ARTIFICIAL INTELLIGENCE FOR CONNECTED AND AUTOMATED DRIVING

Benjamin Wilsch, Edgar Krune
VDI/VDE Innovation + Technik GmbH
Hala Elrofai
TNO - Netherlands Organisation for Applied Scientific Research

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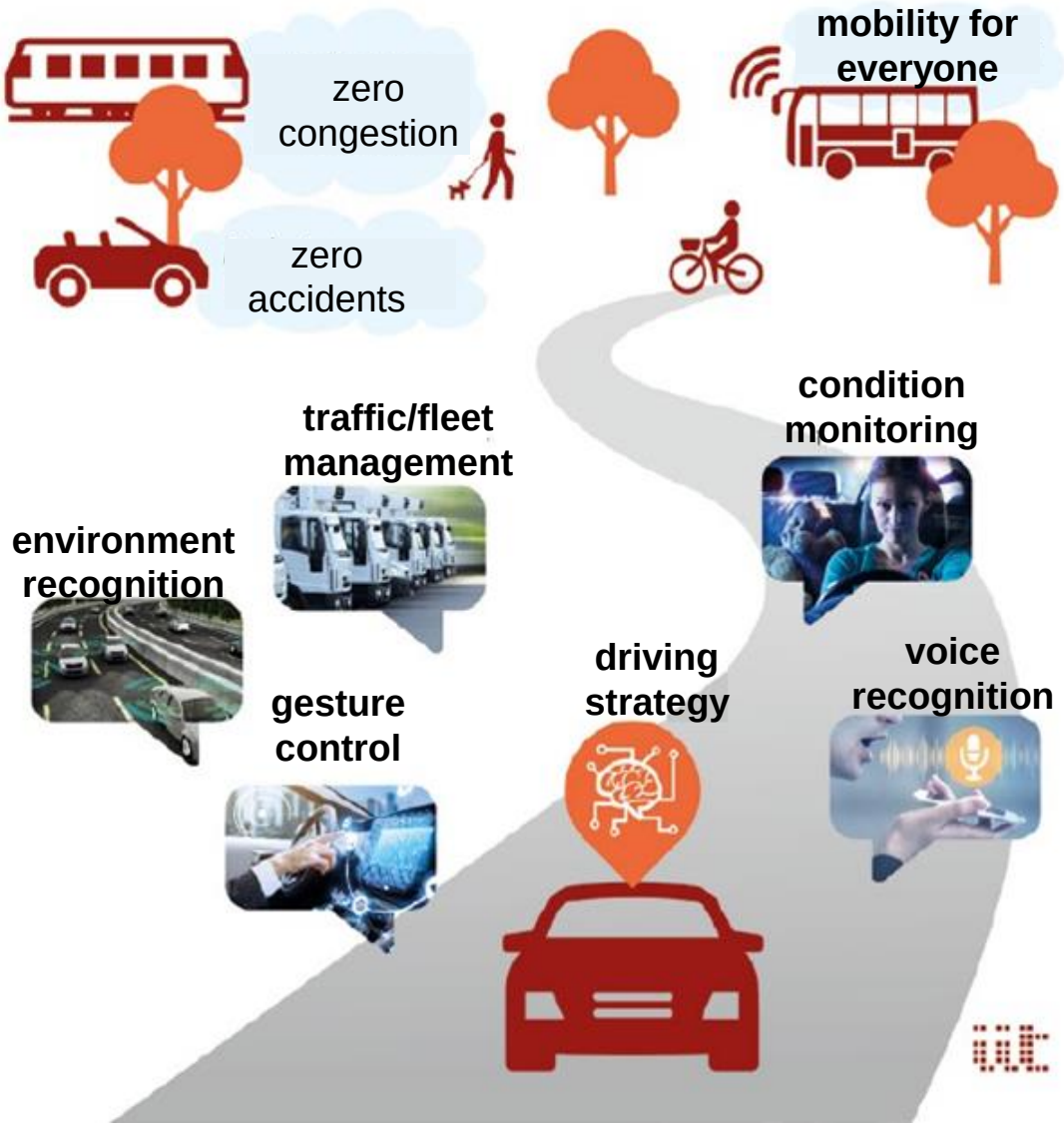
Outline

- 1 State of the Art
  - AI methods for CAD
  - AI hardware
- 2 Opportunities
- **3 Challenges**
  - Data availability
  - **Training and validation**
  - Traceability of AI-based decision-making
- **4 International competitiveness**
- 5 Outlook
  - **New methods**
  - New hardware development

Opportunities



https://voyage.auto/

Challenges

- AI applications rely on Machine Learning using deep neural networks

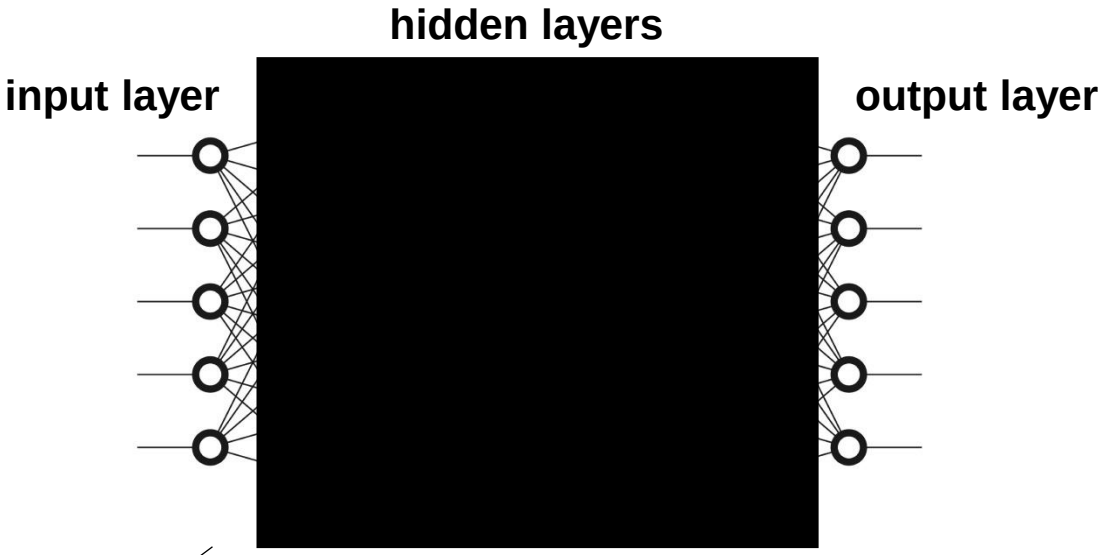


Image credit: Datanami

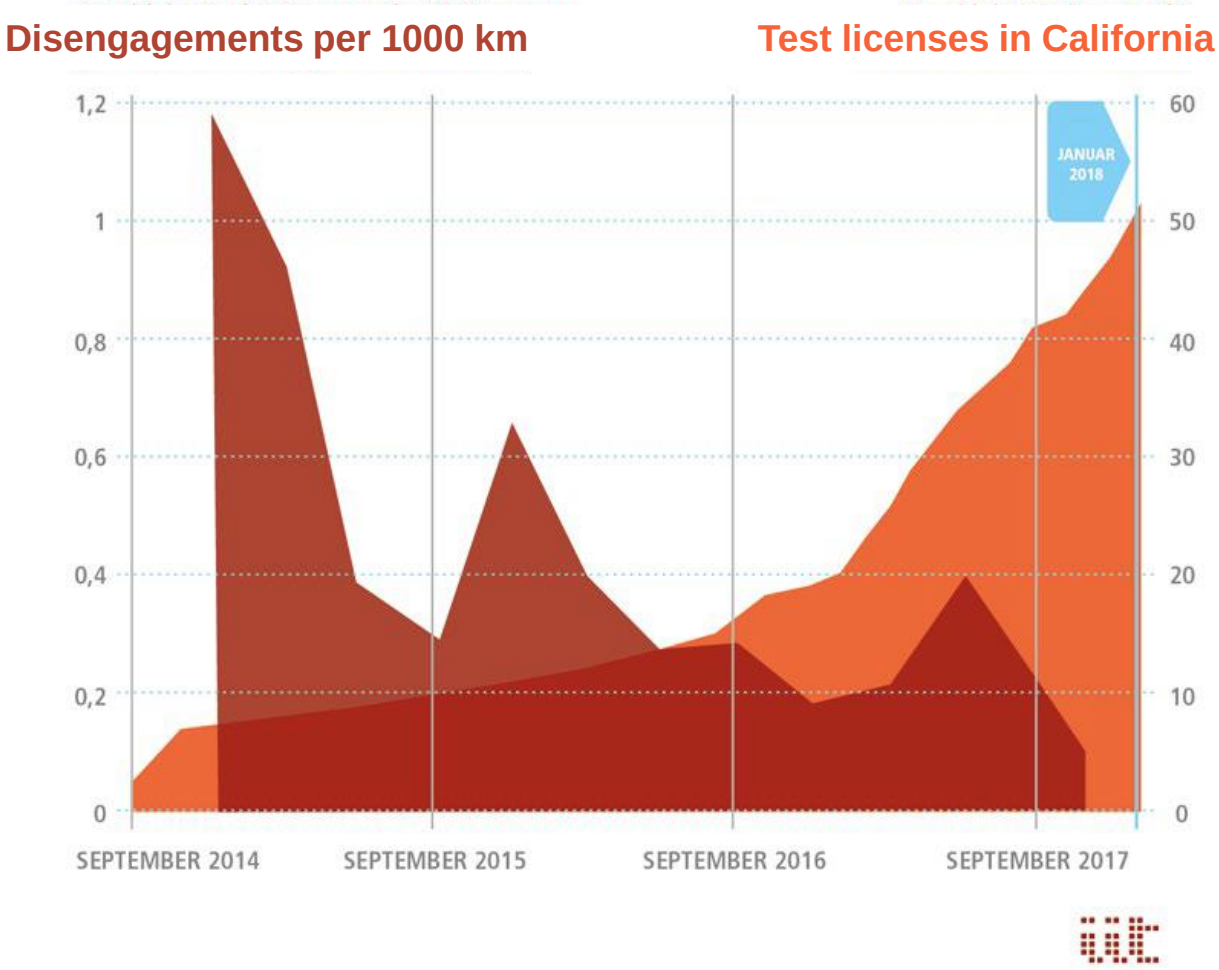
Lack of transparency/traceability

Validation

Lack of modularity

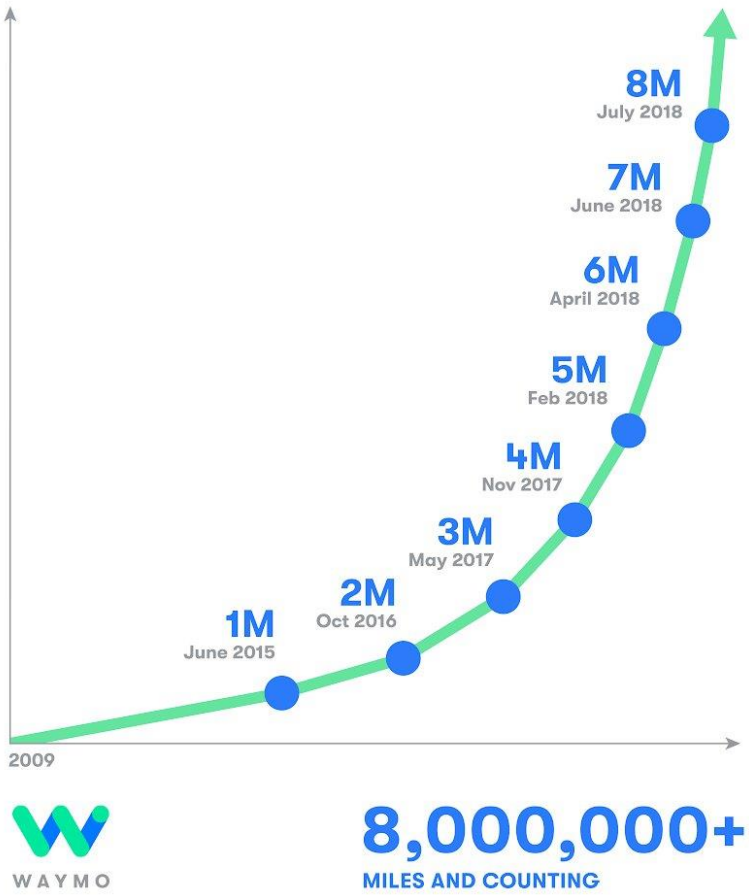
Understanding physical, computational and theoretical limits

Challenges



- Number of disengagements is not a reliable indicator for AI performance.

Challenges

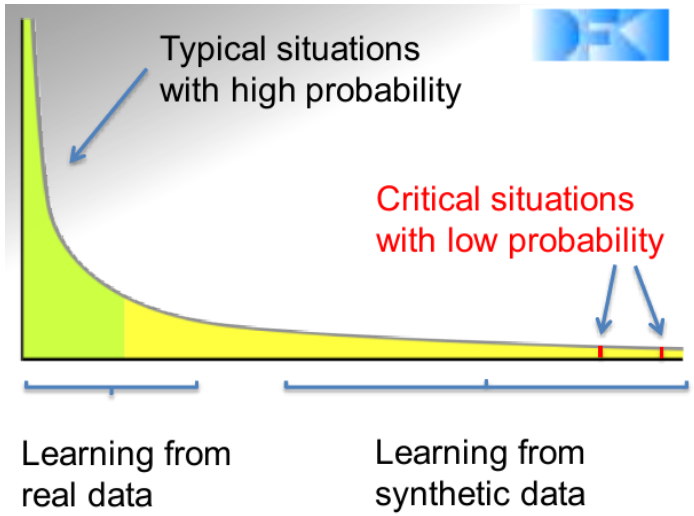


- AI already outperforms humans at certain tasks, but the complexity of life-critical applications in CAD is much greater.
- Waymo reached **9 million self-driven miles** in September 2018.
- They supplemented these with over **5 billion miles** in simulation.
- Validation of AI functions must be a combination of simulation and real-world data.

CAD Symposium 2018

Breakout Session: *Validation of AI and AI for validation*
Speakers: Árpád Takács, Outreach Scientist, AImotive
Prof. Slusallek, DFKI

- Simulation for AI training provides increased scope, diversity and completeness as well as the speed of testing.



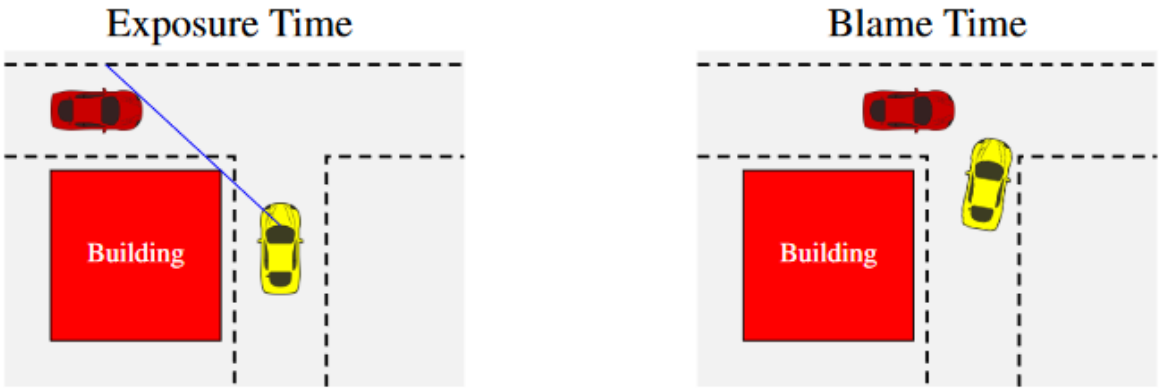
- Scalable benchmarking of development processes using open architectures for model and simulation integration,
- GENESIS: open platform for learning, simulation, training and validation of autonomous systems (DFKI and TÜV Süd).

Alternative Approaches

- Technical and non-technical issues that arise from ML applications have sparked research for “Explainable AI”.

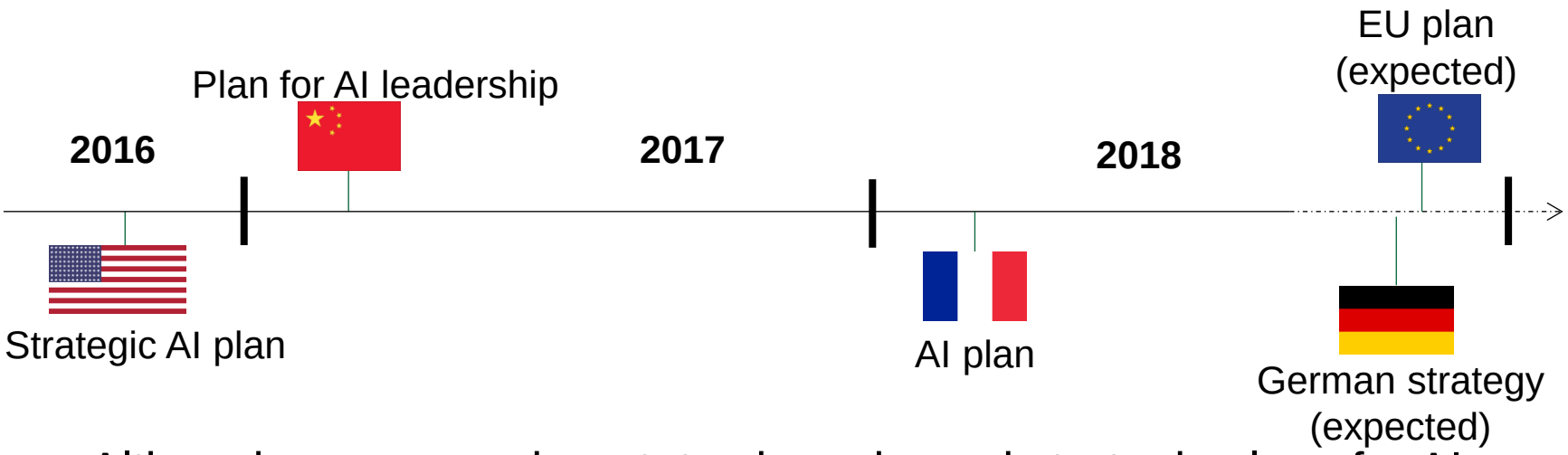
- Grey-box solutions: integrate physical models in existing algorithms to increase control over decision-making process.

- MobilEye:
  - Interpretable, mathematical model for safety assurance. Rule-based driving policy combined with environment perception using AI classification.
  - Responsibility Sensitive Safety (RSS) formalizes the common sense of human judgement.
  - Use of semantic language to formulate longitudinal and lateral goals.



MobilEye

International competitiveness



- Although some member states have issued strategic plans for AI development/leadership, a coordinated EU plan is still missing.
- EU: - Declaration of cooperation on AI in April
  - 1.5 billion funding as part of H2020
- Securing the AI talent pool will be a key requirement for future success.
- Data sharing should be encouraged to increase the amount and diversity of available data, but must be balanced with data privacy concerns.

Position Paper: Big Data and AI

Challenges

Technical

- Big Data collection, storage and processing: quality, reliability and availability

Policy

- Privacy and security barriers
- Frameworks for data sharing

Organisation Ecosystem

- Avoiding parallel investments for AI development
- Lack of data sharing

User acceptance

- What level of safety must AI achieve?
- Media coverage of AI-related errors

Statements: common ground and open for discussion

Future Research Needs

https://connectedautomateddriving.eu/big-data-artificial-intelligence-and-their-applications/

STRIA Input

Thematic Area: **Connected and Automated road transport**
Big Data, Artificial Intelligence and their application

New tools and models for storage and sharing of valuable data

- Ensure availability, interoperability and exploitation of high quality data
- Generate new and innovative business services – respecting the security, privacy and the highest ethical standards.

Optimised Big Data for effective design and planning of traffic and mobility management, services and operations.

- Securing functional safety of automated driving.
- Optimised design and planning of traffic and mobility management, services and operations.

Further development and use of artificial intelligence in road vehicles (on and off-board)

- Develop ‘new’ AI concepts and technologies.
- Ensure the operational safety of these technologies.

Summary

- AI is the key enabler of vehicle automation and unlocks benefits, in particular less accidents and better social inclusion.
- ML methods pose central challenges and raise non-technical issues that are still to be resolved.
- Complementary or alternative methods may help to resolve specific non-technical issues.
- Due to the central importance of AI for automation, future development and international competitiveness in particular will be closely related to AI-specific capabilities.

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Thank you for your attention!