SoC for ultra HD mono and stereo-vision processing

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VisLab

Group started in **mid ‘90s** at the University of Parma, Italy

Spin-off launched in **2009**

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Acquired by Ambarella in **2015**

Ambarella

- Chip company working on ultra-HD video

VisLab + Ambarella

- Starting July 2015 VisLab is working with Ambarella
  - Ambarella, a chip company
  - VisLab, a computer vision startup

Goal

- Design an engine for automotive systems (from ADAS to Autonomous Driving):
  - High performance
  - Low cost
  - Low power consumption
  - Automotive grade

to handle perception, data fusion, and ultimately also path planning

Ambarella CV SoC

- Current CV chip (CV-2):
  - 4k images (up to 8 image streams, incl multiscale) @30fps
  - IDSP on board, H.265 on board
  - Stereo processing @ 30fps (incl multiple stereo)
  - Monocular processing @ 30fps (CNNs, vector, serial)
  - Power consumption: under 5W
  - AEC-Q100

4k Image Resolution

4k, cropped (3840 x 1280)

Image Quality – Sun

Image Quality – Night

4k Stereo Vision

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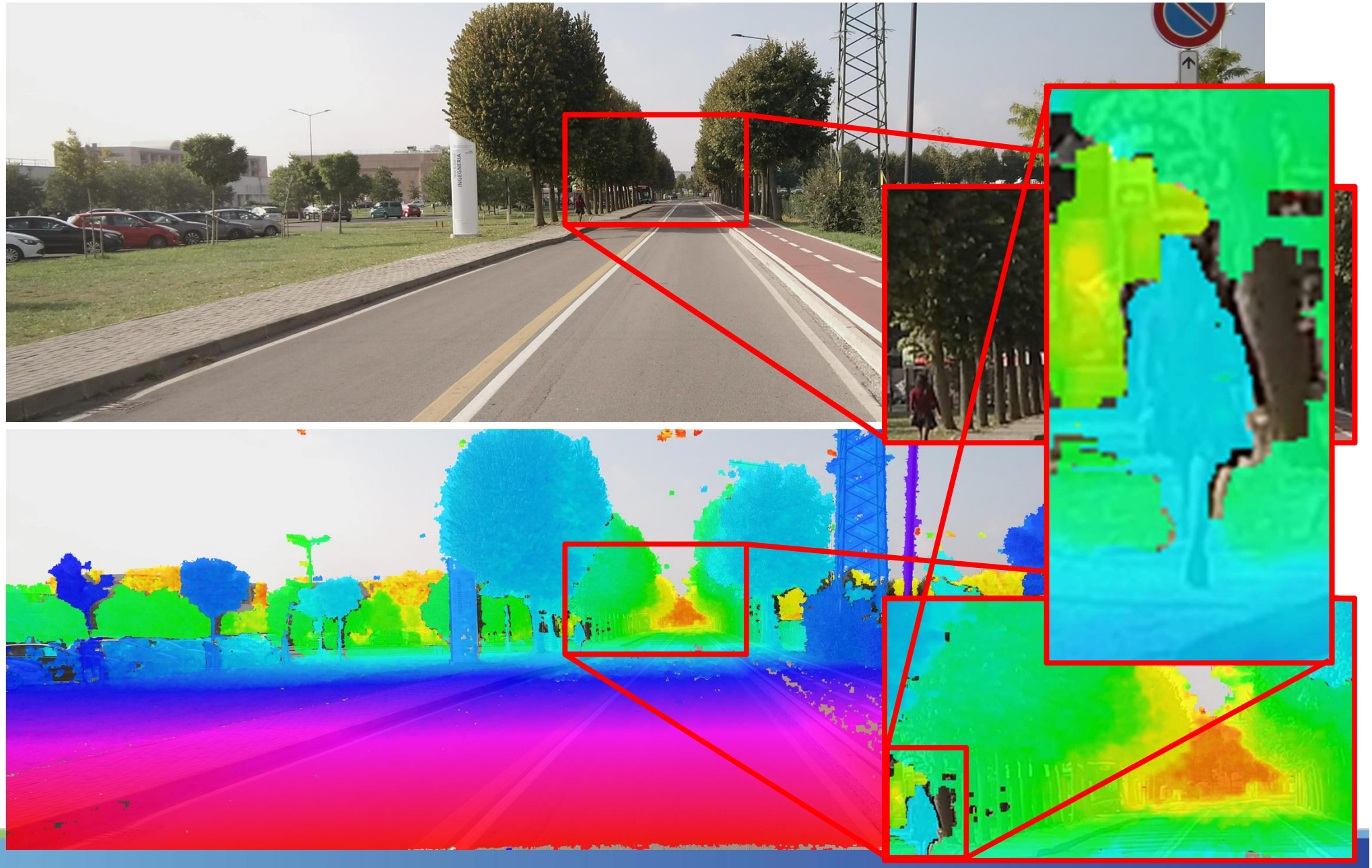

Stereo Calibration

- In the past calibration has been one of the **major showstopper** for stereo vision, especially on vehicles
- A stereo camera is a measurement instrument
- Calibration needs to be maintained… for years

Stereo AutoCalibration

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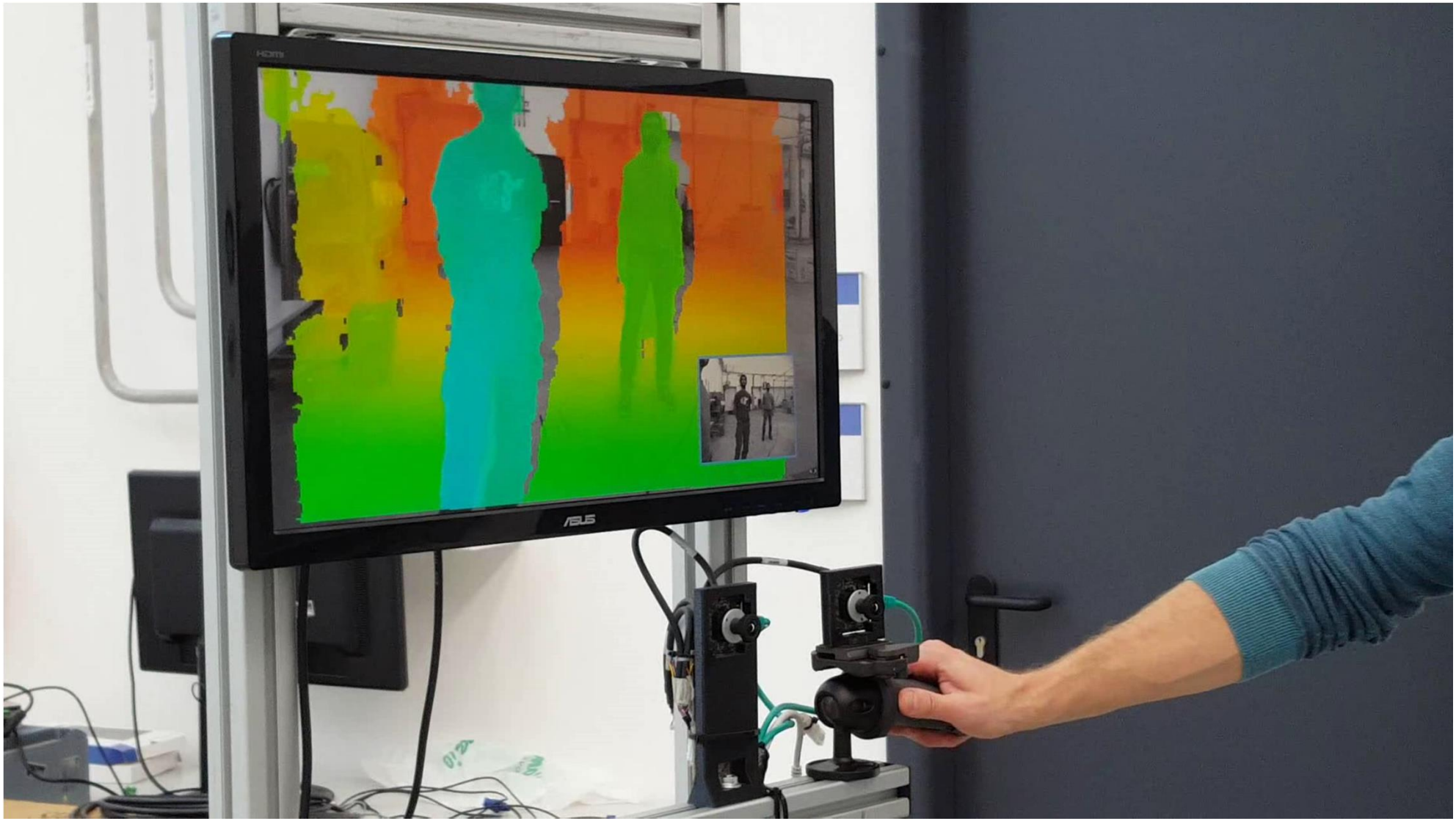

Stereo History

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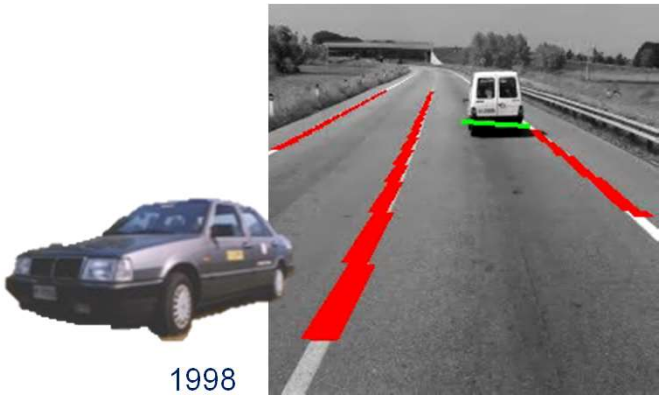
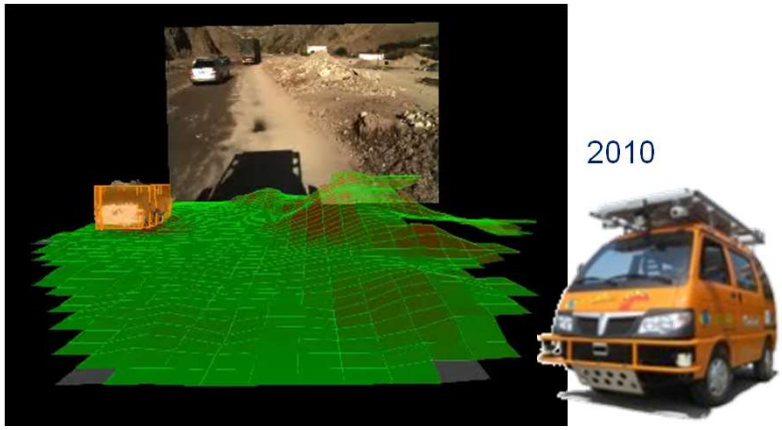
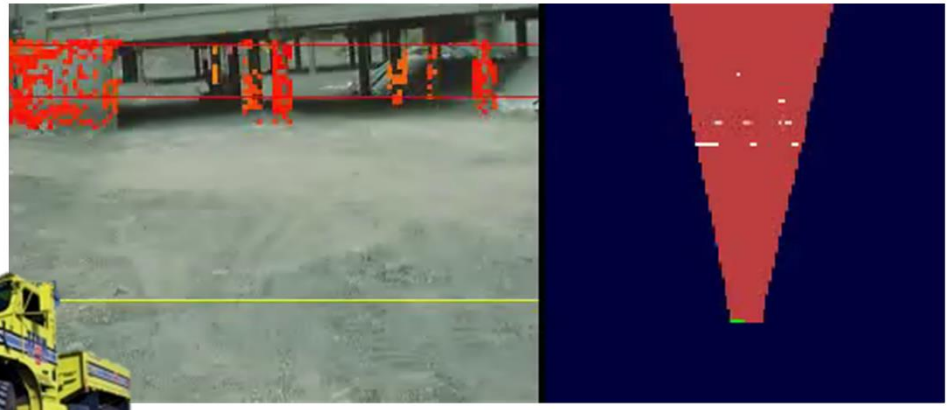
Stereo processing and autocalibration come from VisLab's multi-year history



1998



2010



2005

2013

4k Stereo Vision

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4k Stereo Vision

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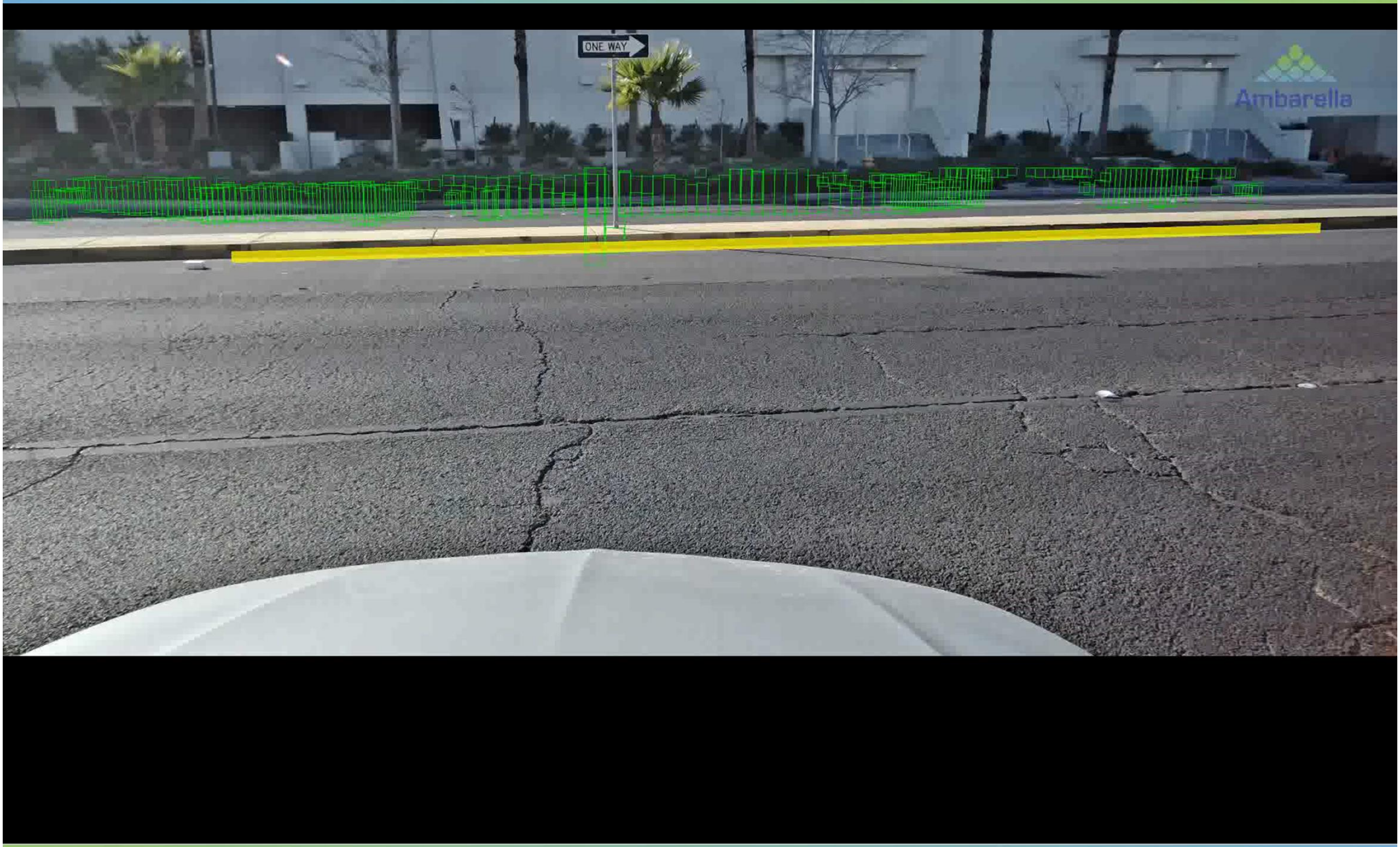

4k CNN Classification

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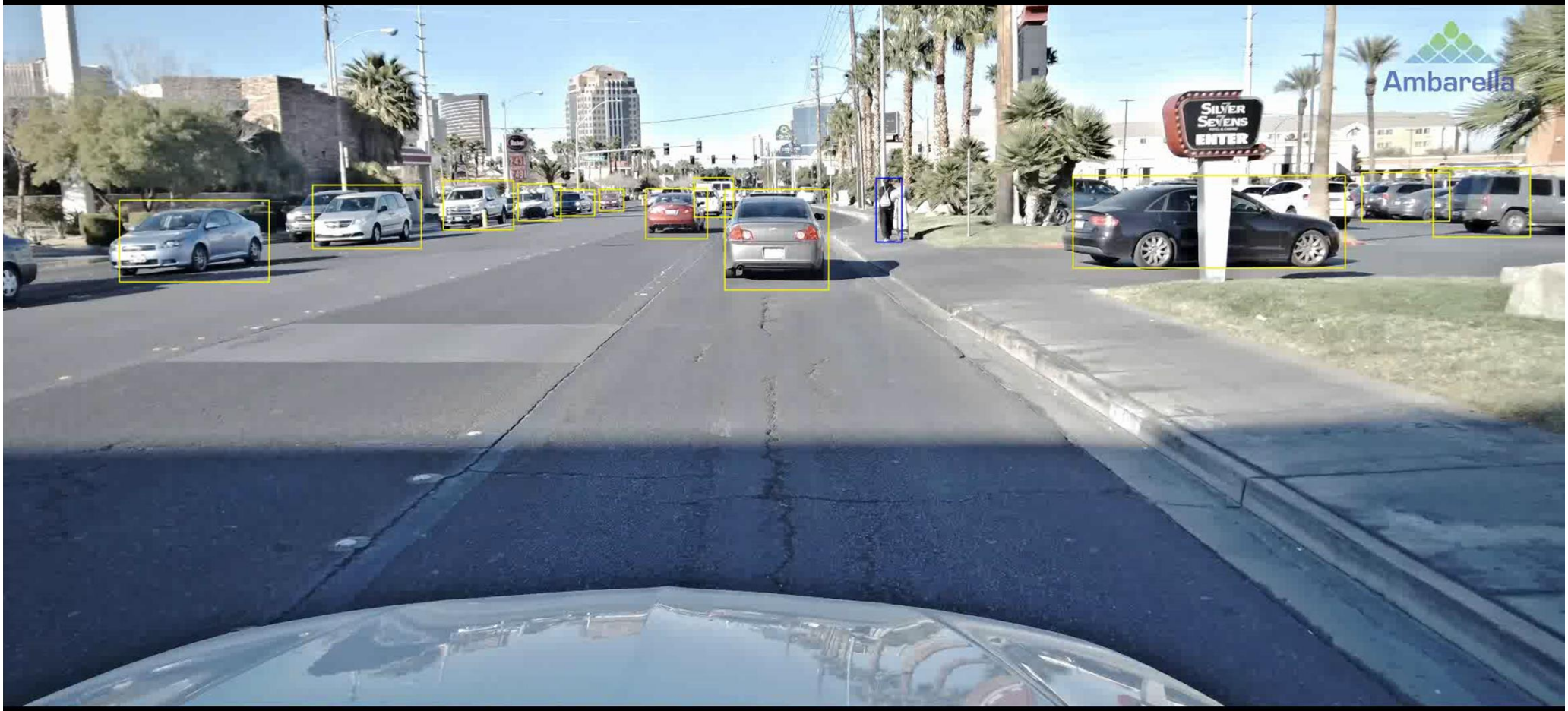

EVA – Embedded Vehicle Autonomy

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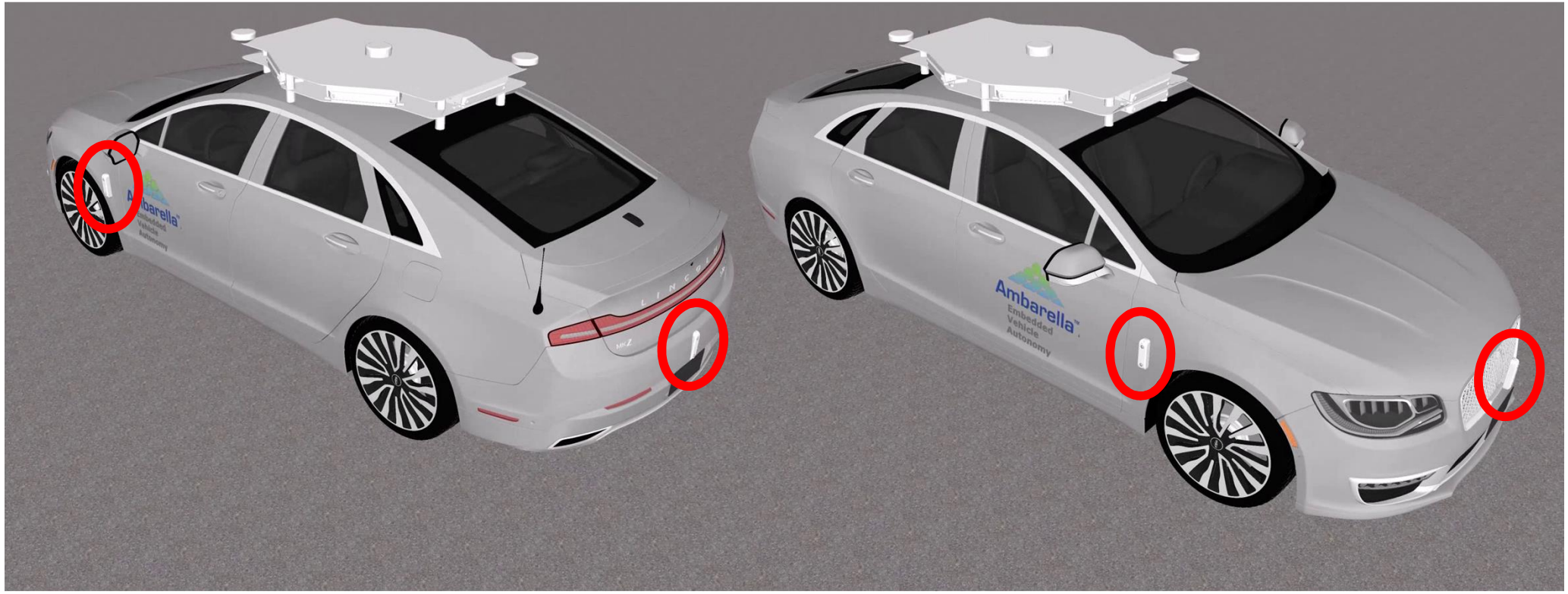
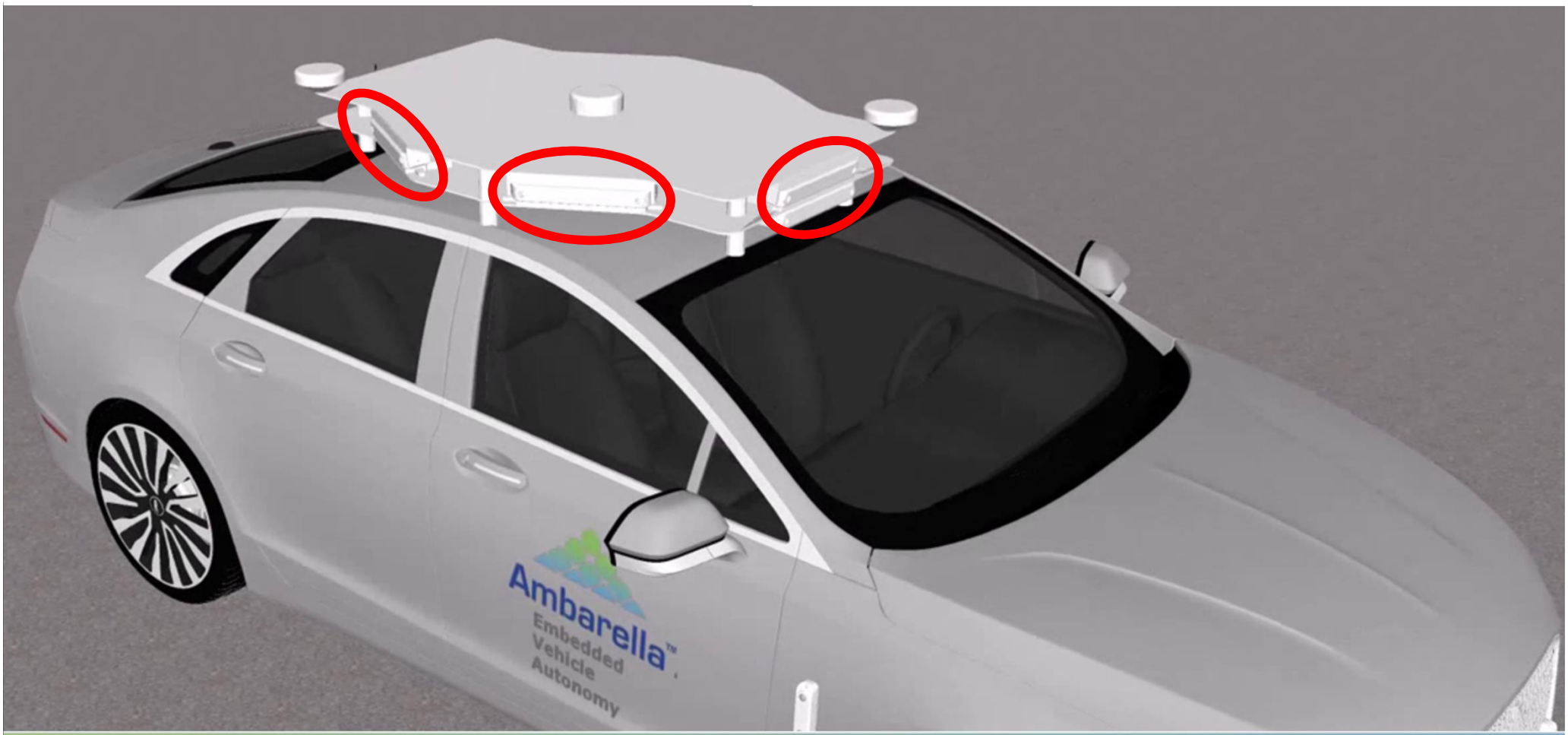
EVA – Embedded Vehicle Autonomy

- Short Range Module: 4x 1080p stereo cameras

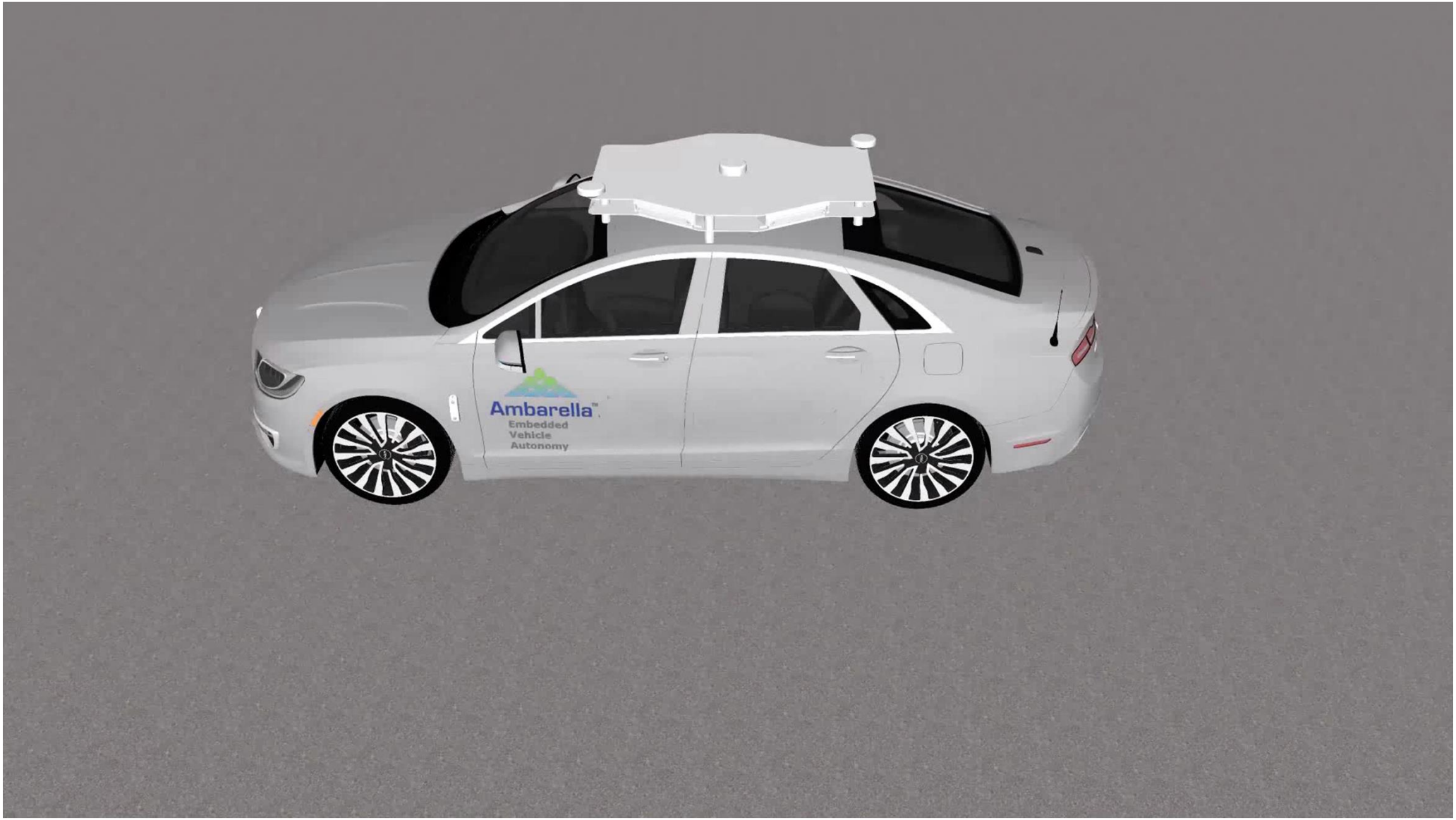


EVA – Embedded Vehicle Autonomy

- Long Range Module: 6x 4k stereo cameras



EVA Stereo Vision Sensing



Conclusion

- Visual perception is key for intelligent vehicles
- We are porting advanced tools (like stereo and CNNs) into a low-cost, low-power, high performance chip
- The CV family: CV-1, CV-2, CV-22,…