KIDELTA LEARNING

Scalable AI for Automated Driving

KI Delta Learning
Project presentation

KI DELTA LEARNING
Scalable AI for Automated Driving

Agenda

KI Delta Learning as part of the KI Familie

VDA Leitinitiative autonomous and connected driving | The KI Familie and its projects

Vision and goals

Scalability of AI | Typical domain changes | Delta Learning

Methodological and conceptual approach

Transfer learning, didactics, automotive suitability | Exemplary approaches in Delta Learning | Innovations

Project facts

Project structure| Interaction of subprojects | Project milestones

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KI Delta Learning as part of the KI Familie

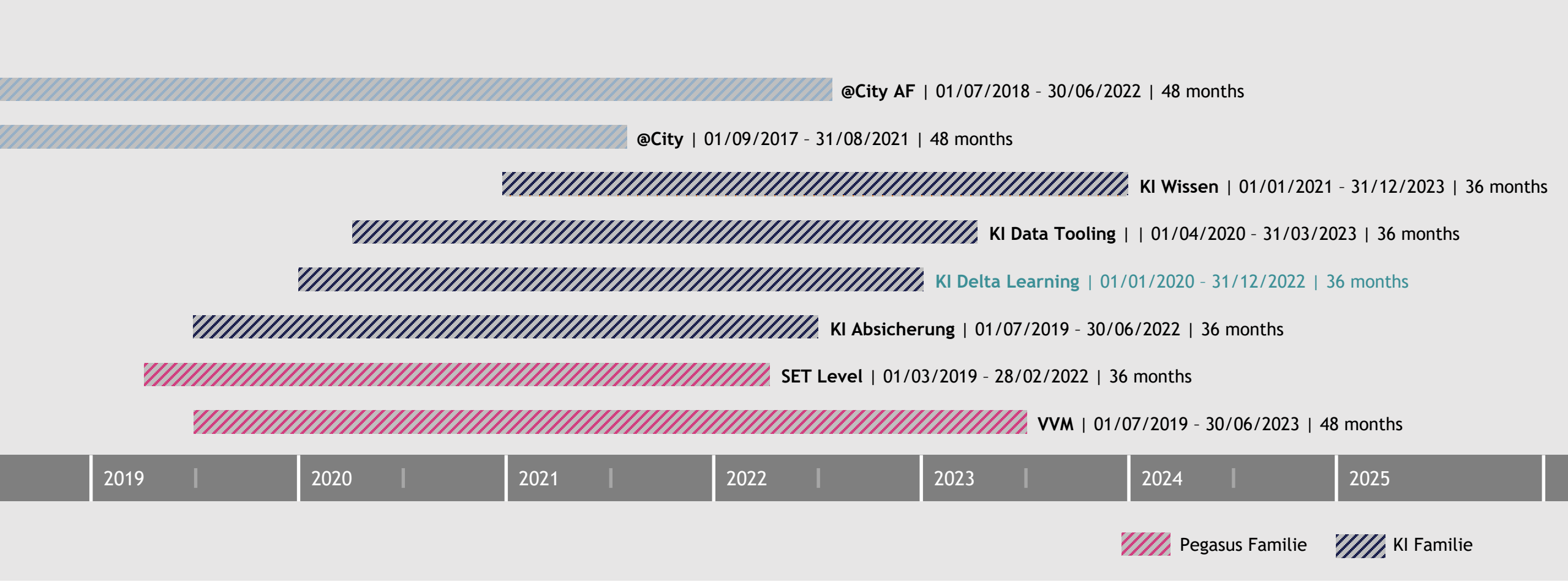
VDA Leitinitiative autonomous and connected driving

Within the framework of the **VDA Leitinitiative**, the leading companies in the German automotive and supplier industry are pursuing **innovative paths of cooperative technology development**. The **project families** initiated and developed by the Leitinitiative address **research fields** which are crucial for competitiveness, such as the development of **artificial intelligence** as well as the **verification and validation of highly automated driving** functions.

Leading safe autonomous driving.

VDA Leitinitiative

Overview of current projects of the VDA Leitinititative



The KI Familie and its projects

KI WISSEN Development of methods for the integration of knowledge into machine learning

KI DELTA LEARNING
Development of methods and tools for the efficient expansion and transformation of existing AI modules in autonomous vehicles to meet the challenges of new domains or more complex scenarios

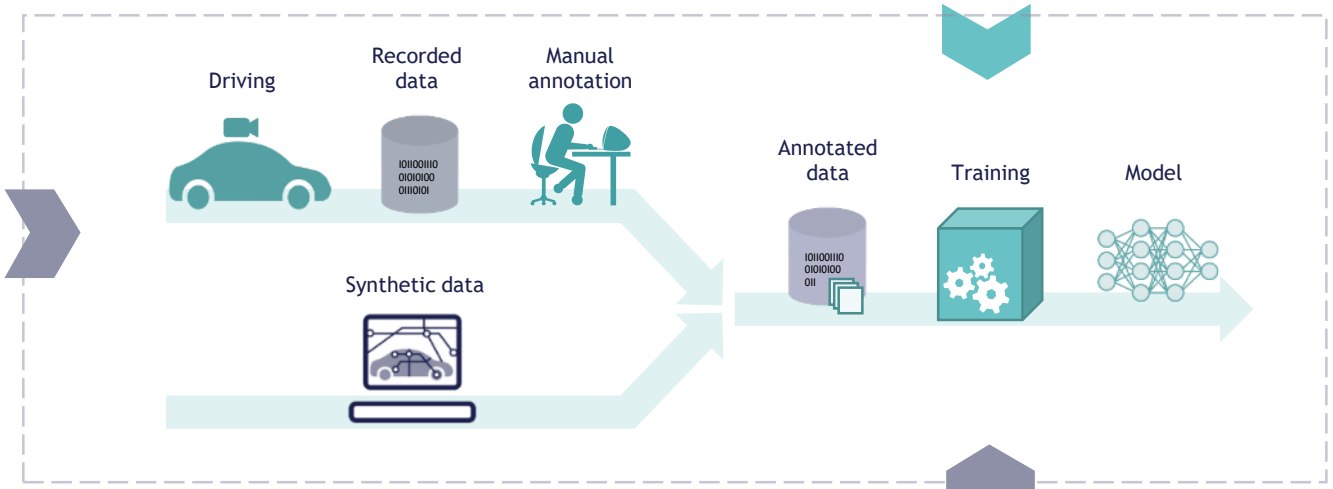
KI ABSICHERUNG Methods and measures to safeguard AI-based perception functions for automated driving

KI DATA TOOLING Methods and tools for the generation and refinement of training, validation and safeguarding data for AI functions in autonomous vehicles

Mastering AI: from data generation to safeguarding

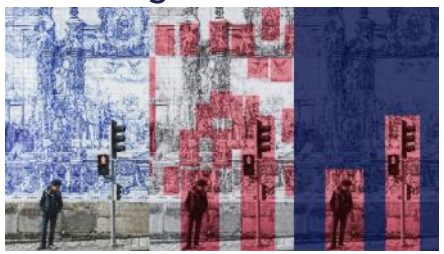
Scalability

High-quality data basis



Safeguarding

Knowledge



Budgets and workforce of the KI projects

KI ABSICHERUNG
Safe AI for Automated Driving

Budget:	*€ 41 M*
Funding:	*€ 19.2 M*

KI DELTA LEARNING
Scalable AI for Automated Driving

Budget:	*€ 26.15 M*
Funding :	*€ 15.87 M*

KI DATA TOOLING
The Data Kit for Automotive AI

Budget:	*€ 25.7 M*
Funding :	*€ 16.2 M*

KI WISSEN
Automotive AI Powered by Knowledge

Budget:	*€ 25.9 M*
Funding :	*€ 17.4 M*

› 700
persons

› 80
partners

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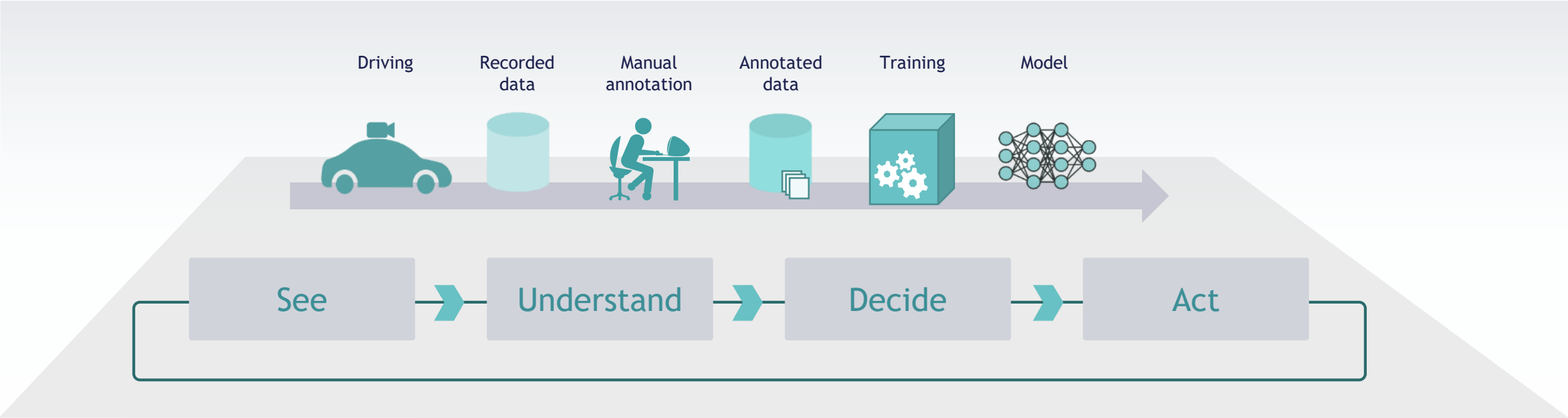
Vision and goals

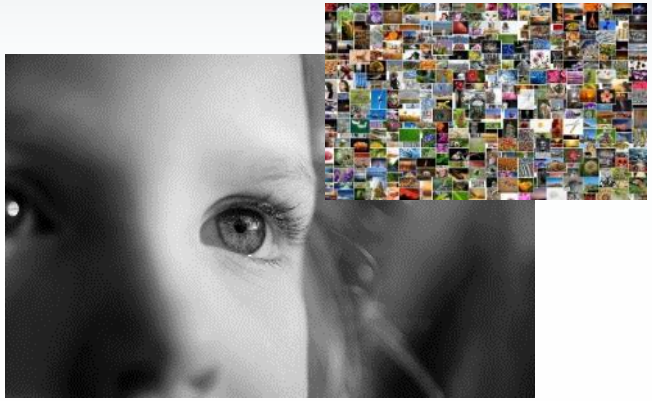
Using artificial intelligence we want to drive better than humans



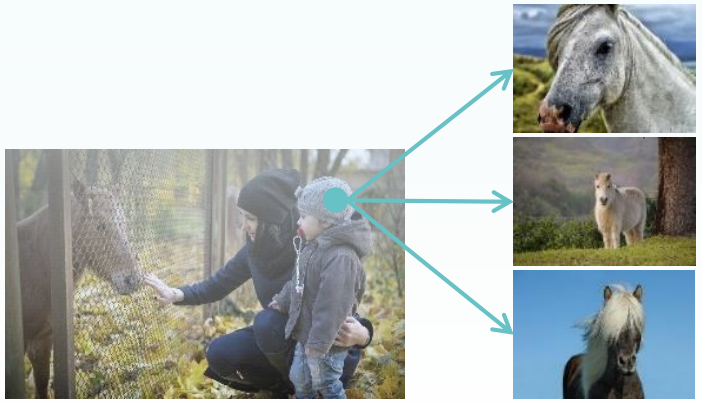
AI and machine learning can be used successfully in all four subtasks.
Especially in perception and prediction, excellent results are achieved.

Where humans still outperform intelligent machines

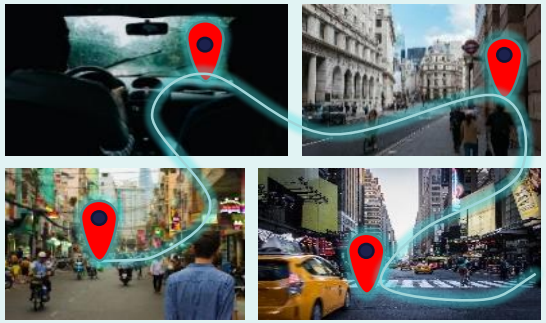
Seeing a lot in a short time



Learning effectively



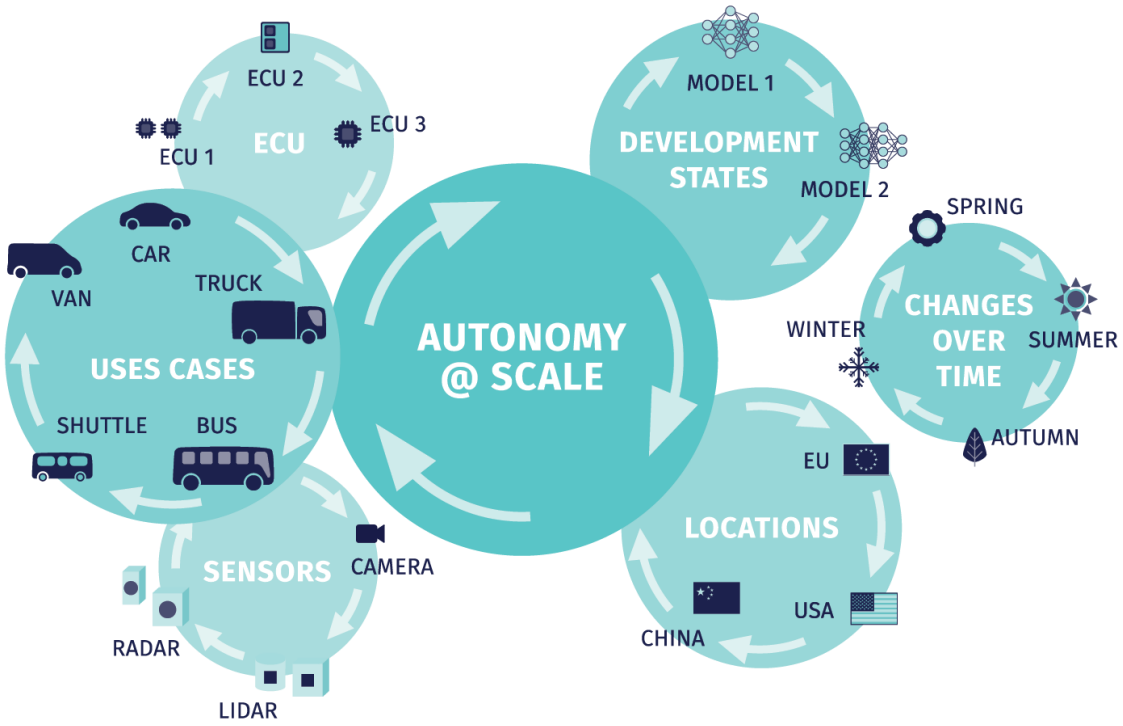
Continued independent learning



Scaling quickly:

Humans are able to adapt quickly to new situations and to learn continuously

Scaling AI:
Efficient inclusion of requirement changes into training

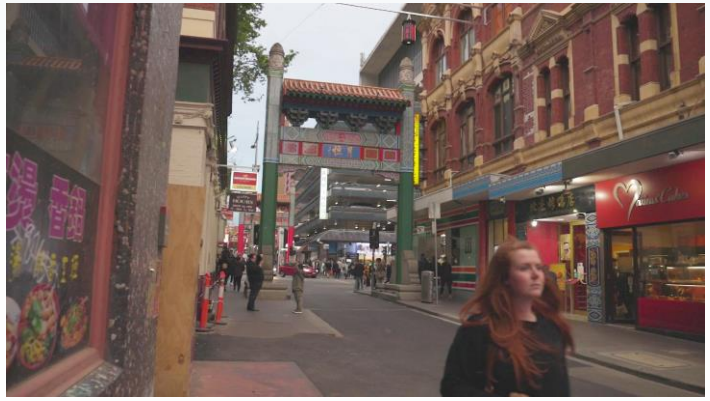


The dynamics of the automotive application field: An enormous amount of time and personnel is required for application-specific data acquisition as well as the retraining of algorithms. The goal is to reduce this learning dependency of data.

Typical domain changes for automated driving

Changes in localities

China



Europe

USA

Typical domain changes for automated driving

Short-term changes

Streets and surroundings

Weather

Seasons









Typical domain changes for automated driving

Long-term changes

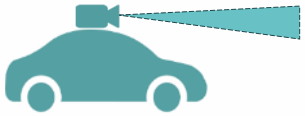
2012

2021

Typical domain changes for automated driving

Sensor changes

Passenger car frontal

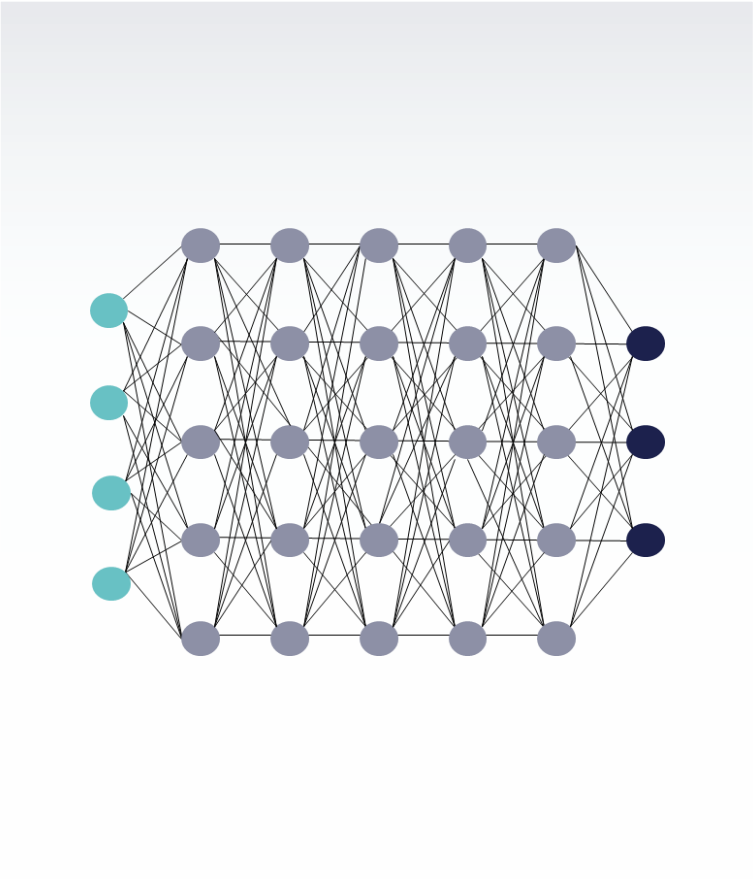


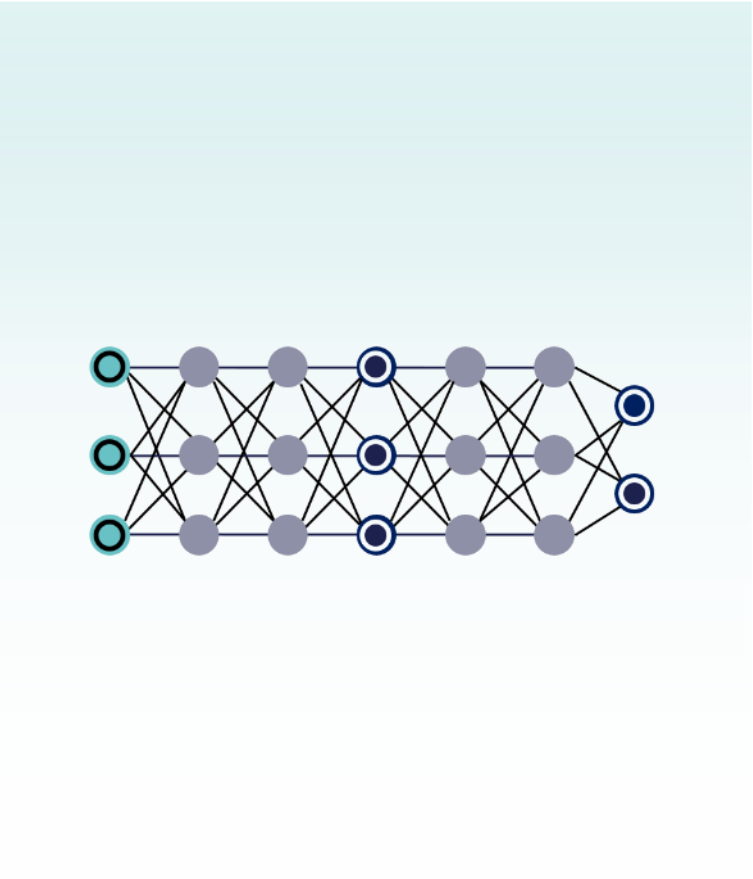
Truck / bus frontal

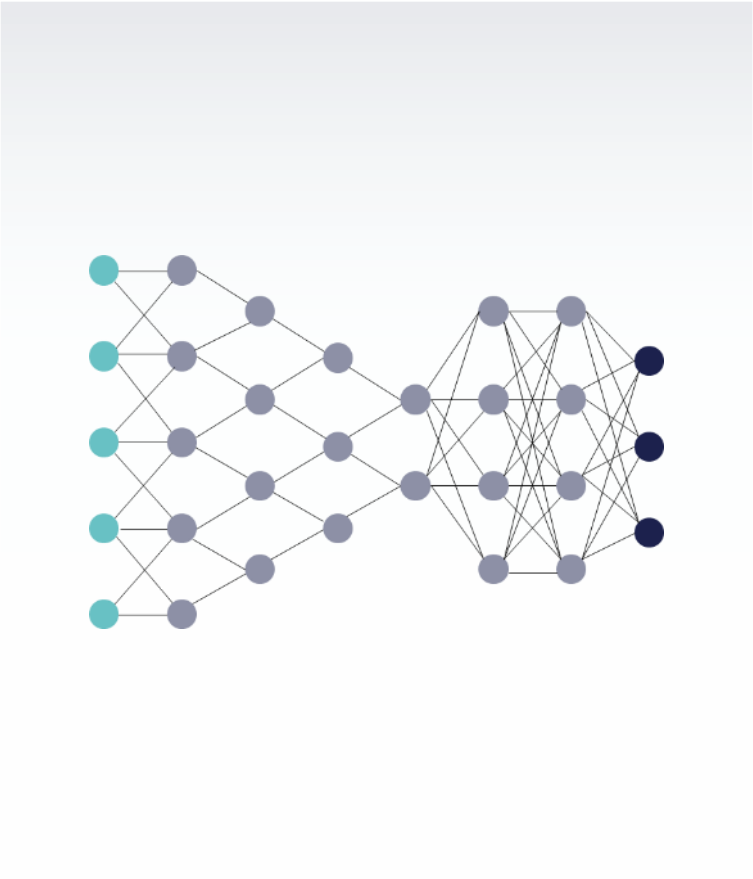
Fish eye camera

Typical domain changes for automated driving

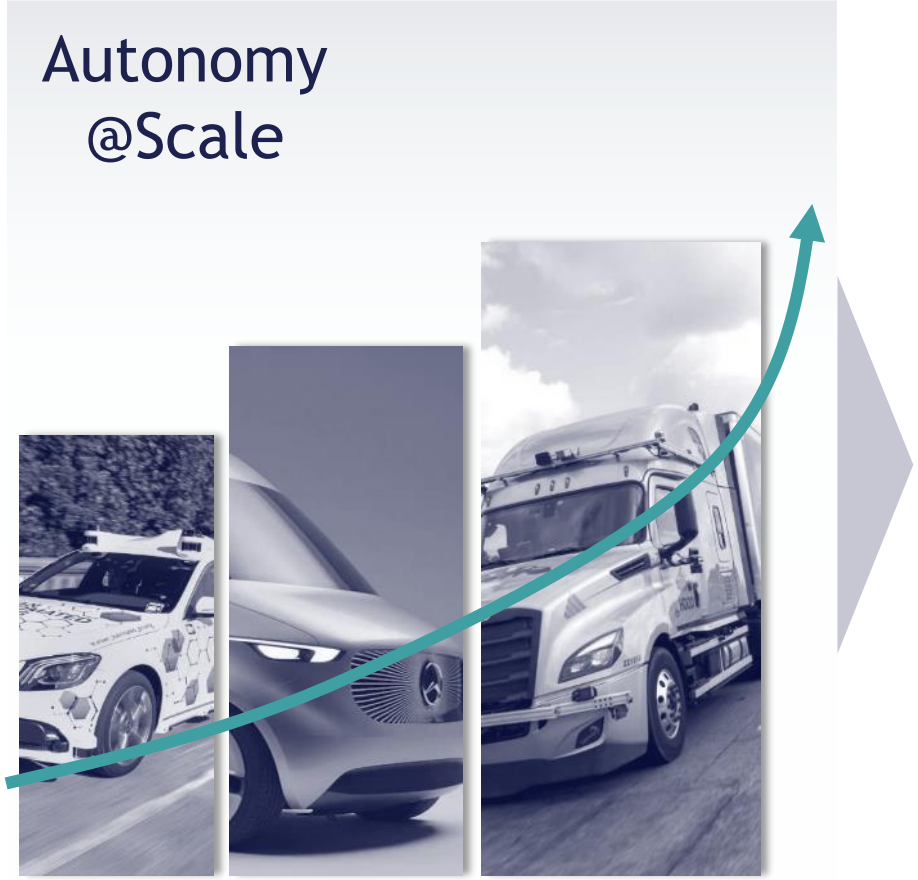
Changes in neural networks





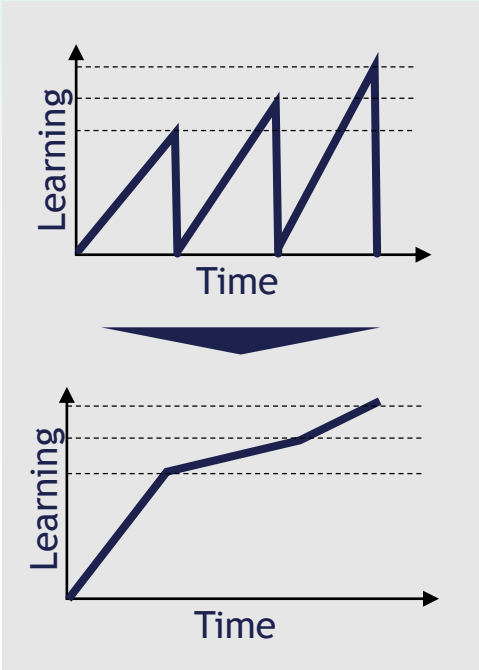


Goal: Scale AI solutions effectively and efficiently despite these dynamics and continuous changes



Expandability

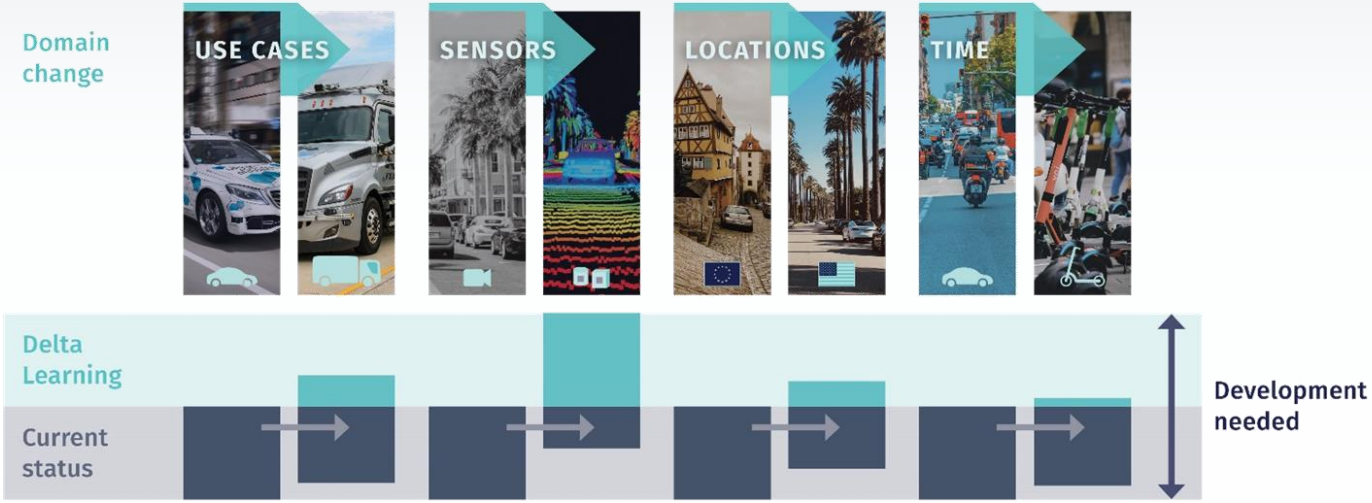
Expanding AI systems through new features & functions



Flexibility

Learning to deal with changes & new variants in new domains

Our approach for scaling effectively and efficiently:
Delta Learning



Methods and tools to efficiently extend and transform existing AI modules of autonomous vehicles to cope with new domains and complex scenarios in a continuously evolving traffic environment.

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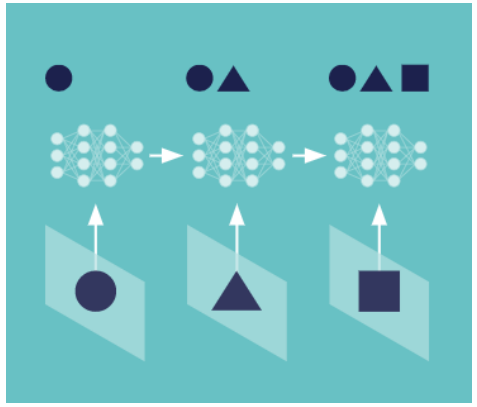
Methodological and conceptual approach

How we use Delta Learning for scaling

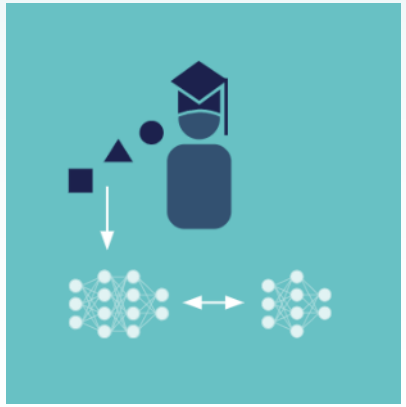
Transfer Learning

Transferring learned knowledge to new domains



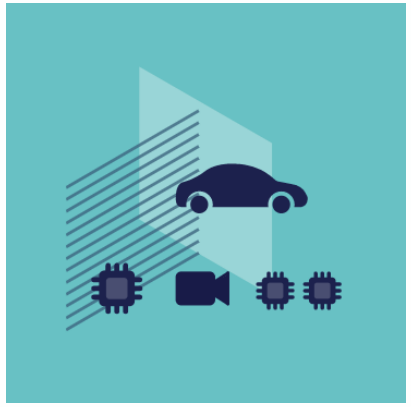
Didactics

Controlling and guiding learning processes, developing learning strategies



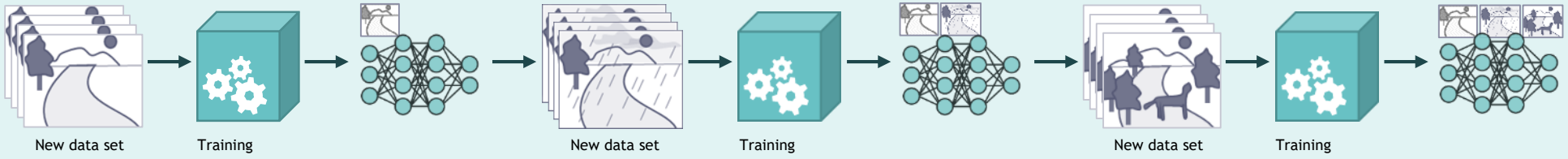
Automotive Suitability

Considering the specific automotive requirements within the learning process

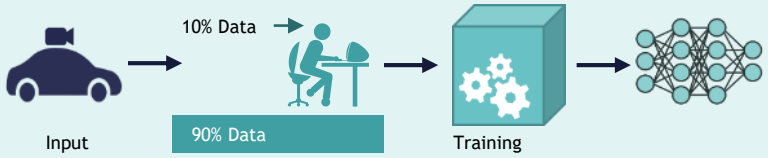


Exemplary approaches in Delta Learning

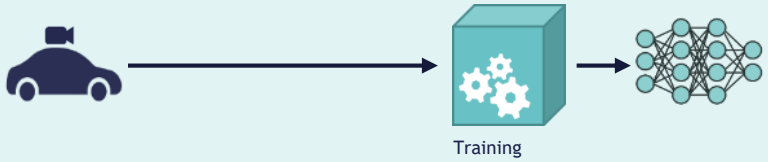
Continuous learning



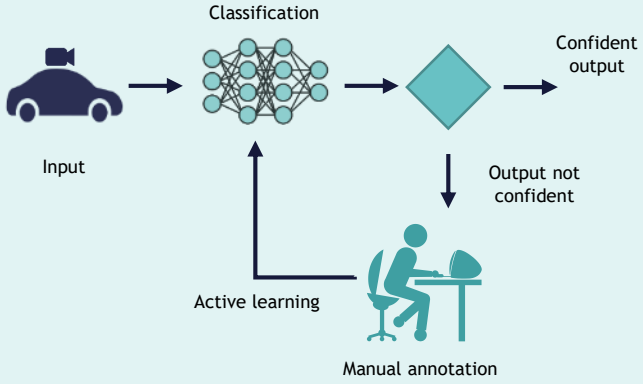
Semi-supervised learning



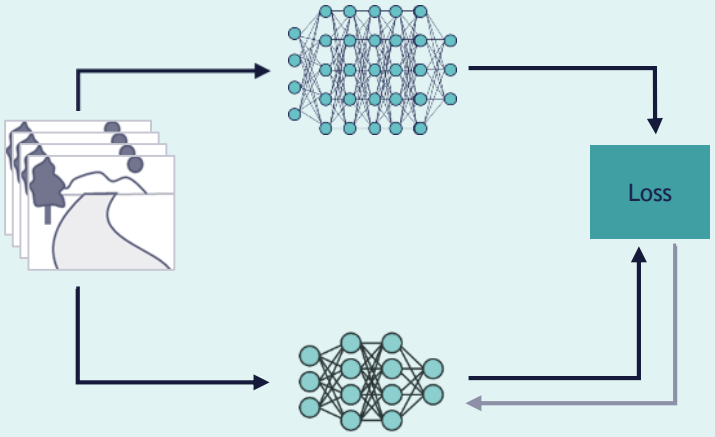
Unsupervised learning



Active learning



Knowledge distillation



Innovations

KI Delta Learning will

- increase the **flexibility** and **expandability** of AI modules.
- enable the **scaling of AI approaches without proportionally increasing data** and **development costs**.

Delta Learning thus enables **more efficient adaptation to new market requirements** and **faster access to international markets** with **optimised development effort.**

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Project facts

Project structure

KIDELTA LEARNING
Scalable AI for Automated Driving

TP1 Valeo
Data acquisition

- **AP1.1** CMORE Automotive — Integrated data management & processing
- **AP1.2** Valeo — Real data recording
- **AP1.3** OFFIS — Synthetic data generation
- **AP1.4** DLR — Data labelling

TP2 Bosch
Transfer learning

- **AP2.1** BMW — Continuous learning
- **AP2.2** Valeo — Use of synthetic data
- **AP2.3** Bosch — Cross sensor adaptation
- **AP2.4** CARIAD — Location and time domain
- **AP2.5** Mercedes-Benz — Environment adaptation

TP3 ZF
Didactics

- **AP3.1** Porsche Engineering — Semi-supervised and unsupervised learning
- **AP3.2** BUW — Training organisation
- **AP3.3** BMW — Active learning
- **AP3.4** Mercedes-Benz — Knowledge transfer

TP4 OFFIS
Automotive suitability

- **AP4.1** Mercedes-Benz — Robustness in the open world
- **AP4.2** OFFIS — Challenges of embedded systems

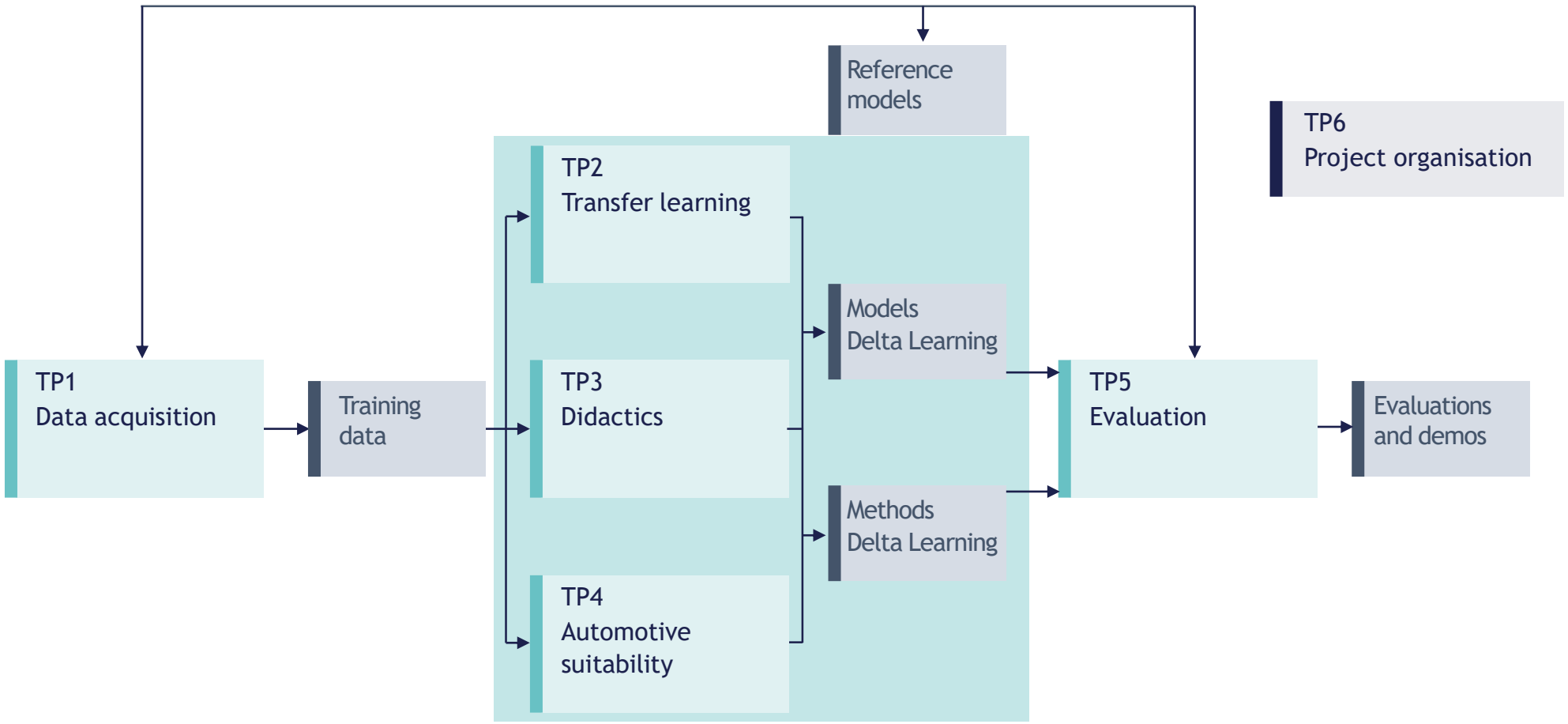
TP5 Mercedes-Benz
Evaluation

- **AP5.1** Mercedes-Benz — Review and refinement
- **AP5.2** BMW — Baseline and training of reference models
- **AP5.3** DLR — Evaluation and demonstration

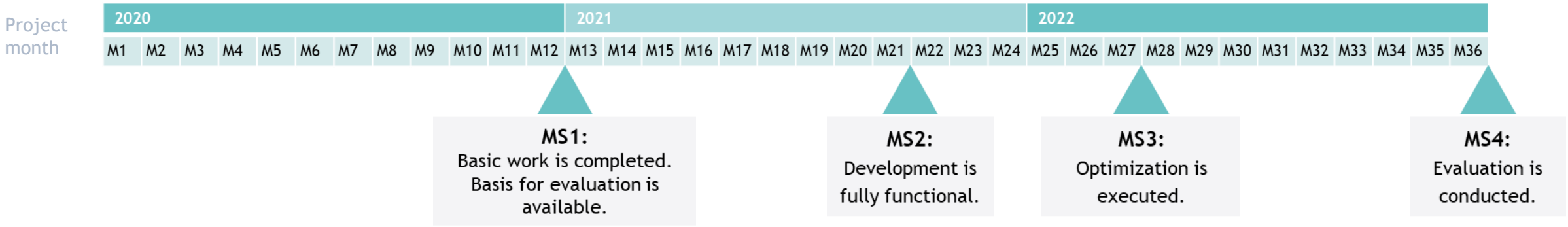
TP6 Mercedes-Benz
Project organisation

- **AP6.1** Mercedes-Benz — Management & coordination
- **AP6.2** Mercedes-Benz — Exchange with other projects
- **AP6.3** Mercedes-Benz — Dissemination of results

Interaction of the subprojects



Overview project milestones



KI Delta Learning: the project at a glance

Project lead:	***Mercedes-Benz AG***	*Project budget:*	***€ 26.15 M***	*Project runtime:*	***36 months***	***18 partners***
Deputy project lead:	***ZF Friedrichshafen AG***	*Funding budget:*	***€ 15.87 M***	***01/01/2020 – 31/12/2022***		

OEMs

Tier-1

Technology providers

Research bodies

Universities

Contact persons

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Scalable AI for Automated Driving

KI Delta Learning is part of the KI Familie and was developed by the VDA Leitinitiative Autonomous and Connected Driving.

KI FAMILIE

www.ki-deltalearning.de @KI_Familie KI Familie

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