



# Situational awareness from the **perspective** of an **autonomous vehicle**

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# Situational awareness from the perspective of an autonomous vehicle

R & D



□ KULeuven: 

university computer vision lab  
at KU Leuven  
ESAT-PSI-VISICS (Prof. Luc Van Gool)

□ TRACE: 

"*Toyota* Research on Automated Cars in Europe  
non-profit company structure  
consortium of academia joining efforts in AD research  
KUL / ETH / MPI / CAM / CMP

# Introduction : *where are we with autonomous driving*



- Ongoing race between diverse participants  
hip tech companies <> major car manufacturers
- Expectations of the industry is changing.  
impressive results <> strong statements on future AD  
L1 – L5 withdrawn later.
- There's just too much involved. The cars need to be able to not only drive themselves, they have to also communicate with each other.
- The solution is not obvious: standardization,  
different brands, different systems
- Need for high communication bandwidth such as 5G.



# Introduction : *What should autonomy be ?*



- There will be a transition phase with both drivers and cars employing different forms of autonomy

Autonomous	
Automated	driving
Assisted	

In our cooperation with Toyota,  
the attention goes to

- \* safety,
- \* comfort,
- \* human-machine interface
- \* add functionality gradually in the new cars



→ *Make the technology a reliable co-pilot*

# POC : *Woven City*



- unique opportunity to develop future technologies, including a digital operating system for the city's infrastructure
- Fully connected ecosystem
- Living laboratory

- Autonomous cars
- Personal mobility
- Robotics
- Surveillance
- Artificial intelligence
- Smart homes



# Research Summary



General context : two business models : **B2B/MAAS** vs. **B2C**

**MAAS** = Mobility As A Service :

- the autonomous taxi
- opportunity to install expensive sensors
- Less constraints on the looks
- recover costs later





# Research Summary



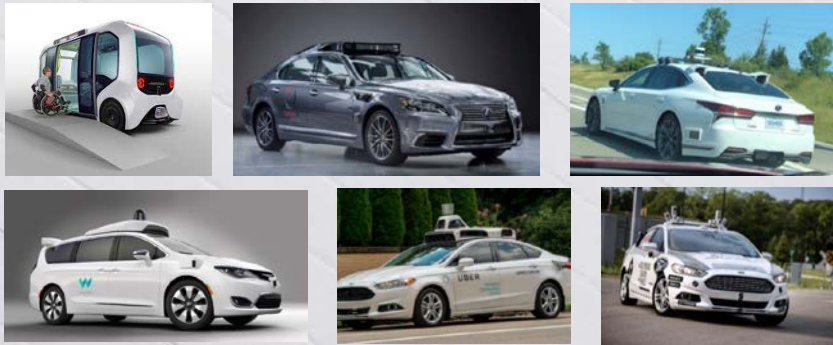
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**Commercial market** = private cars:

- esthetic, streamlined look  
*“ no KFC bucket “*
- budget friendly
- Safe
- *but still to be able to do everything*  
→ *cameras, vision*

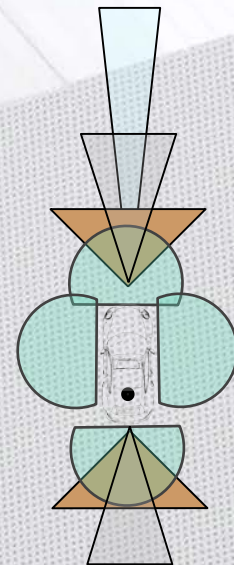
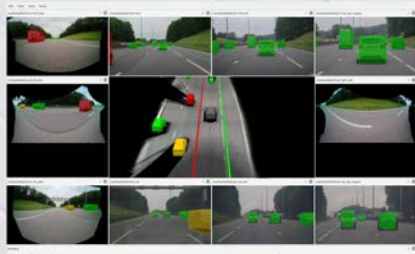


# Research Summary



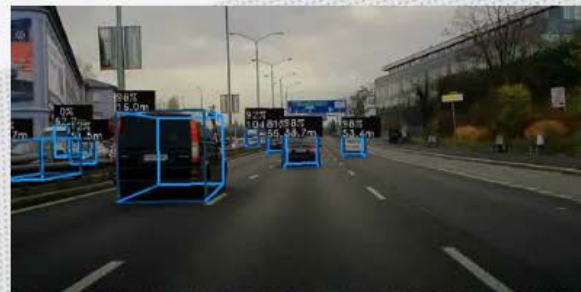
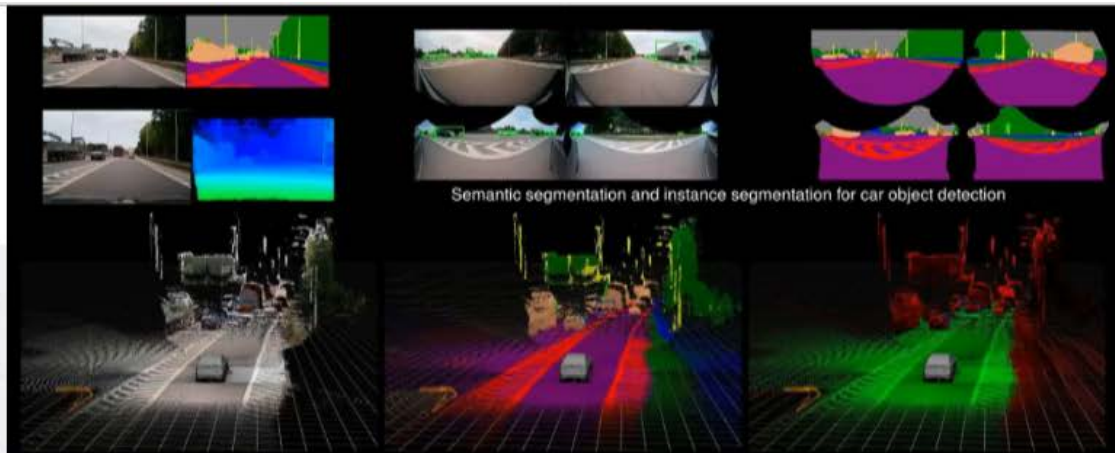
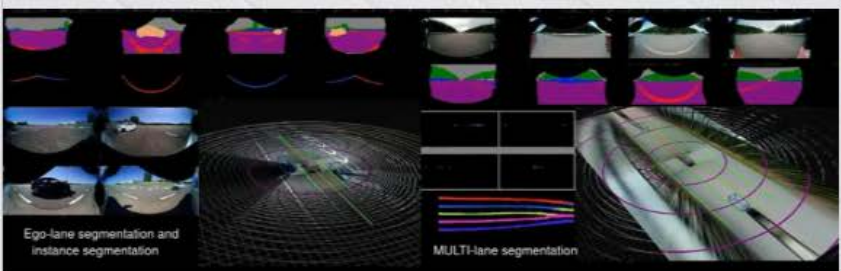
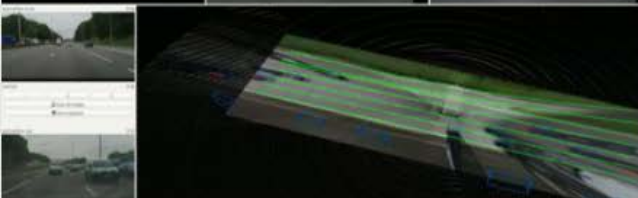
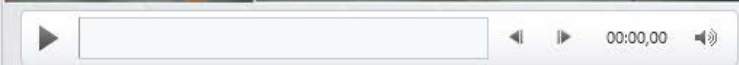
## Our focus :

- Use commodity cameras (Parking View Monitor fisheyes + optional windshield cameras) to perceive environment instead of lidar(s).
- Main focus on camera-only perception.  
Other sensor for ground truth / evaluation / training
- Challenges : resolution, distortion, ..  
→ push the limits of vision for AD.
- Multi-view/360° camera input
- 3D surround perception
- State-of-the-art + fast/real-time



TRACE : Research : S-O-T-A    Development : Engineering, optimization, reality check

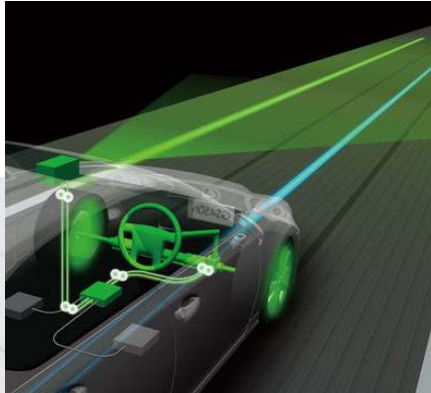




# AD driving vs. human machine interaction (HMI)



- Intuitively visualized ADAS info based on 3D 360deg surround camera perception.
- provide valuable feedback without distracting the driver
- Guarantee safety and comfort



Increase value to customer based on camera perception  
Reduce fatalities car-to-car, VRU, pedestrians

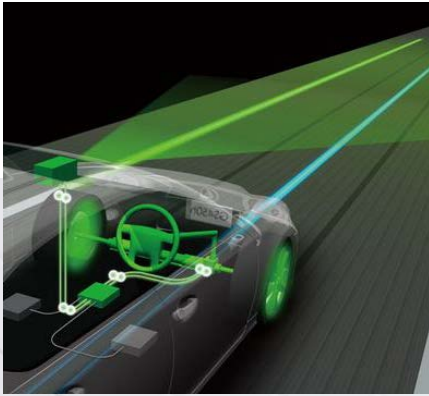




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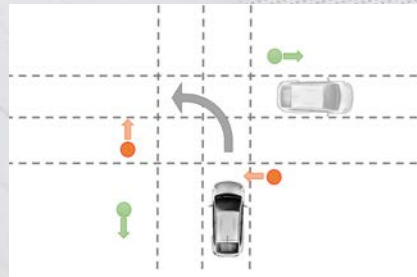
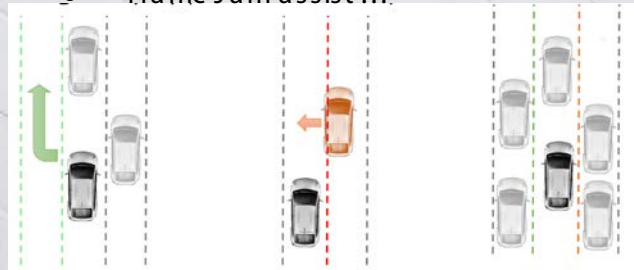
Increase value to customer based on camera perception  
Reduce fatalities car-to-car, VRU, pedestrians (night)

## Highway : Awareness road users

- Early warning cut-in
- Merge / lane change assist
- Traffic Jam assist ...

## Urban : Awareness Vulnerable Road Users (VRU)

- Detect pedestrians at junctions/crossings
- Detect hazards within the free space





# Conclusion



- added value to various industrial R&D projects
- translating cutting edge research into real-life applications
- bridge the gap between state-of-the-art research and practice
  - Vision related software for AI based application
  - Traditional computer vision vs. Deep Learning

