

# **Applied Artificial Intelligence**

#### for Assisted and Autonomous Driving



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SensePlanAct

Chassis & Safety | Advanced Driver Assistance Systems

#### Agenda

- Continental Advanced Driver Assistance Systems
- 2 Artificial Intelligence in ADAS
- **3** From Research to Industry
- 4 Summary



# **Continental ADAS Products** History

> Continental is much more than tires!





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# **Continental ADAS Products** History

> Continental is much more than tires!





Competence Center Deep Learning



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#### **On the Way to Automated Driving**



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# **Comprehensive Environment Model**

- Multiple types of sensors
- Plan and act based on our understanding of the environment



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#### Traditional algorithms: "Software 1.0"

- Algorithm defined by the programmer.
- Algorithm solves the problem directly.
- Interpretable, predictable output.
- Fails to handle problems beyond certain complexity. Autonomous driving is beyond.

#### Machine Learning: "Software 2.0"

- Algorithm specifies how to learn another algorithm based on many examples of task-solution pairs.
- Solves the problem indirectly.
- Needs *lots* of data to train.
- (Will be) capable of reaching human level and beyond.



#### Al is better than classical SW

#### Example Pedestrian Detection (caltech pedestrian dataset)



#### Al shows great potential

🗿 The formation of the

- Revolution in Computer Vision
- Deep Learning outperforms classical methods
- Radical performance increase
- Industry-wide shift for automotive technology

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## **Real world Deep Learning challenges**

> Fundamental difference in weather conditions



#### Precipitation

#### Visibility conditions



#### **Real world Deep Learning challenges**



- The real world is often too complicated to model it completely
- Deep Learning is an approach to deal with that



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## From Research to Industry Methods



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## **From Research to Industry** Methods



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## **From Research to Industry Methods**



## **Applications vs Methods – Different problems to solve**





## From Research to Industry Product

#### **Complexity Reduction**

Example: Object Detection @Kitti dataset "cars hard"





## **From Research to Industry** Product

#### **Complexity Reduction**



#### **Embedded Hardware**

**PrefetchingSparsity** 

**OR-Nets** 

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## From Research to Industry Product

#### **Complexity Reduction**

Example: Object Detection @Kitti dataset "cars hard"



#### **Embedded Hardware**

#### Experience yourself





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## **Summary**

- > Continental is working on ADAS systems for over 20 years
- > AI shows great potential to be a key technology for automated driving
- > Research results are often a starting point for a development of a great product
- > Major challenges
  - Wide variety of data (weather conditions, rare events)
  - Big Data (several 10s of Petabytes)
  - Training Hardware (distributed, scalable, fast access)
  - > Embedded Hardware
  - Simulation
  - Validation



# Safe and Dynamic Driving towards Vision Zero

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http://www.continental-jobs.com

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