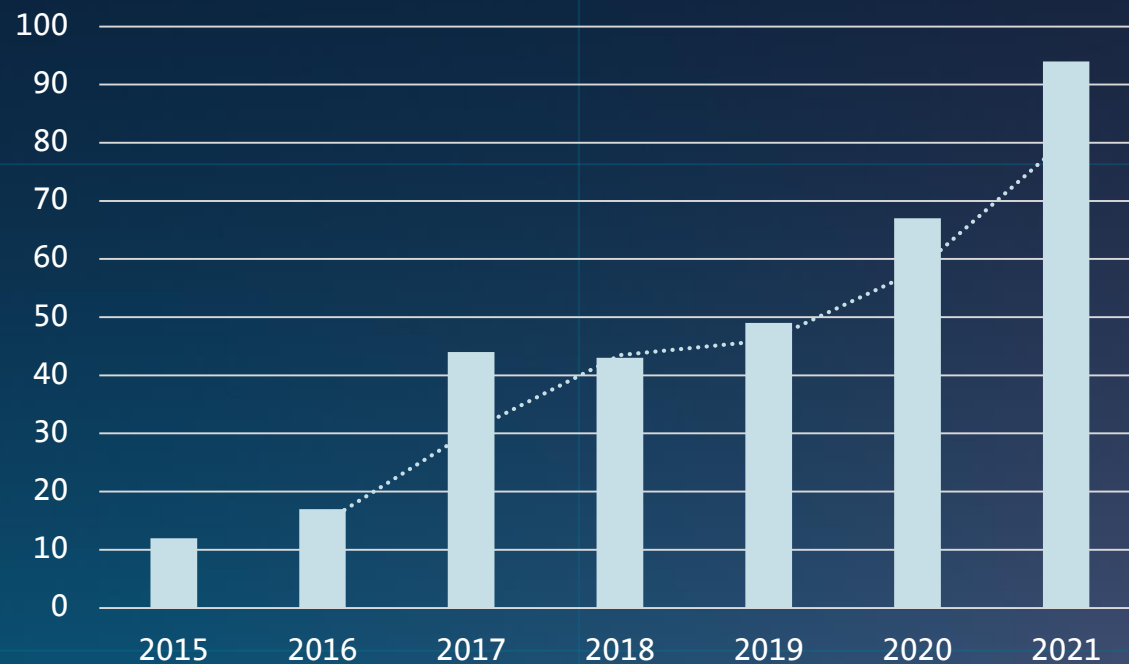
Big Money Bets on AI. If your company becomes digitized, the AI potential increases as well.



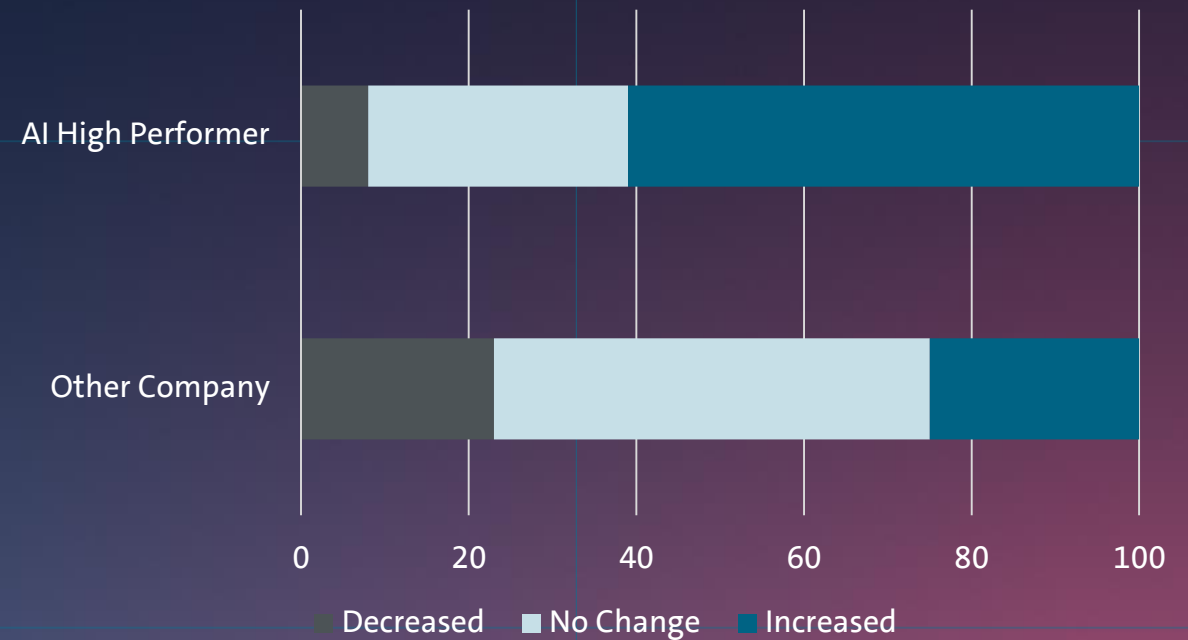
- Source: SoftBank Q3 Earnings Report, https://cdn.group.softbank/en/corp/set/data/irinfo/presentations/results/pdf/2019/softbank_presentation_2019_002.pdf
- Source: Ark Invest Big Ideas Report 2021, <https://ark-invest.com/big-ideas-2021>

We witness a race to arms in AI investments. AI High Performers see increasing returns on AI Projects.

Global Corporate Investment in AI in \$bn,
Stanford AI Index 2022



Average change in AI Investments across
Business Units in %, McKinsey 2020



- Source: Stanford AI Index 2021, <https://hai.stanford.edu/blog/state-ai-10-charts>. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nd/4.0/>.
- Source: McKinsey Global Survey: The state of AI in 2020, <https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/global-survey-the-state-of-ai-in-2020>

The upcoming EU AI Act will regulate the development of AI applications which can cause a user physical or mental harm.

The EU AI Act:

- Classifies AI applications in unacceptable, high-risk, and limited-risk categories
- Unacceptable risk applications are i.e. social scoring, facial recognition for police work, or dark pattern AI
- High-risk applications can be i.e. CV scoring, AI to support judicial cases, recommenders
- Will affect any company which wants to use AI-based products in the European Union
- Could become a global standard



Brussels, 21.4.2021
COM(2021) 206 final

2021/0106 (COD)

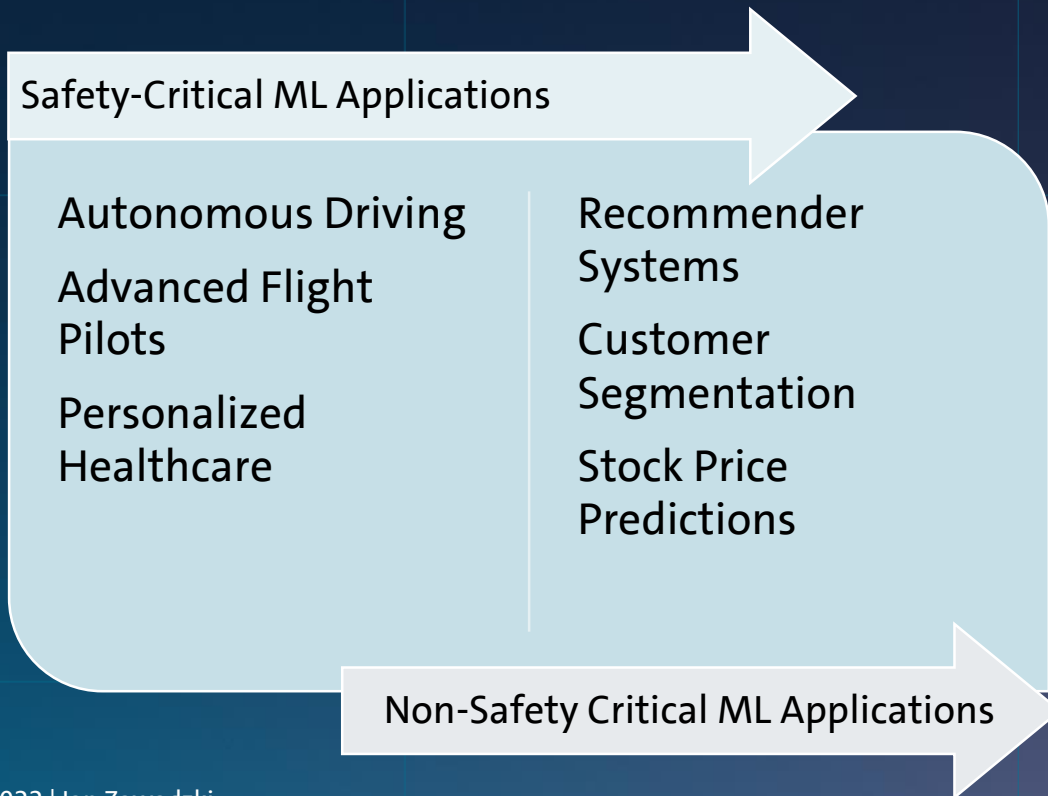
Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

**LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE
(ARTIFICIAL INTELLIGENCE ACT) AND AMENDING CERTAIN UNION
LEGISLATIVE ACTS**

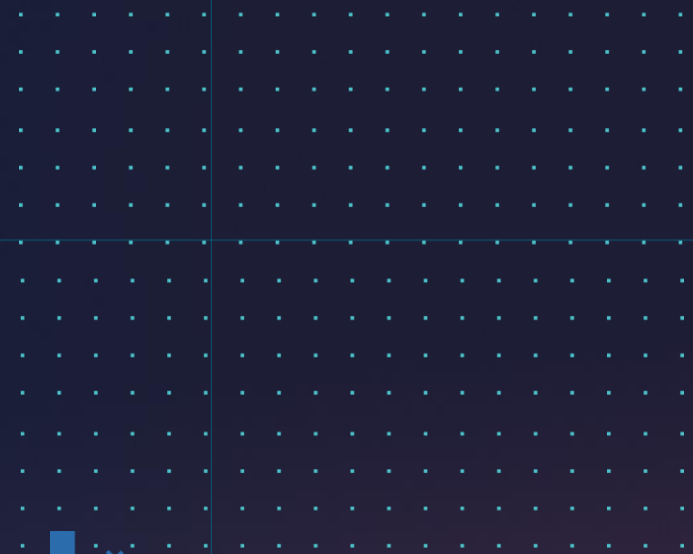
{SEC(2021) 167 final} - {SWD(2021) 84 final} - {SWD(2021) 85 final}

There are safety and non-safety critical AI applications. Some best practices from one domain could be reused by the other.



The automotive industry focuses on integrating ML into safety-critical applications. Some best practices can be useful to non-safety relevant use-cases in the future, e.g. to comply with future EU AI regulations.

Enter CARIAD SE



We are the newest member of Volkswagen Group.



Challenge

Technological



The current technological disruption is driven by the global paradigm of digitalization. Complexity in software and electronics is growing exponentially and building their own tech stack from the scratch is an impossibility for many OEMs.

Economical



The latest market shifts favor recurring revenue over sales and services over products, enabling new players in an increasingly complex market landscape with rising cross-industry collaboration.

Environmental



The increasing pollution of our ecosystems, dwindling natural resources and a sharp decline in biodiversity require all manufacturing industries to adjust their effects on and prepare for the reality of the global climate change. E-mobility is a must have nowadays.

Sociopolitical



Climate change, growing cities with infinite traffic jams, thousands of traffic deaths each day. These topics are moving people all over the world. Regulatory standards are also rising and demand new solutions.

The car needs to be rethought.

Connectivity

Making cars and mobility part of our customers' digital life.

Software driven

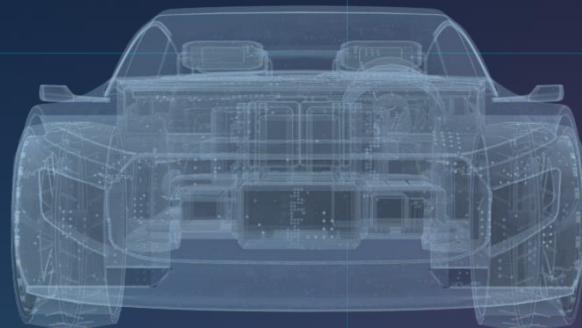
Rethinking the car from a software perspective, turning it into an intelligent companion.

Electrification

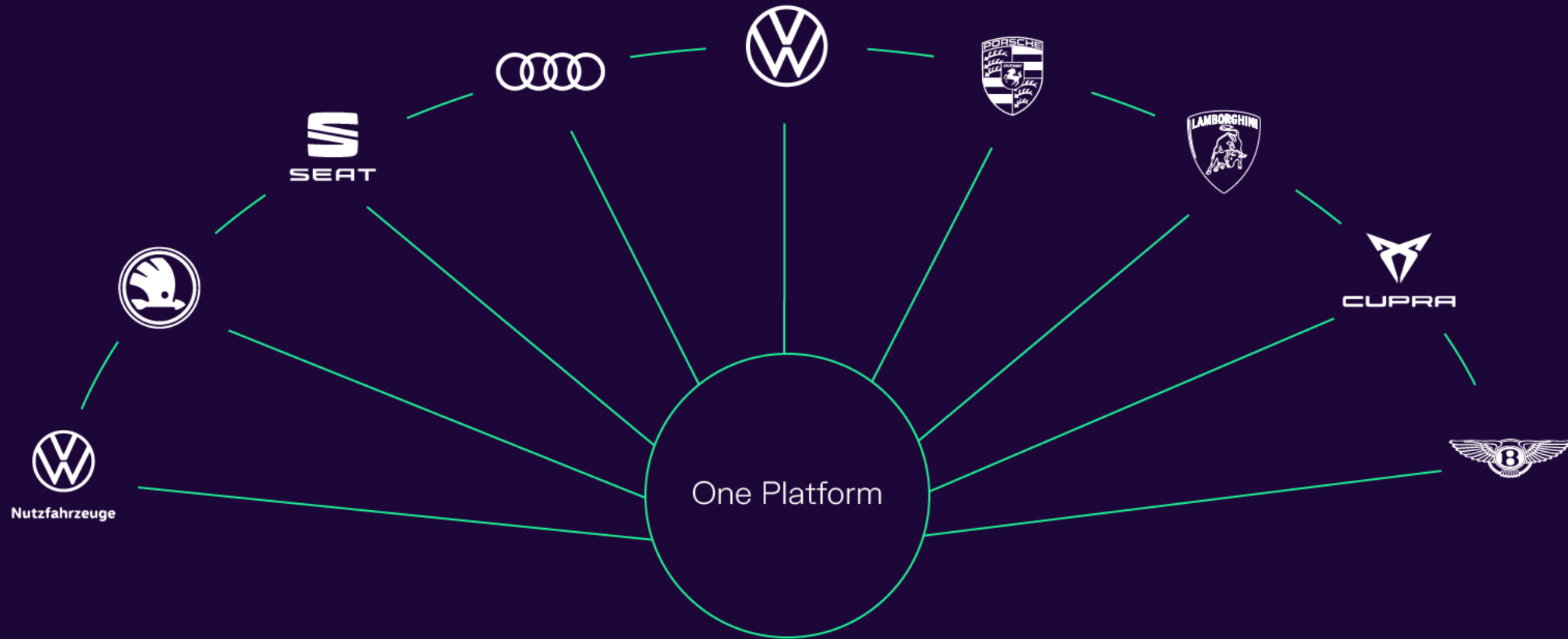
Making mobility more sustainable.

Autonomous driving

Making cars safer and more comfortable for everyone.



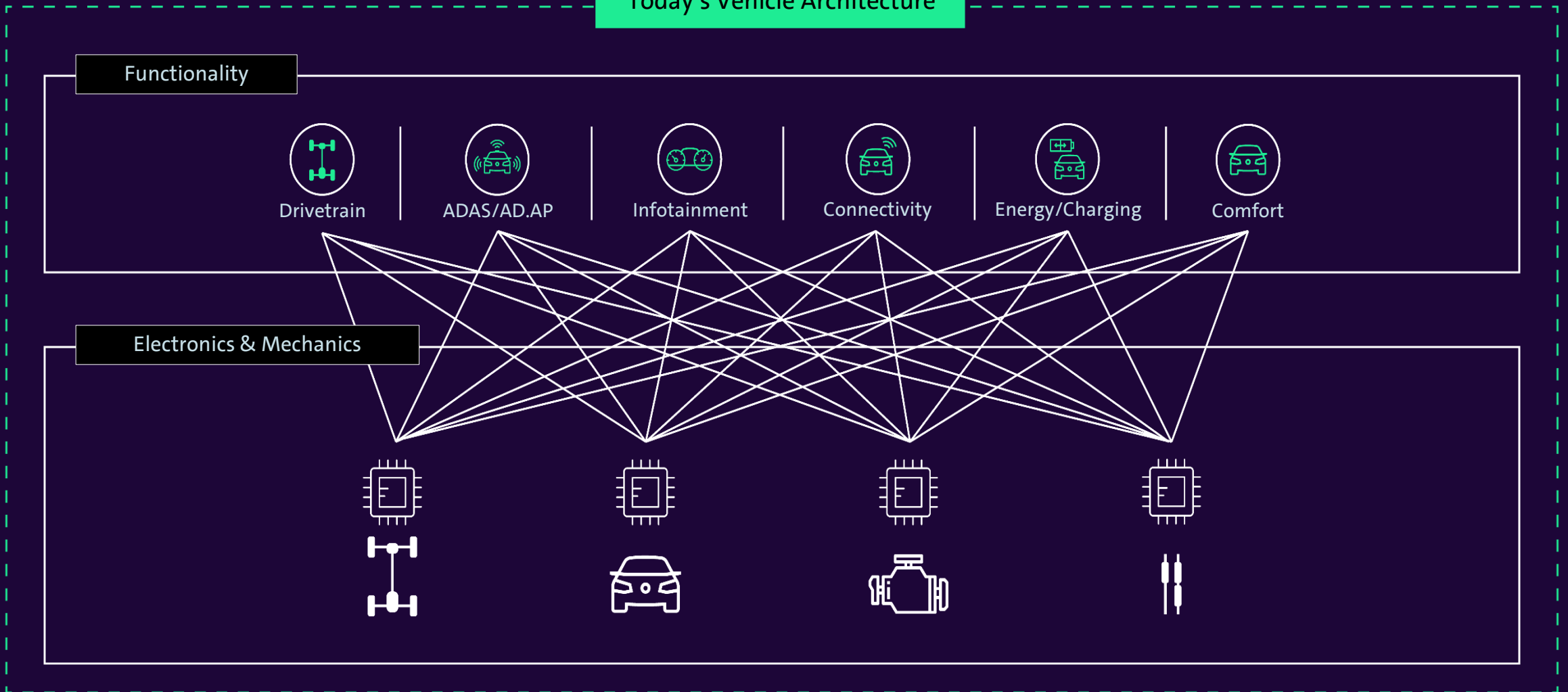
Platform is key.



Volkswagen is the pioneer in platform development

THE PROBLEM: Car software development is way too complex & cars have limited capabilities.

Today's Vehicle Architecture



OUR SOLUTION: Dispose complexity, adding functionalities.

Digital Device Architecture

Apps



Platform



Hardware



OUR SOLUTION: One unified and scalable platform for all.

1. Hardware layer

The hardware layer consists of cameras, sensors, actuators – and a very powerful and scalable computing platform.

3. Application layer

The application layer enables all the automotive features and services that shape the great experience of millions of customers.

2. Software layer

The software layer features VW.OS – our groundbreaking Volkswagen Operating System. This in-vehicle software is constantly connected to our global Volkswagen Automotive Cloud VW.AC.

One software platform. Lots of benefits.



Updatability

Constant and efficient updatability enables attractive vehicles and the best, always fresh customer experiences.



Speed

The seamless software platform and intelligent data analysis speed up development and time to market.



Scalability

The digital platform suits any car model – from entry-level to top-end. Applications can easily be customized.



Simplicity

One unified platform reduces complexity – and less hardware reduces costs and weight.



Customer orientation

Data-oriented development helps us to learn from and react to customers' needs and desires.



New revenue streams

Car brands can generate new digital business models – from after sales to monetizing data or third-party apps.

At CARIAD, we bring sustainable change to one of the largest enterprises on the planet. We are gathering the brightest digital minds.

5,000+
colleagues

360
teams

74
nationalities

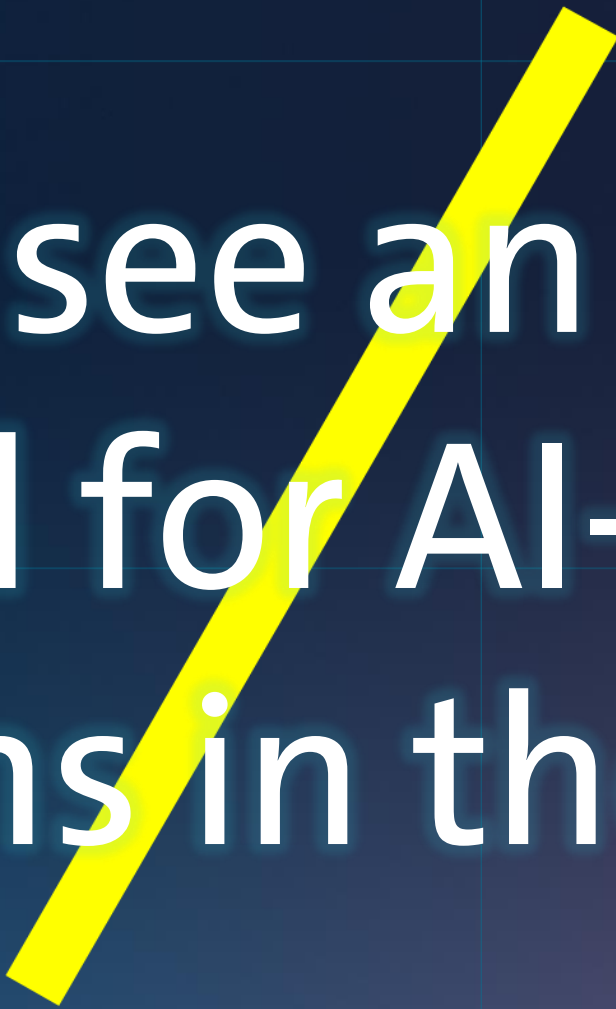
100
job profiles

60%
of software developed in-house
by 2025

15
code languages

Automotive ML Development





We will see an increased
demand for AI-based
functions in the future.

Through the AI-Ready Architecture, CARIAD empowers VW to unlock the Virtuous Cycle of AI.



We want to use the vehicle as an AI Platform by quickly deploying AI functions to our customers safely.

The key components of an AI-Ready Architecture are:

- Customized compute power with AI acceleration in the vehicle
- Capability to collect valuable data
- Powerful backend to efficiently and safely develop AI Products



AI Projects Examples at CARIAD

Our projects range over a broad spectrum of use-cases and AI algorithms



Project Highlights (Extract)

Processes & Development Chain



Big Loop & Data Collection

AI Safety & Dev Processes

Automated Pre-Labeling

ML Development Pipeline

In-Car Customer Functions



Customer-centric personalization

Automated Driving

Performance Improvement

Mobility Pattern Prediction

Automated Driving and AI

Processing chain of autonomous driving & the use of AI along the value chain



Arguing Safety in Automated Driving Systems

AI goes safety critical

CENTRAL CHALLENGE

1. AI goes safety critical

SAFETY **(FuSa + SOTIF)**

Central Challenge in bringing highly automated driving on the road.

Argument on safe functioning needed to allow for acceptance & road permission

COMPLEXITY DRIVERS



Mere driving will not suffice to plausibilize safety
— particularly challenging with respect to software updates over time. “Black-Box” approach seems impracticable



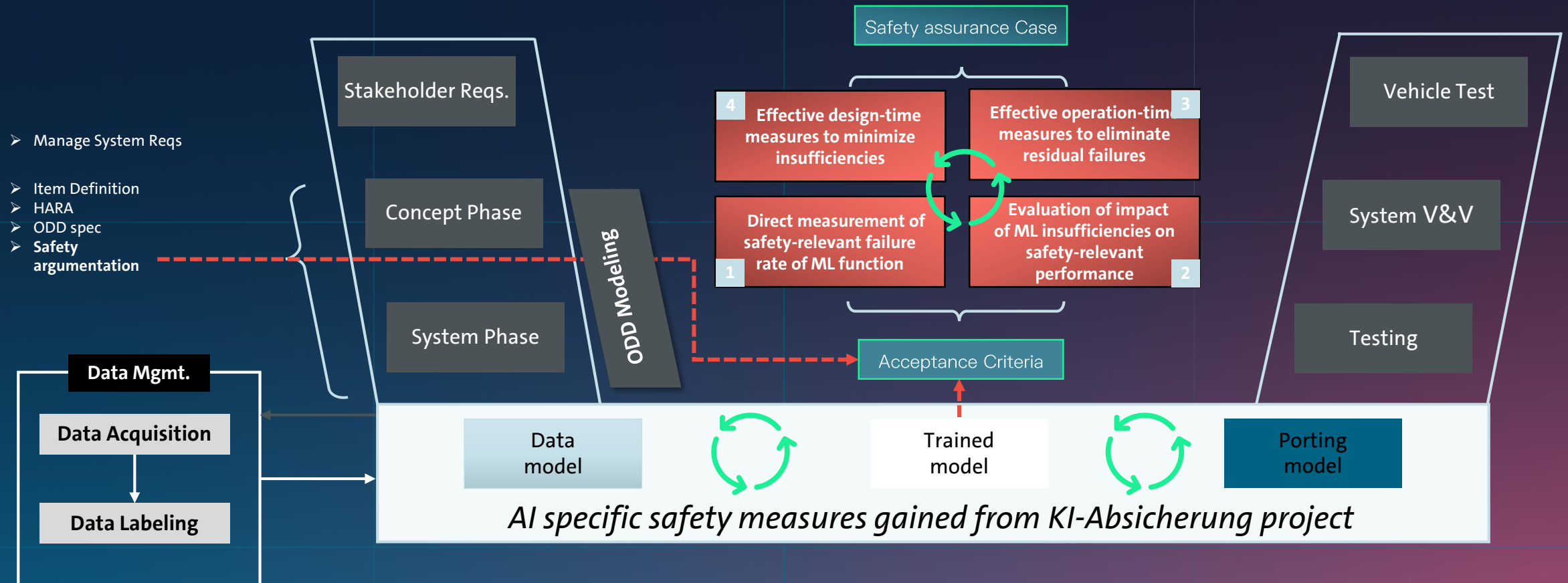
Handling complexity of the driving environment –
open world, unknown unknowns, etc.



Need for continual safety monitoring & assurance
— continuous monitoring

The overarching process for safety-critical ML development adjusts classical development to make it more iterative

Big System V + 3 agile V-models for data processing, training and porting





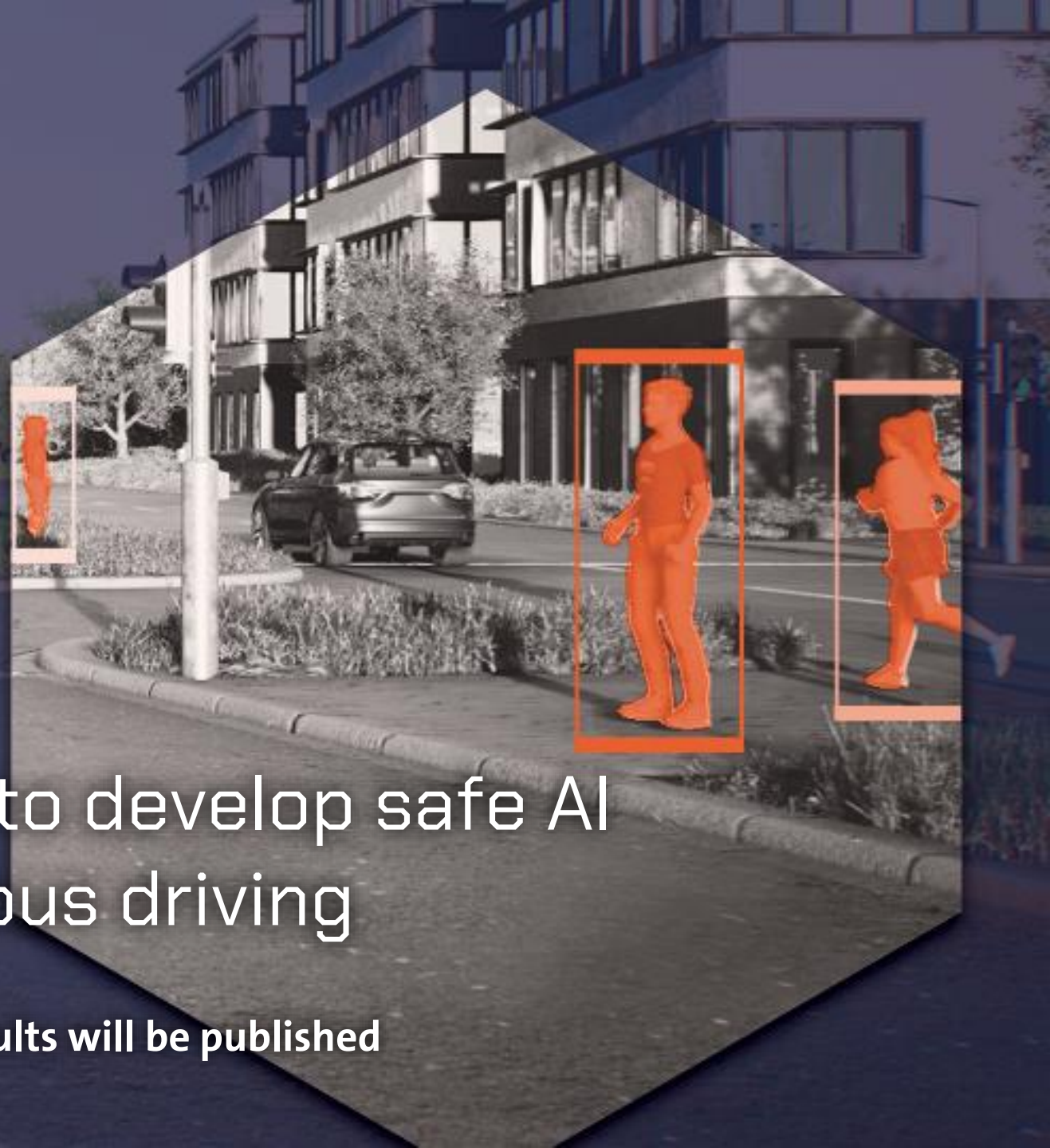
KI

ABSICHERUNG

Safe AI for Automated Driving

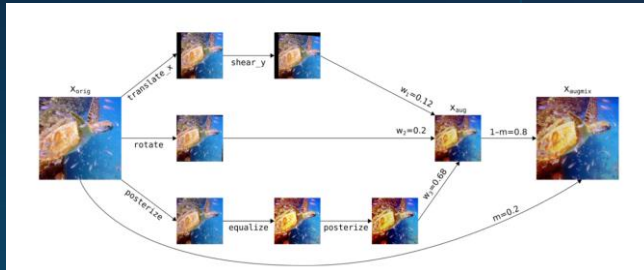
A publicly funded project to develop safe AI applications for autonomous driving

The project will conclude June 23rd 2022 and results will be published



Our Approach: Identify, Measure and Counteract „DNN-specific Safety Concerns” via AugMix

Addressed Safety Concern:
Brittleness of DNNs
Corruption Robustness



Combined
using AugMix

+ Improved robustness
+ Improved generalization
+ Data efficient augmentation
strategy

AUGMIX: A SIMPLE DATA PROCESSING METHOD TO
IMPROVE ROBUSTNESS AND UNCERTAINTY

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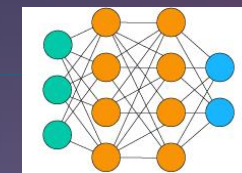
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Training

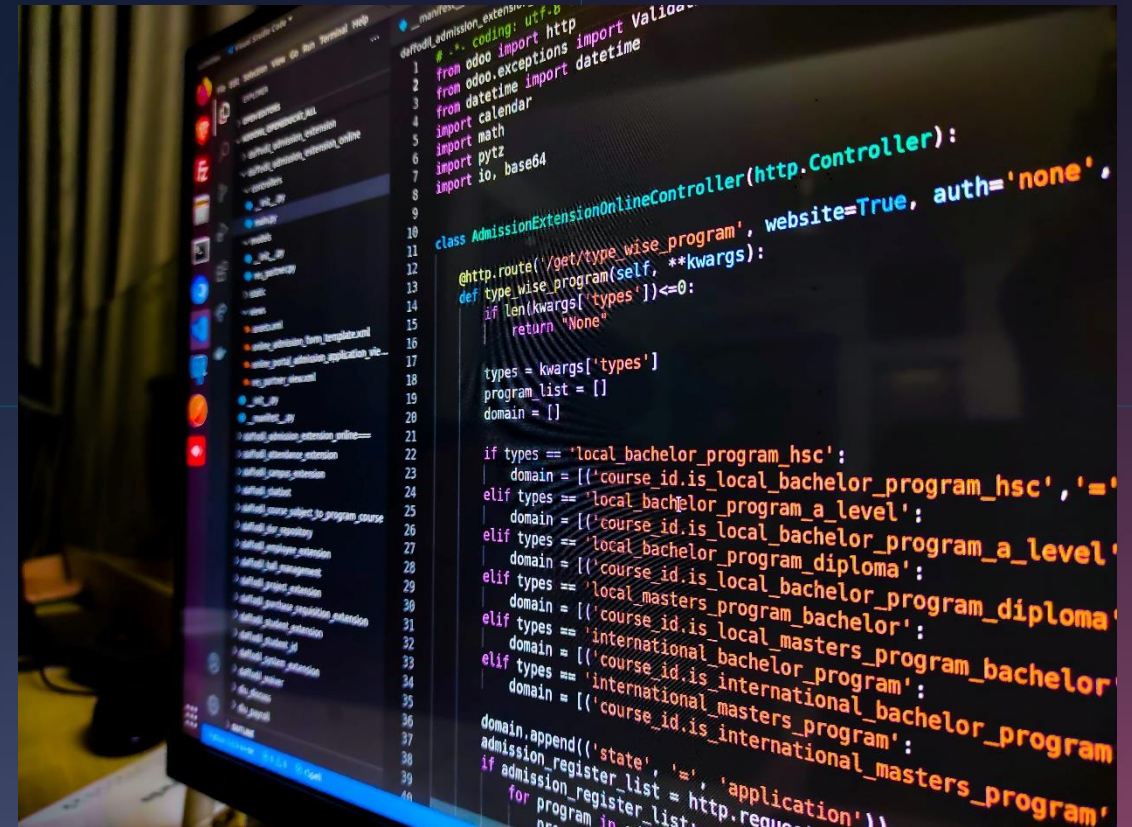


Evaluation on 14
unseen „real-world“
corruptions

Safe AI development tooling needs to implement the overarching process and integrate existing methods.

Tooling:

- Ensure traceability -> everything connected over all process steps
- Versioned -> if possible, have everything-as-code
- Certified -> tool does exactly what it promises to do
- Reusable -> helps you scale across use-cases



Using consistent tooling is key to ensure safe AI development and increase developer productivity.

Artificial Intelligence and Machine Learning will bring tremendous potential for the future of mobility.



Given the abundance of potentially available data, we will witness an abundance of potential for ML-based value creation in the future.



CARIAD prepares for this future by engineering an AI-Ready Architecture which has the right capabilities to flexibly bring new AI-based applications into the vehicle.



We are working on a cutting-edge process to safely develop AI applications, which can be used beyond the mobility industry.

It was a pleasure speaking with you today.
Please connect to stay in contact.



I am Jan Zawadzki

Head of AI@CARIAD SE (Volkswagen AG)
LinkedIn, Medium or Twitter @janmzawa
Data Science + Business + Cars

Thank you!



BACKUP



Agenda

- CARIAD vorstellen (10 Min)
- AI Generalpitch (10 Min)
- AI@CARIAD Projekte (10 Min)
- Ethische AI für die Automobilbranche / was bewegt uns um safe ai zu entwickeln, AI PMT, EU AI Act (15 Min)
- Q&A (15 Min)

Sli.Do für Fragen?