

OWM Future Inspiration Day

22. März 2017

Artificial Intelligence – Bosch is teaching the vehicle how to drive.

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VP Marketing and Business Strategy

Robert Bosch GmbH





Drivers for automated and connected mobility

Megatrends

Urbanization



Energy & Climate



Demography



Safety & Security



New Player



Mobility behavior



Drivers for automated and connected mobility

Megatrends



Urbanization

66% of the world's population will live in cities in 2050



Drivers for automated and connected mobility

Megatrends



Energy & Climate

30% more energy usage
worldwide until 2035

Drivers for automated and connected mobility

Megatrends



Demography

Average global age will be 4 years older than today by 2030



Drivers for automated and connected mobility

Megatrends



Safety & Security

9 of 10 accidents are caused by human mistakes

Drivers for automated and connected mobility

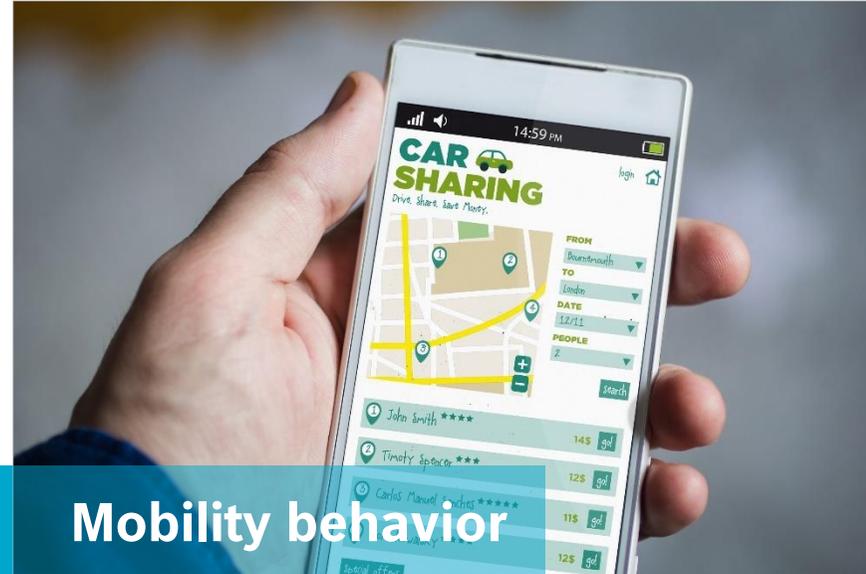
Megatrends



New Player
Without legacy

Drivers for automated and connected mobility

Megatrends



Mobility behavior

Private ownership
replaced by sharing
models (robocabs)

Drivers for automated and connected mobility

Megatrends

Urbanization



Energy & Climate



Demography



Safety & Security



New Player



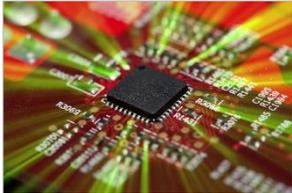
Mobility behavior



Key Technologies

Push from science and technology developments

Computing



Communication



Sensors



Artificial Intelligence



Human Machine Interface

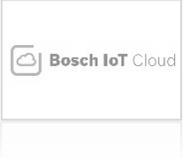
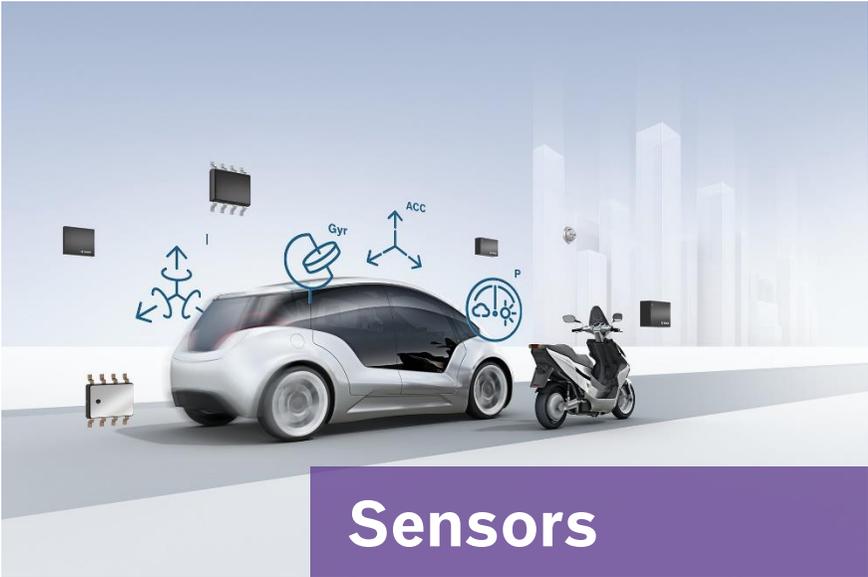


Cloud



Key Technologies

Push from science and technology developments

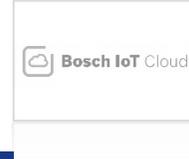
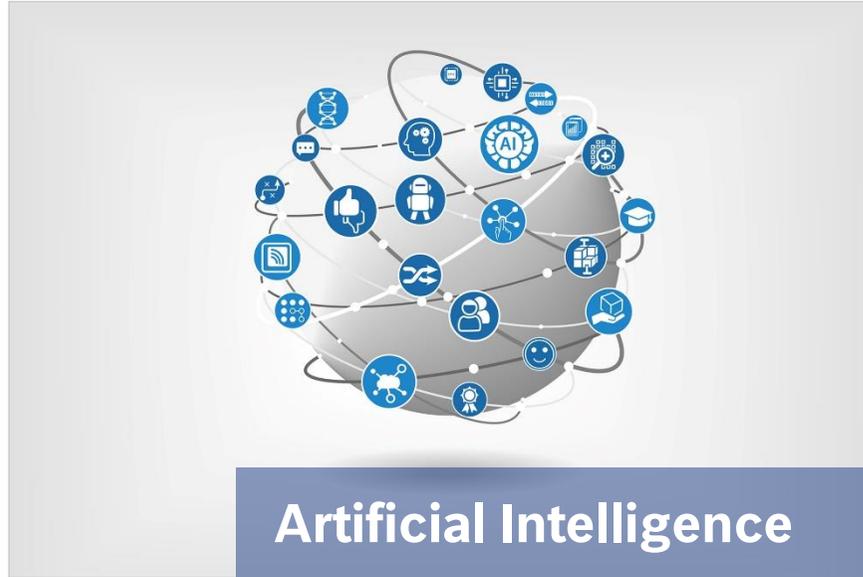


Sensors

Sensors for vehicle dynamics and perception

Key Technologies

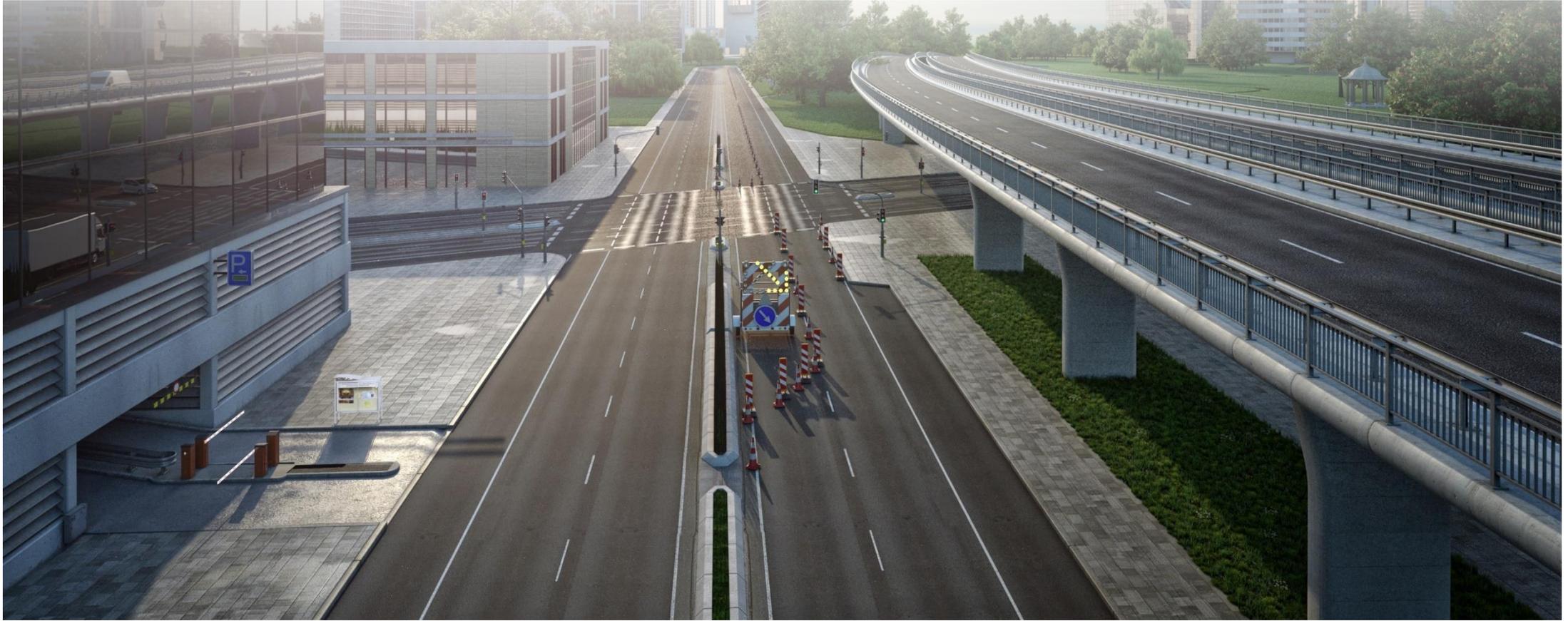
Push from science and technology developments



Artificial Intelligence

Data analytics,
deep learning

Automated Mobility Roadmap



Automated Mobility Roadmap



Highway Pilot 2020

Highway Assist 2018

Int. Cruise Assist 2017

Traffic jam assist 2015

Automated Mobility Roadmap



Automated Mobility Roadmap

Automated valet parking 2018

Remote park assist 2015

Urban Pilot >2026

Highway Pilot 2020

Highway Assist 2018

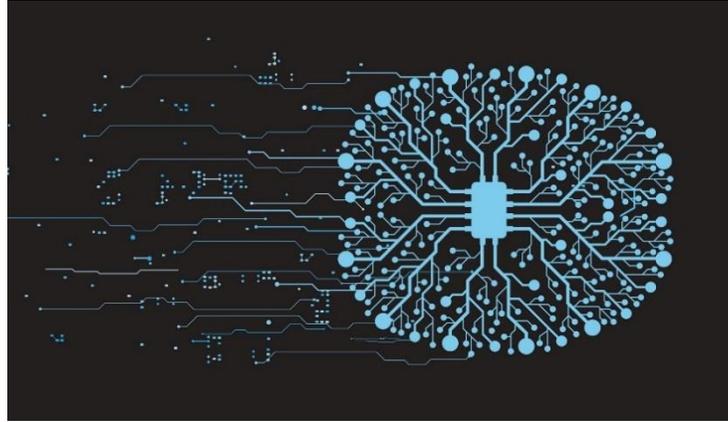
Int. Cruise Assist 2017

Traffic jam assist 2015



Automated Mobility

Core activities



map data fusion
 sensors redundancy
sense
 perception localization
 electronic horizon
 radar lidar

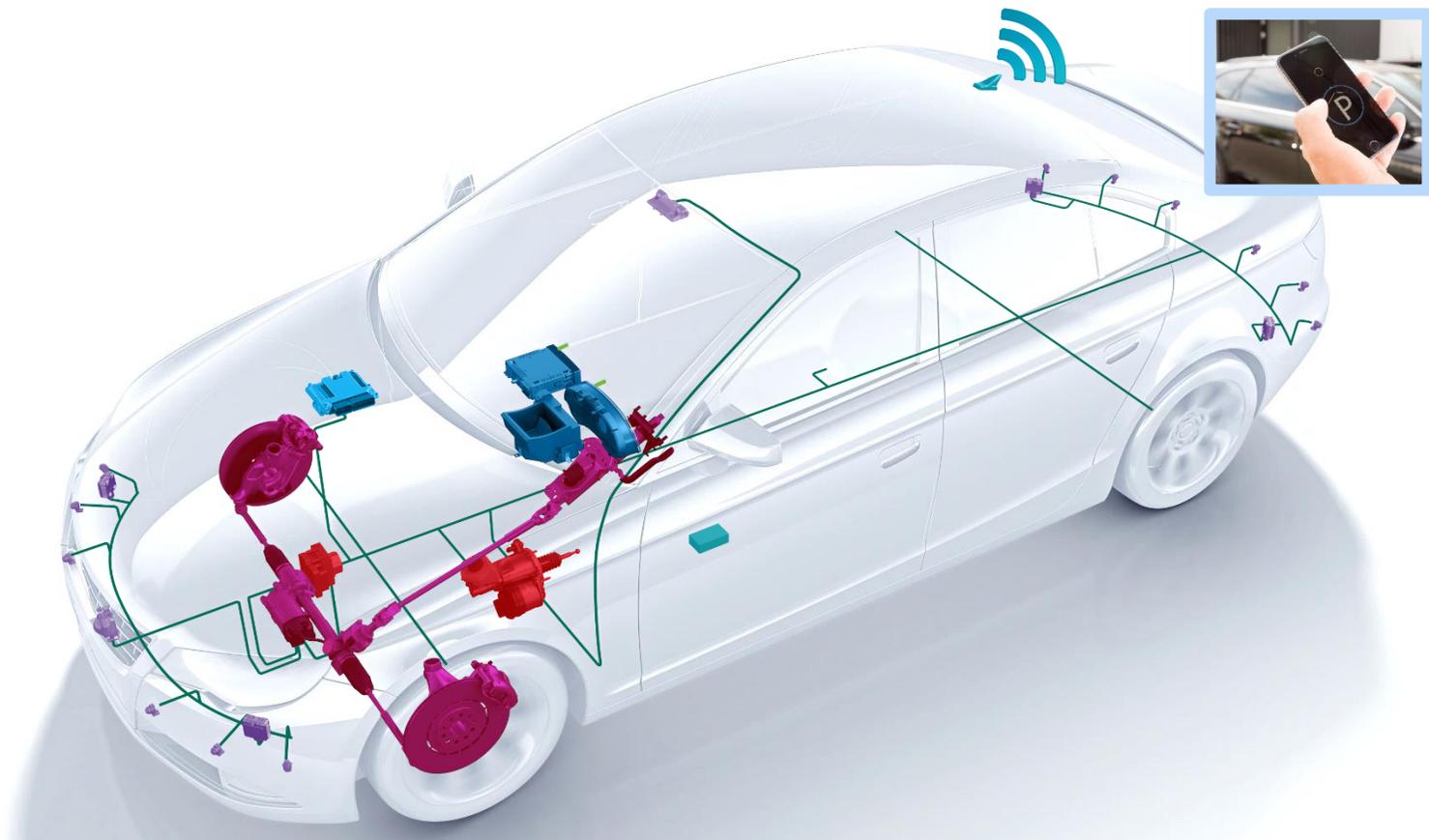
vehicle computer
 data analytics planner
think
 prediction decision
 safety security

actuator management
 braking
act
 steering motion control
 fail operational
 driverless

Automated Mobility

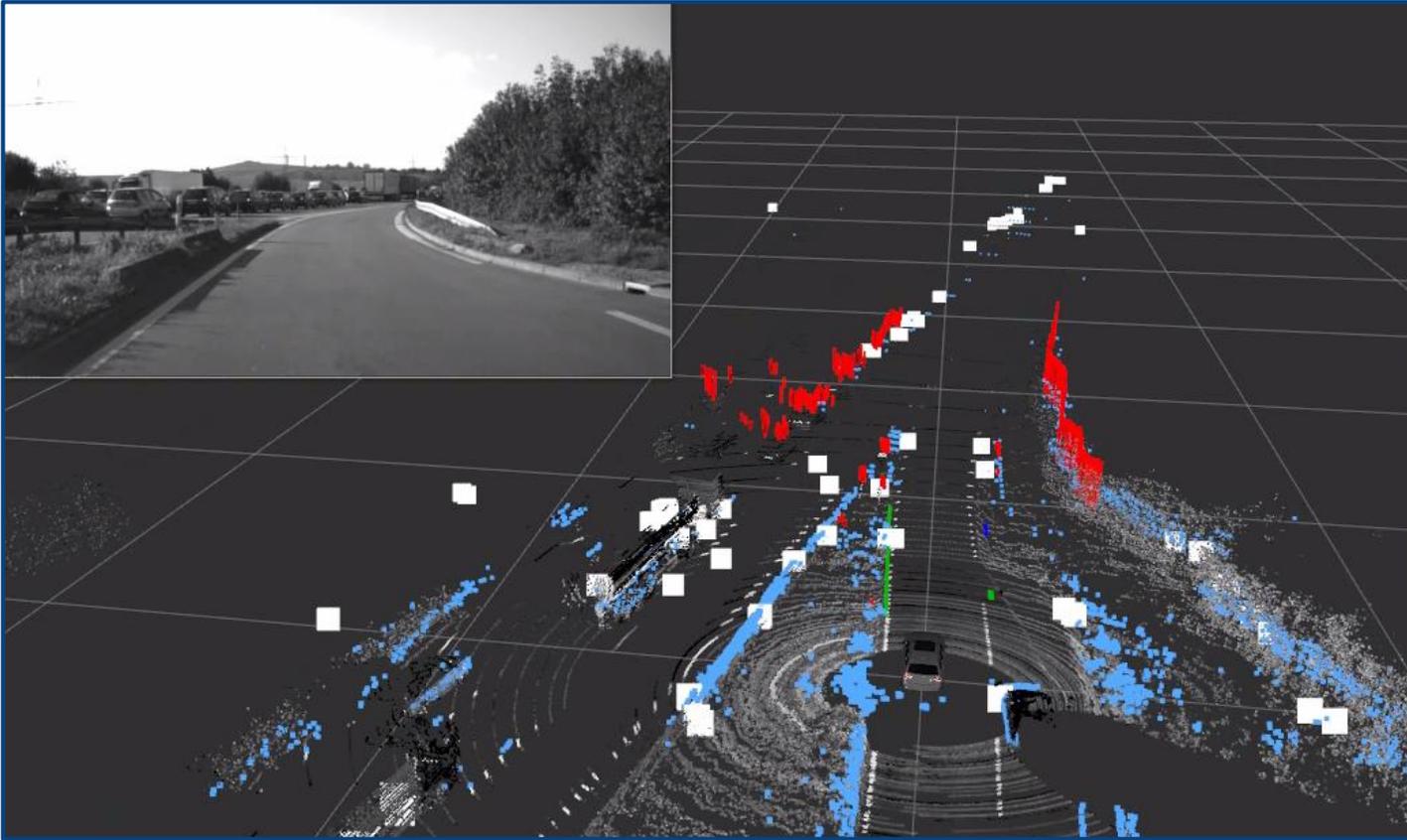
Broad systems expertise as key to success

- **Braking:** ESP®, iBooster
- **Steering:** electric power steering
- **Sensing:** radar, video, ultrasonic
- **HMI/navigation:** head up display, head unit, instrument cluster
- **Engine control unit**
- **Connectivity**
- **Driver monitoring**
- **System network**
- **Backend**
- **Service**



Surround Sensing and Sensor Fusion

Vehicle Sensor Data



- ▶ Each sensing modality delivers sensor data with unique properties
- ▶ Sensor diversity requires sophisticated approaches for sensor data association and environment modeling

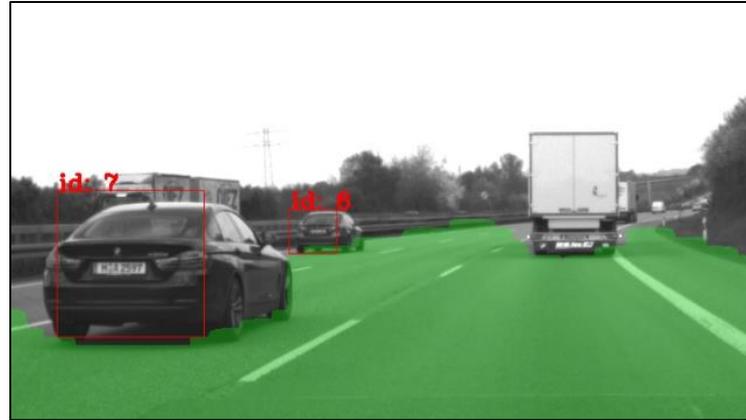


Automated Mobility

Artificial Intelligence Specialties

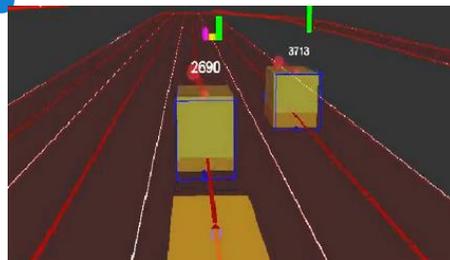
Deep Learning

...for detection of lanes, free space, traffic lights,...



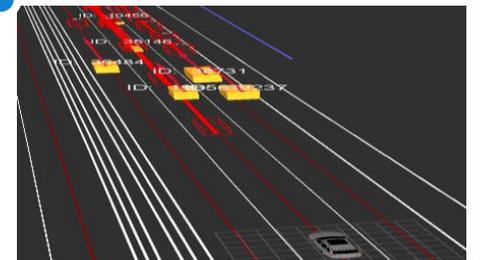
Hidden Markov Models

...to predict lane change behavior of cars



Behavior Heuristic

...for planning the driving strategy several seconds ahead



Automated Mobility

NÄCHSTER SCHRITT: INTELLIGENTE PRODUKTE

Künstliche Intelligenz

- ▶ Produkte müssen lernfähig werden
- ▶ Bosch hat Zentrum für Künstliche Intelligenz mit vier Standorten weltweit gegründet

From cars to smart homes

Mobility solutions have grown in scope



Connected Mobility 3rd living space



Summary

- ▶ Automatisiertes Fahren macht den Straßenverkehr sicherer.
- ▶ Künstliche Intelligenz ist der Schlüssel dazu. Das Auto wird schlau.
- ▶ Bosch hat mit seiner Sensorik den Dingen das Fühlen beigebracht. Jetzt bringt Bosch den Dingen Lernen und intelligentes Handeln bei.