



ACCELERATING THE RACE TO SELF-DRIVING CARS

Danny Shapiro, Sr. Director of Automotive | IEEE



IN THE BEGINNING



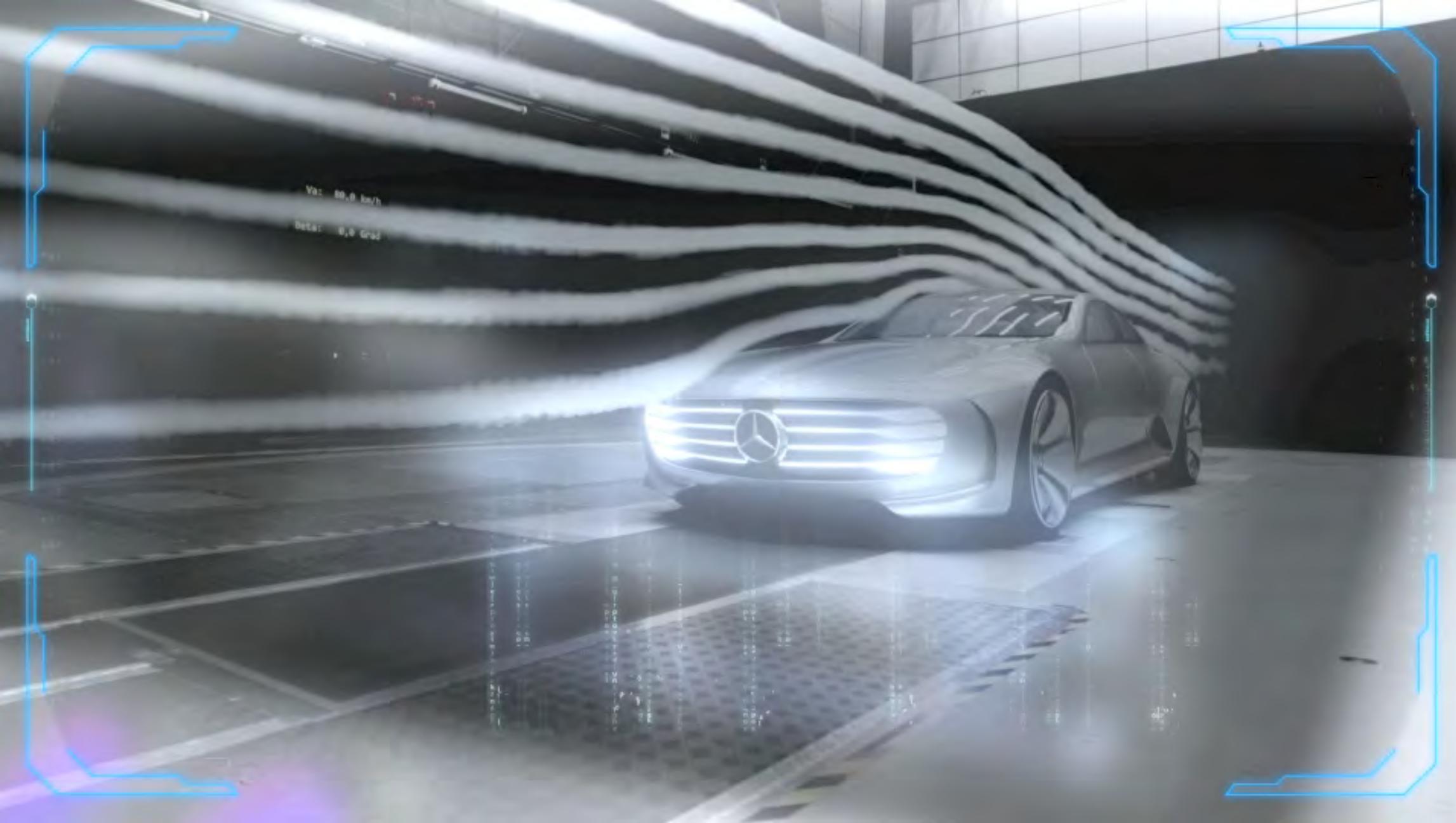


▲ Massimiliano Franc + 0.00.049

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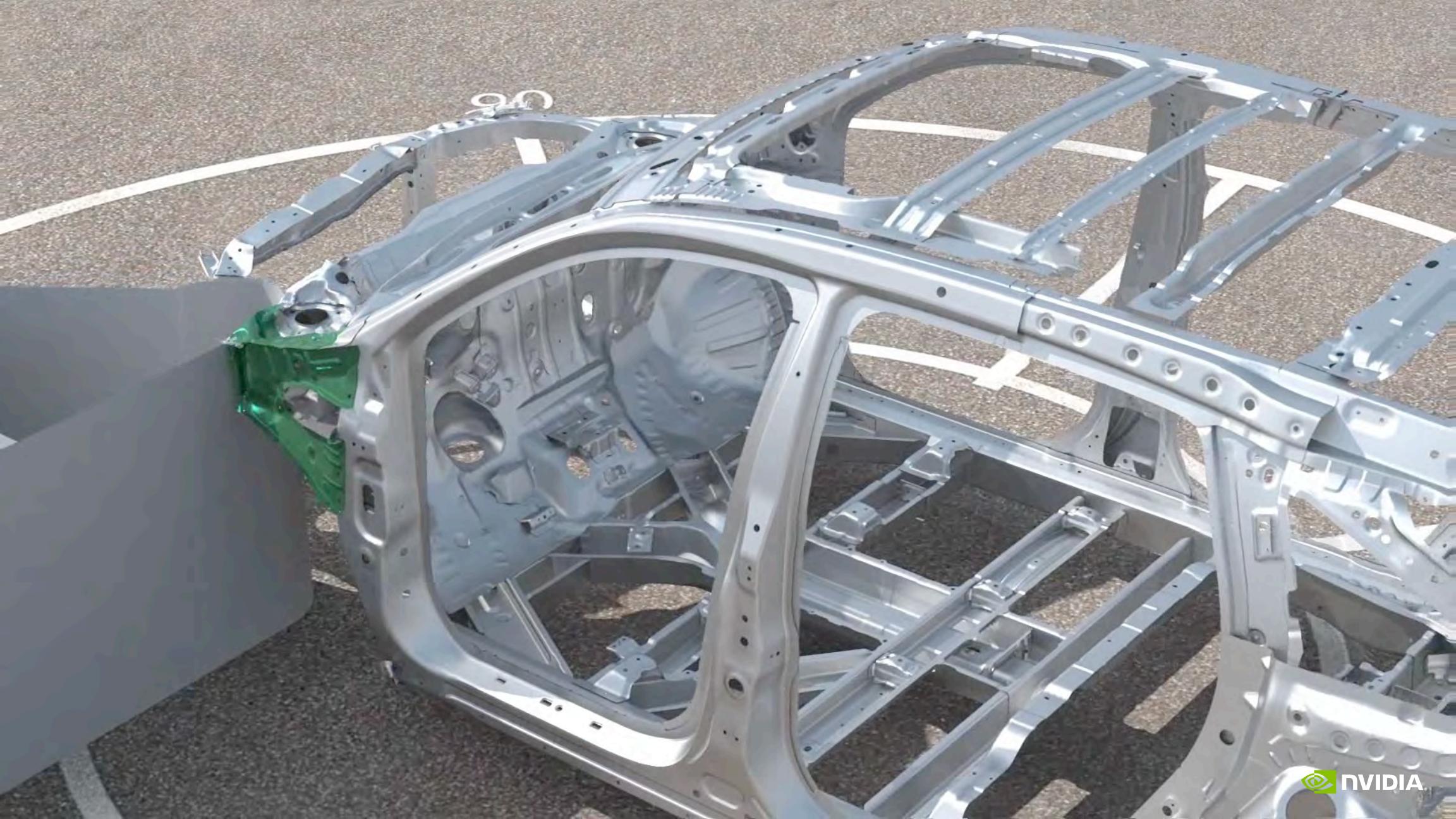
◆ L1/2





Vaz: 80,0 km/h

Detal: 0,0 Grad







ACTUAL CRASH



SIMULATED CRASH

THE FUTURE OF CAR BUYING



R8
China Edition 5.2 FSI
382 kW (520 ps)
内燃机：V10自然吸气
变速器：双离合器
驱动形式：quattro quattro
油耗：
综合油耗：14.6 L/100km
市内油耗：18.0 L/100km
市外油耗：10.0 L/100km
二氧化碳排放量：350 g/km

THE FUTURE OF CAR BUYING



ENABLING THE SOFTWARE-DEFINED CAR



ENABLING THE SOFTWARE-DEFINED CAR



ENABLING THE SOFTWARE-DEFINED CAR



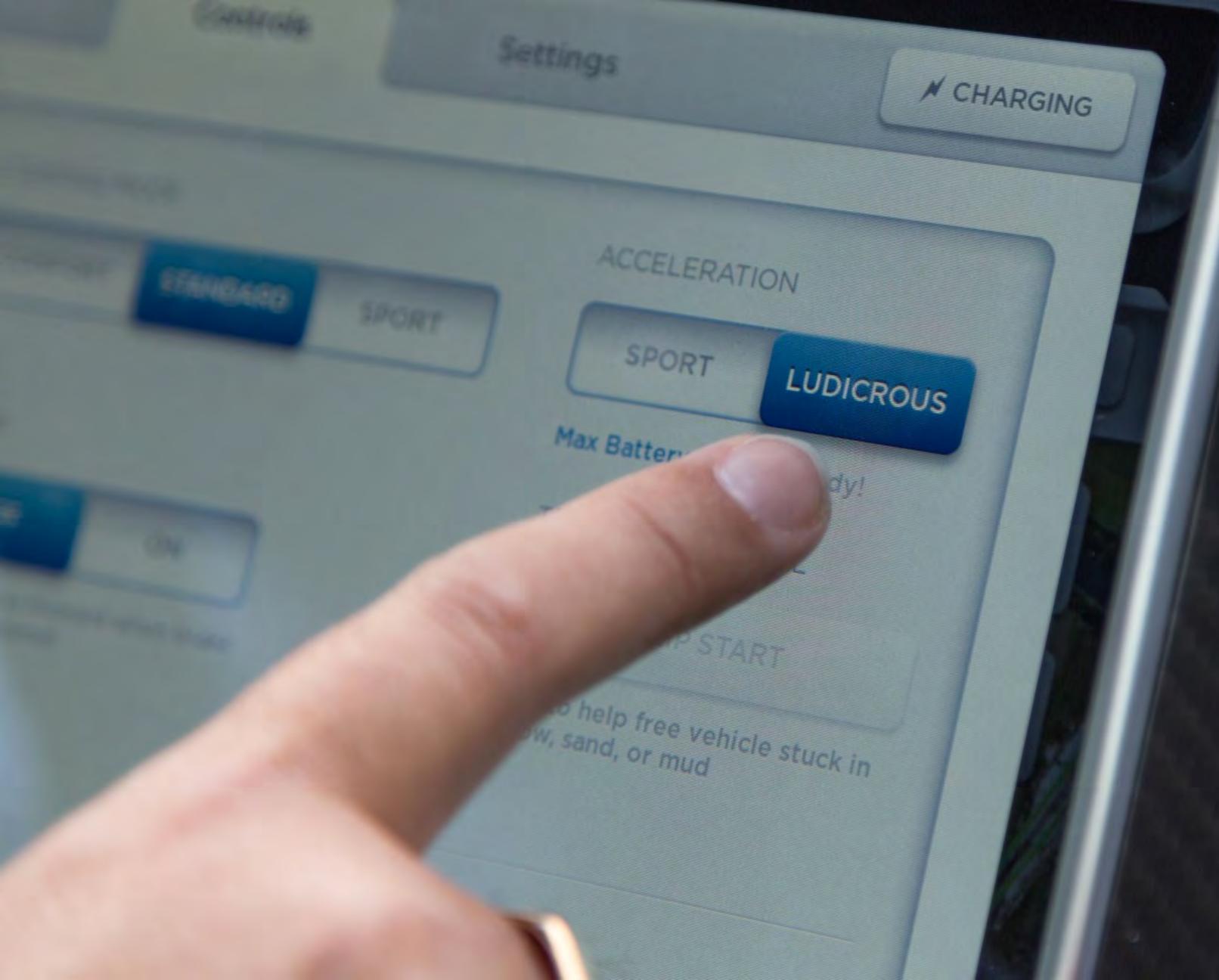
ENABLING THE SOFTWARE-DEFINED CAR



ENABLING THE SOFTWARE-DEFINED CAR







A NEW ERA OF COMPUTING



1995

PC INTERNET
WinTel, Yahoo!
1 billion PC users



2005

MOBILE-CLOUD
iPhone, Amazon AWS
2.5 billion mobile users



2015

AI & IOT
Deep Learning, GPU
100s of billions of devices

San Francisco Bay

Driven to the Valley

Many automotive companies are opening Silicon Valley research labs and offices as car technology, including self-driving systems, grows tantamount to the industry's future.

BELMONT

Volkswagen

FREMONT

Tesla

MENLO PARK

Hyundai

BMW

Google

General Motors

Ford

PALO ALTO

Delphi

MOUNTAIN VIEW

Nissan

Continental

Tesla

Bosch

Honda

SUNNYVALE

Mercedes-Benz

NVIDIA

Elektrobit

Denso

SAN JOSE

3 miles

CALIF.

San Francisco

Oakland

DETAIL

San Jose

Source: the companies

THE WALL STREET JOURNAL.

There's Now a Children's Book About Self-Driving Cars

by Kirsten Korosec

@kirstenkorosec

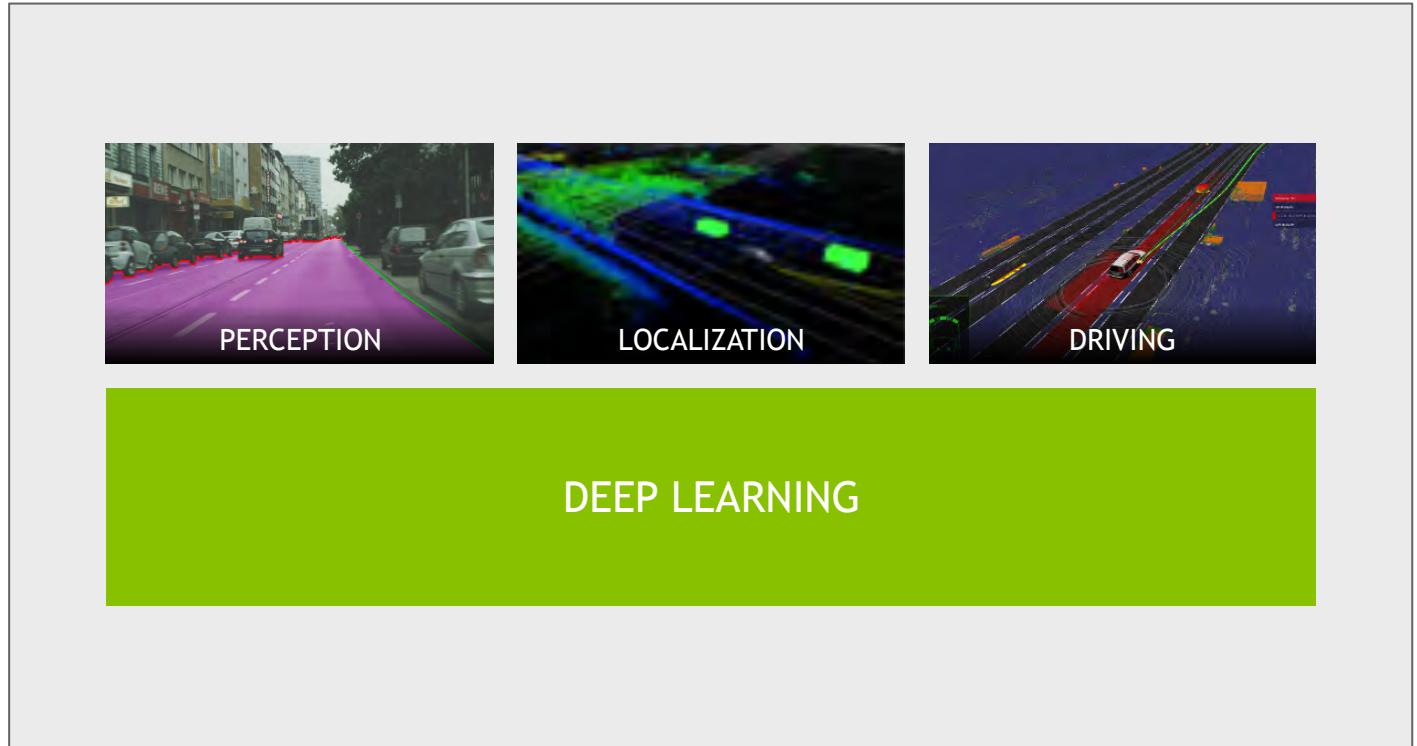
OCTOBER 18, 2016, 4:06 PM EDT



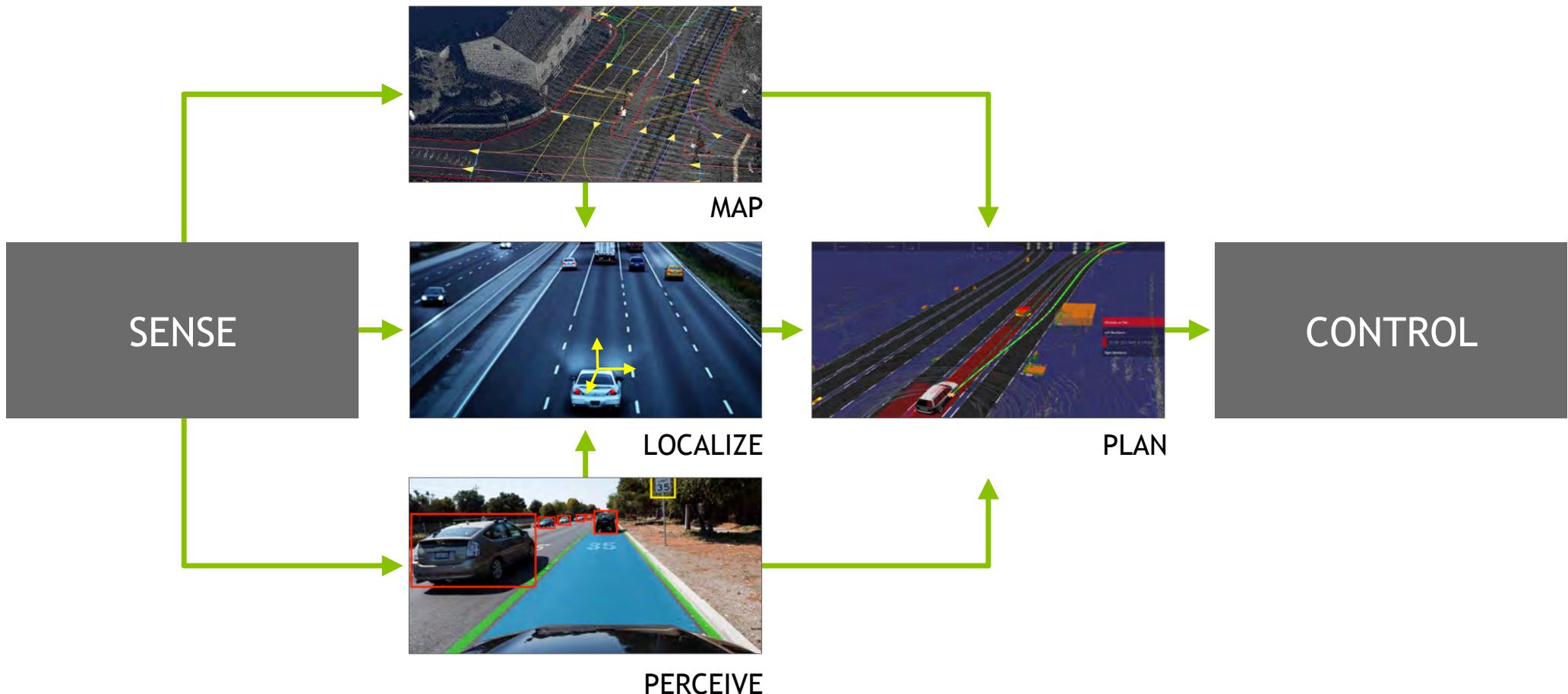
MANY THINGS TO LEARN



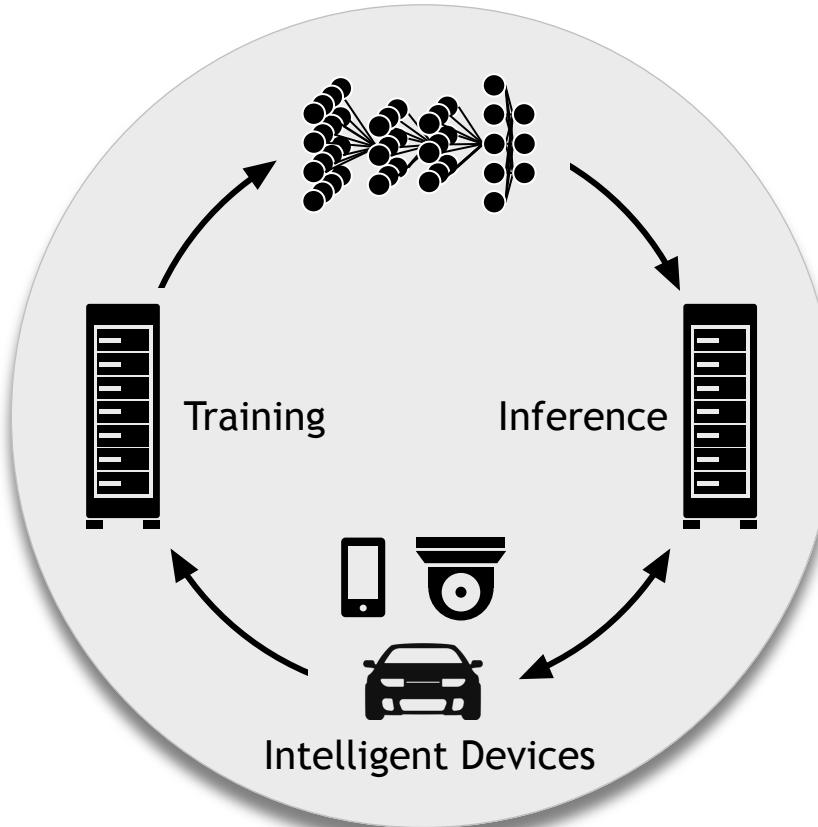
AI TRANSPORTATION – \$10T INDUSTRY



THE BASIC SELF-DRIVING LOOP



GPU DEEP LEARNING IS A NEW COMPUTING MODEL



HOW A DEEP NEURAL NETWORK SEES

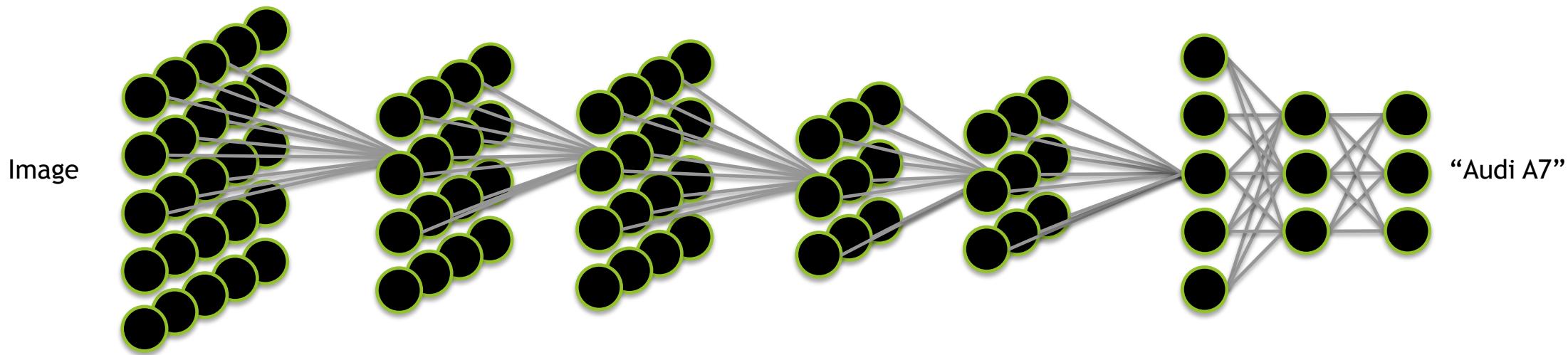
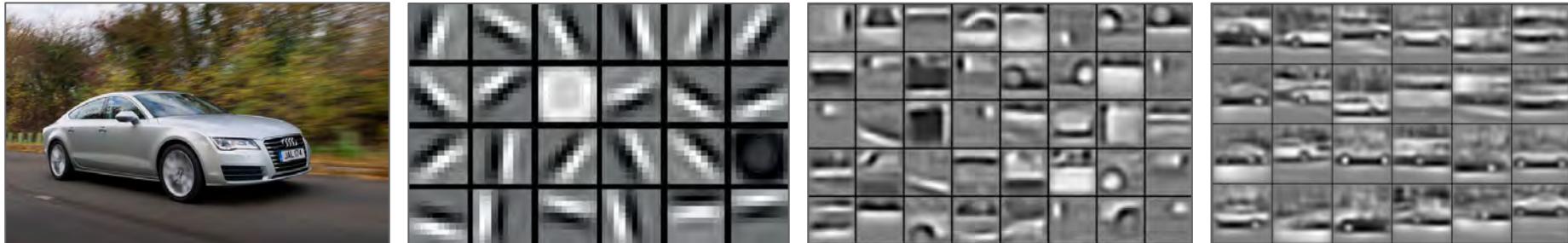
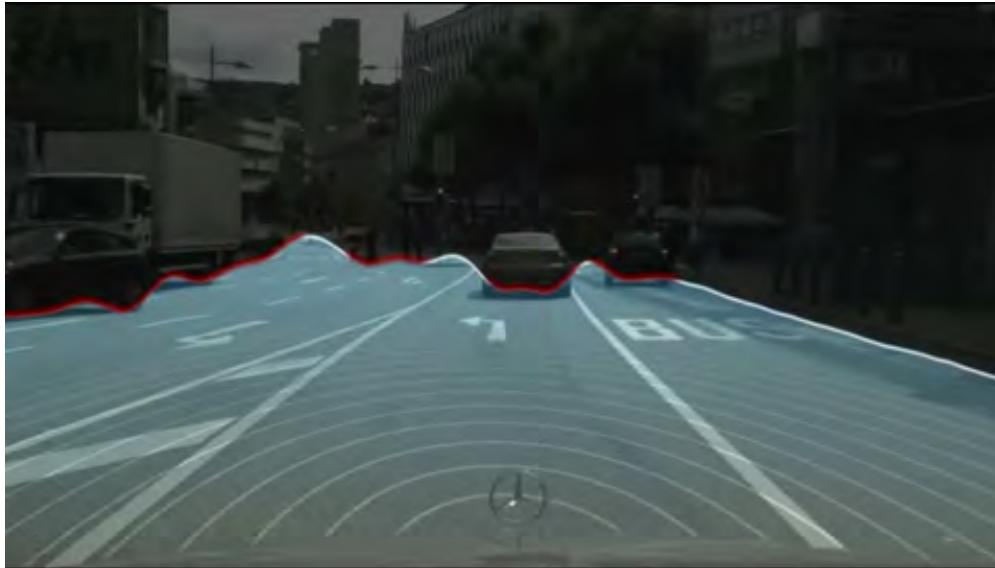


Image source: "Unsupervised Learning of Hierarchical Representations with Convolutional Deep Belief Networks" ICML 2009 & Comm. ACM 2011.
Honglak Lee, Roger Grosse, Rajesh Ranganath, and Andrew Ng.

NVIDIA & BAIDU PARTNER ON AI SELF-DRIVING CARS



INSIDE THE SELF-DRIVING BRAIN



FREE SPACE DETECTION

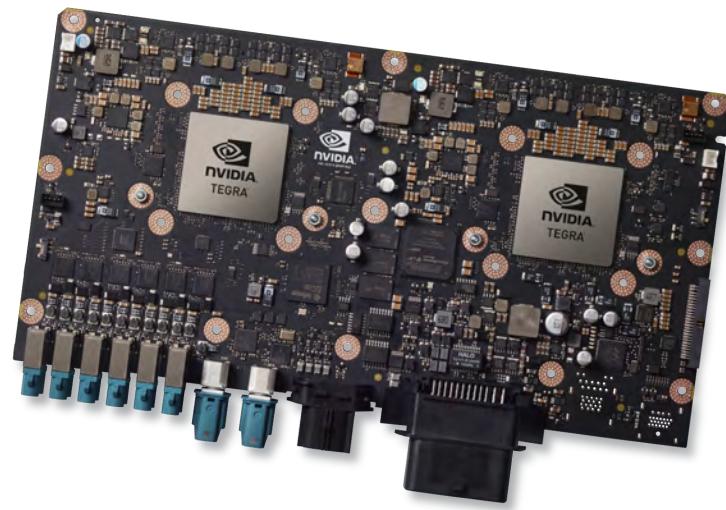


CAR 3D DETECTION

INSIDE THE SELF-DRIVING BRAIN



150 MACBOOK PROS IN YOUR TRUNK



DEEP LEARNING AUTOMOTIVE PARTNERS



Audi



AdasWorks

Baidu 百度

CRUISE

drive.ai

EB
Elektrobit

FICOSA

fka

ibeo

infineon

NAGOYA
UNIVERSITY

Preferred
Networks

GNX

QUANERGY

SoundHound

UNIVERSITAT
BARCELONA

WePods

ZMP

NVIDIA

NVIDIA DRIVE PX 2

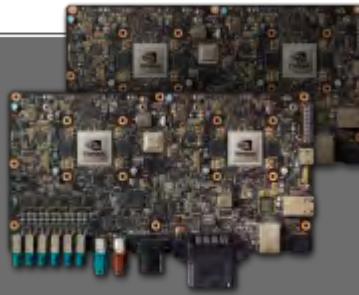
AutoCruise to Full Autonomy – One Architecture



AutoCruise



AutoChauffeur



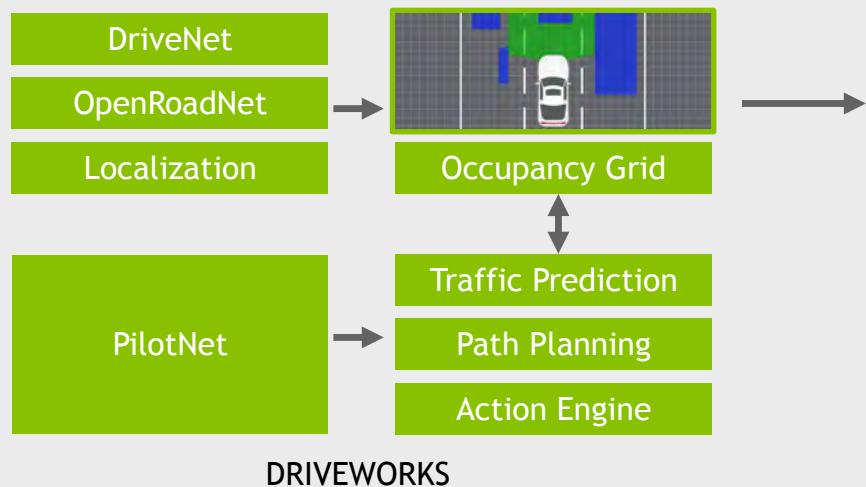
Full Autonomy

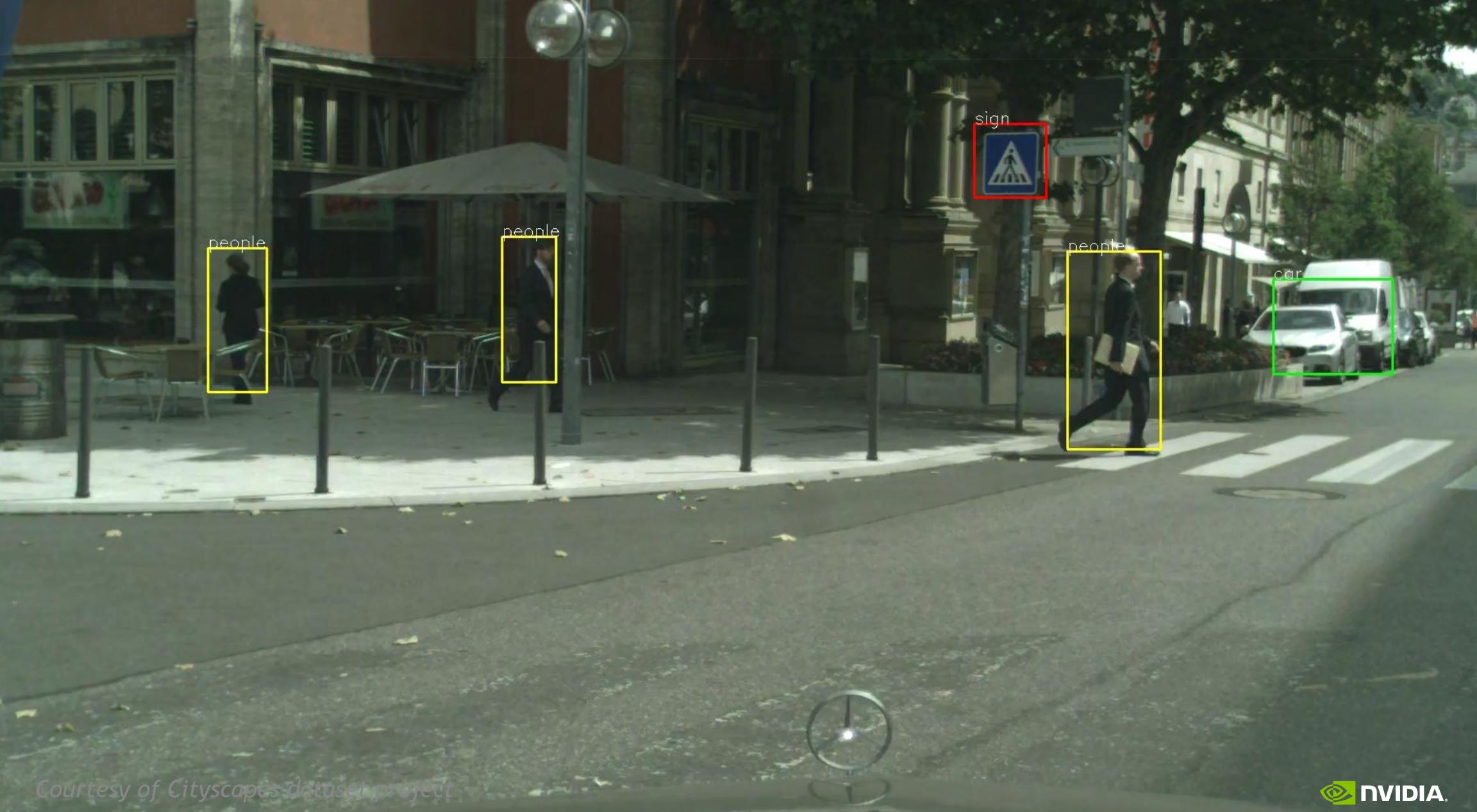
AUTONOMOUS DRIVING

Perception, Reasoning, Driving
AI Supercomputing, AI Algorithms, Software
Scalable Architecture

DRIVEWORKS ALPHA 1

OS For Self-Driving Cars







Courtesy of *Cityscapes* dataset project

 NVIDIA



Courtesy of Audi

 NVIDIA

“Using NVIDIA’s deep learning platform, in less than four hours we achieved over 96% accuracy using Ruhr University Bochum’s traffic sign database. While others invested years of development to achieve similar levels of perception with classical computer vision algorithms, we have been able to do it at the speed of light.”

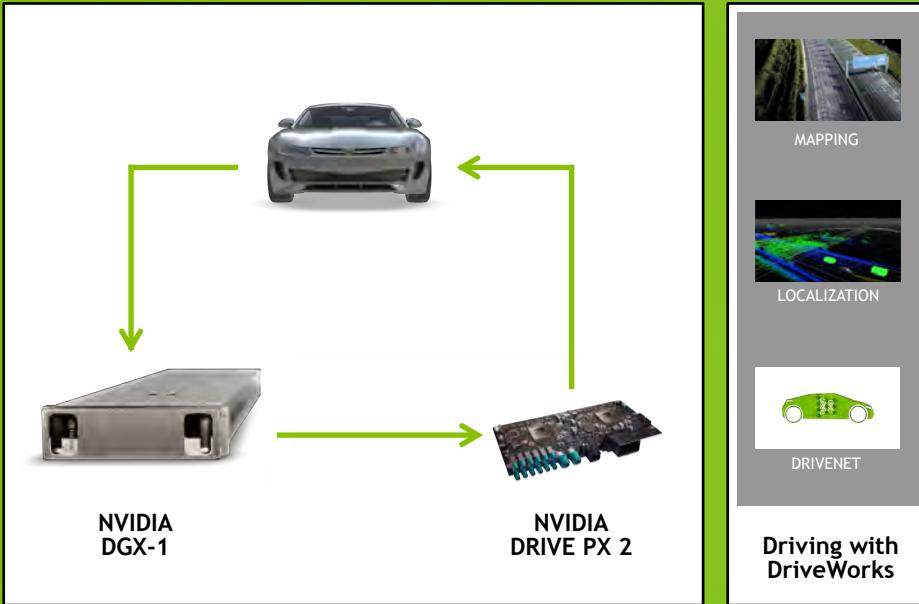
*Matthias Rudolph, Director of Architecture,
Driver Assistance Systems, Audi*



NVIDIA DRIVE



NVIDIA AI SYSTEM FOR AUTONOMOUS DRIVING





BB8 sees the construction cones

E F

AUTOCRUISE ON

11:31 AM

H C J

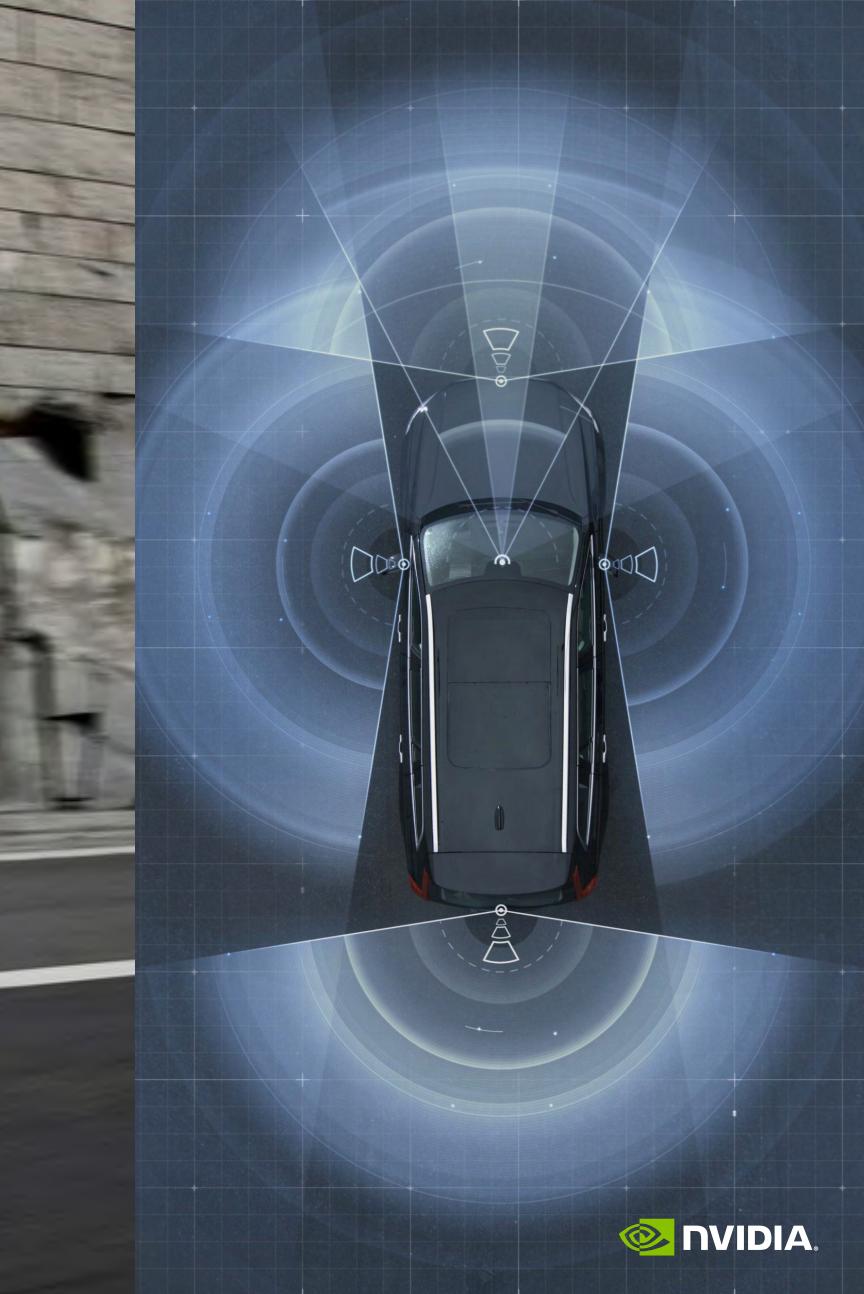


THE FAST AND THE CURIOUS

Udacity Self-Driving Engineer Nano-degree







DRIVE ME PROJECT



- Using public roads ~30 miles (highway)
- Highly autonomous vehicles in 2017
- 100 customer vehicles
- Unsupervised/ SAE level 4 ; secondary tasks allowed
- Co-operation with Swedish authorities



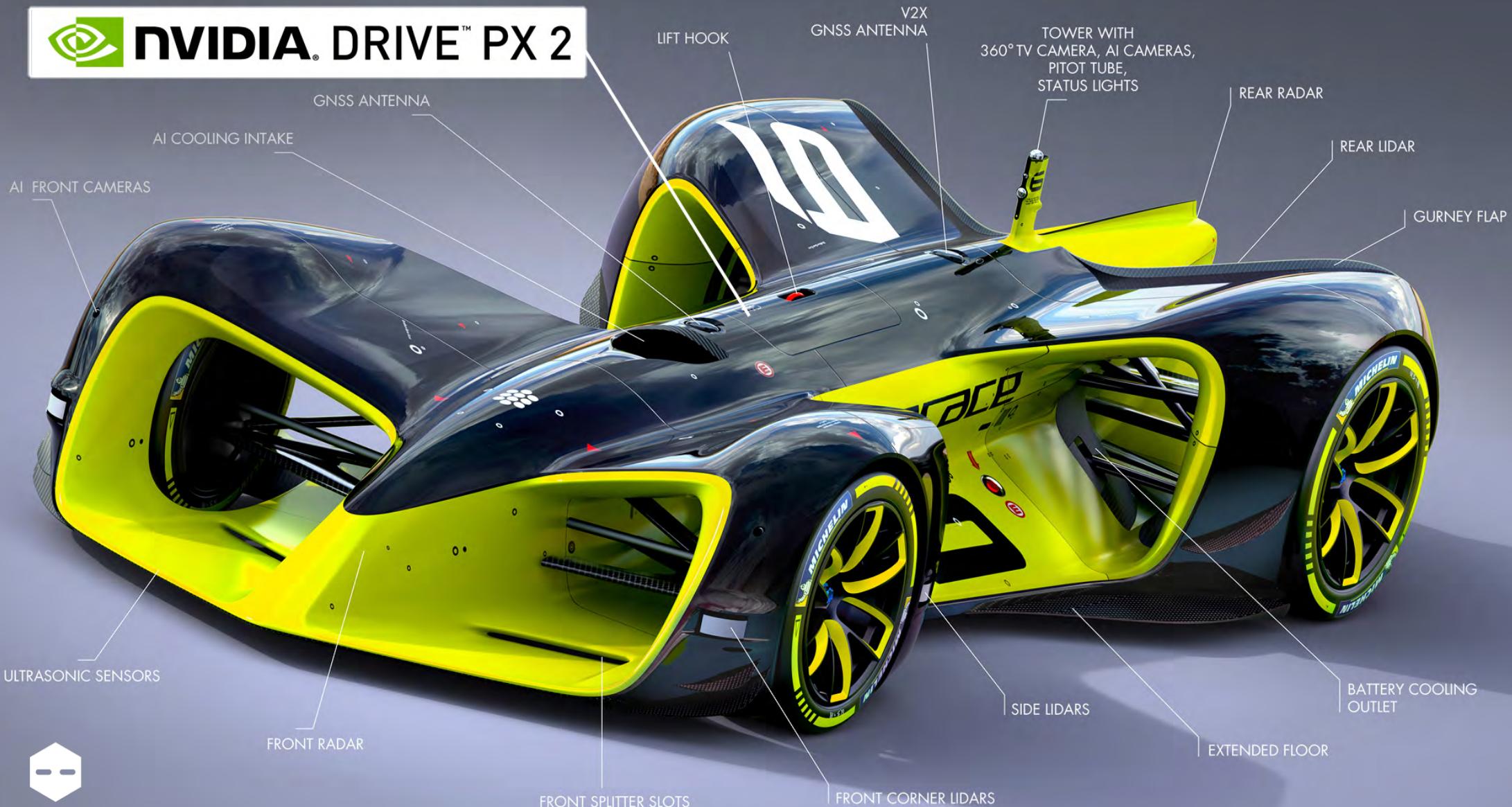


ROBORACE





NVIDIA. DRIVE™ PX 2

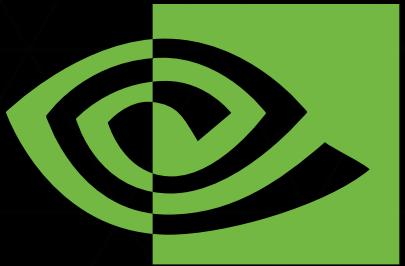


ROBORACE

NVIDIA.



*“Does your car have any idea why
my car pulled it over?”*



NVIDIA®