

A dark blue SUV is shown in motion on a road, with a blurred background. The number '26' is visible on the side of the vehicle. The text 'Autonomous-Vehicle Technology' is overlaid in red.

Autonomous-Vehicle Technology

Mark Campbell

DARPA Challenges



2004



2005

- 2004, 2005: 100+ miles across the desert



2007



- 2007: 60+ miles with other cars, on roads

Cornell's Autonomous Car

Feb 18, 2007: First drive



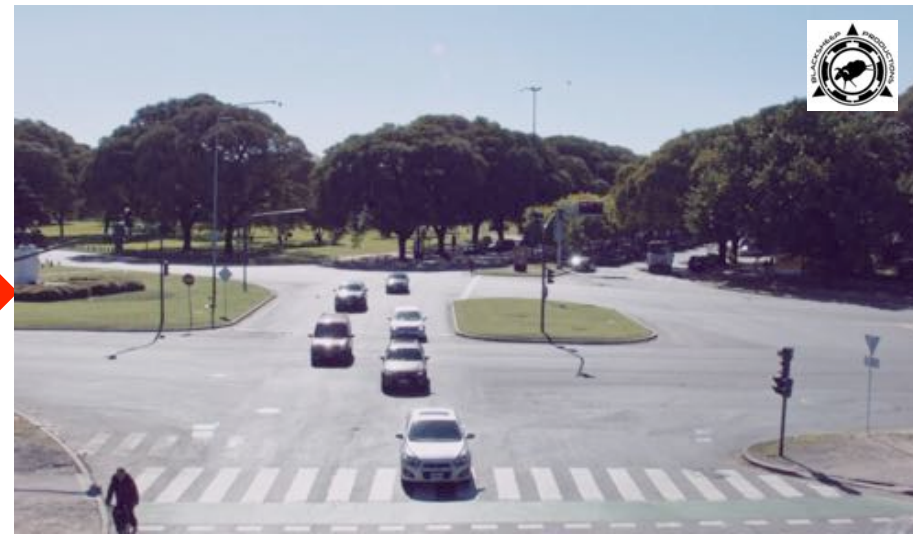
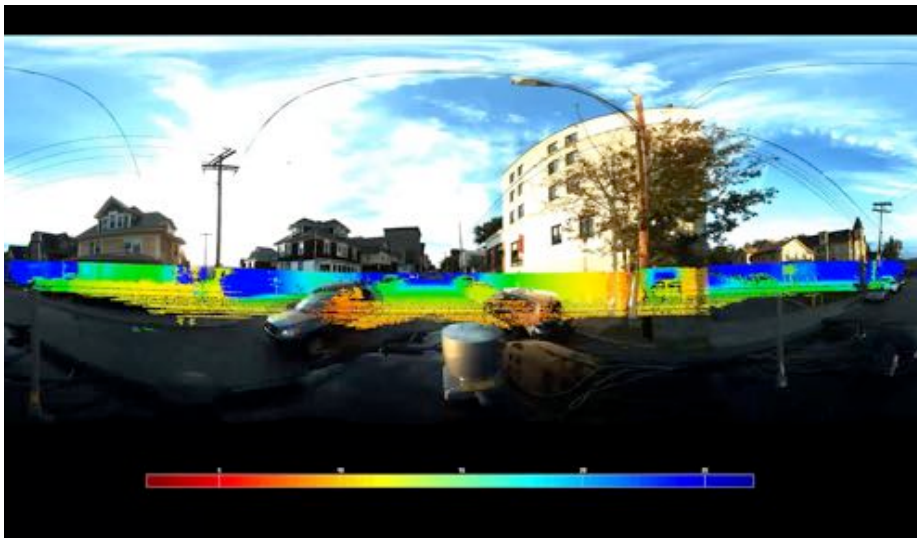
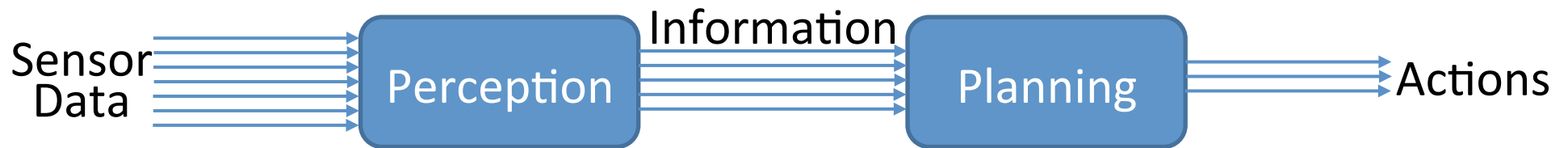
Feb 24, 2007: Fast Reverse



A Typical Self-Driving Car



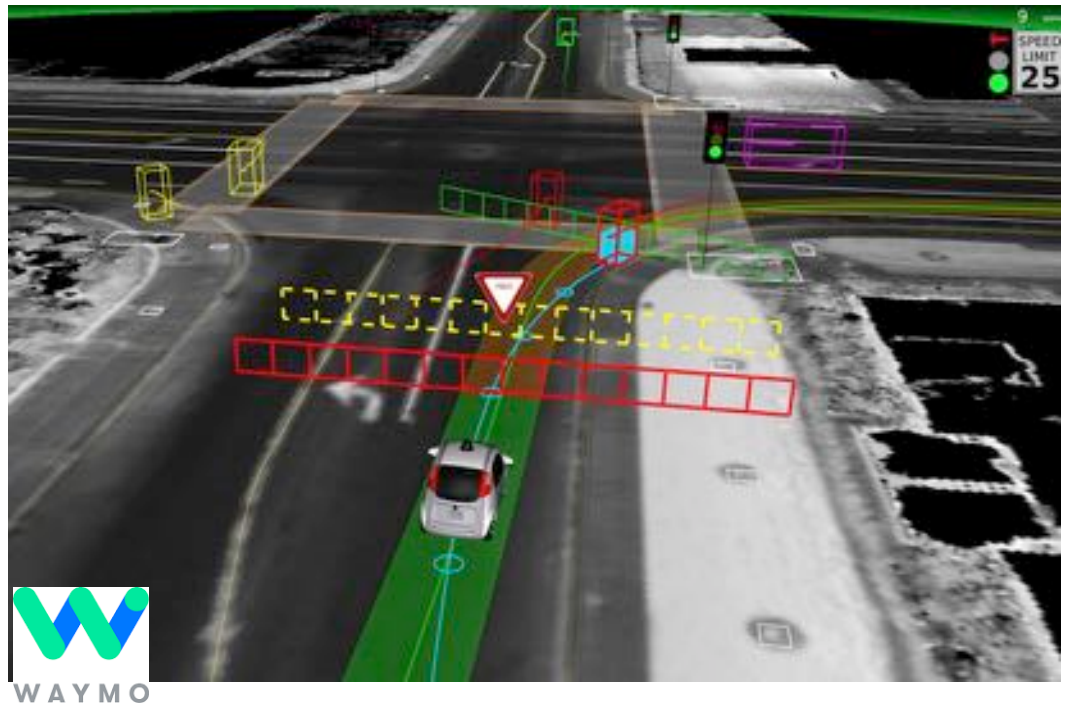
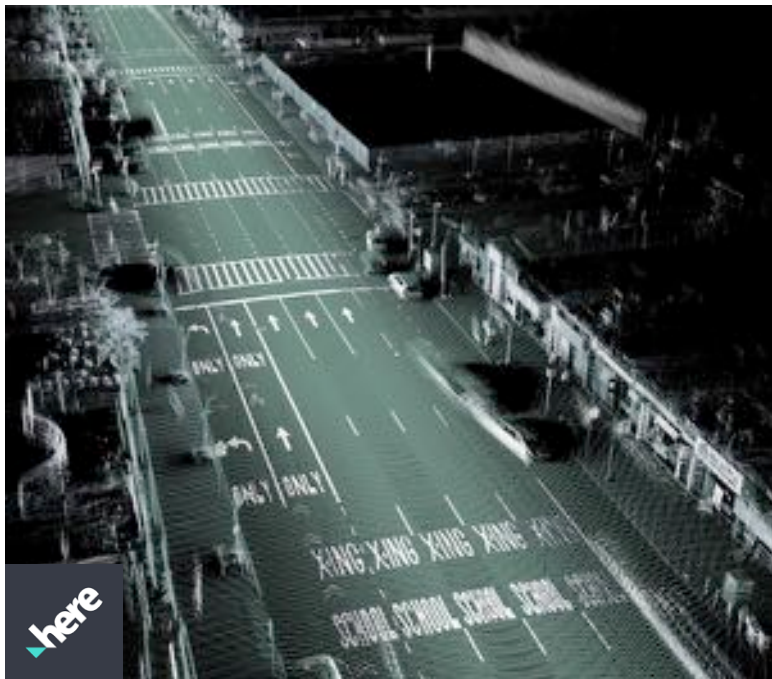
Software Pipeline for Autonomous Driving



Technology: Perception (Data -> Info)



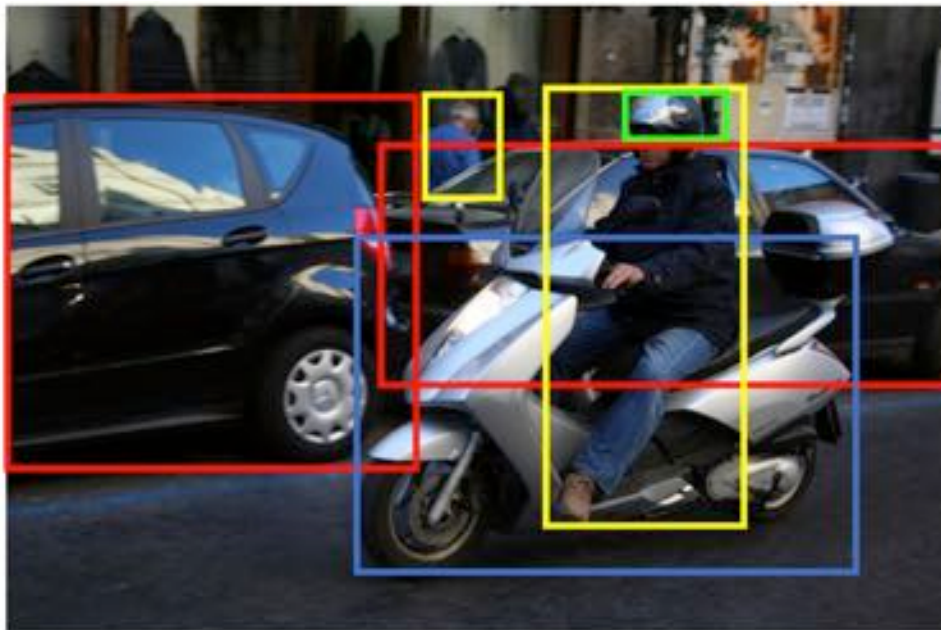
Technology: Mapping



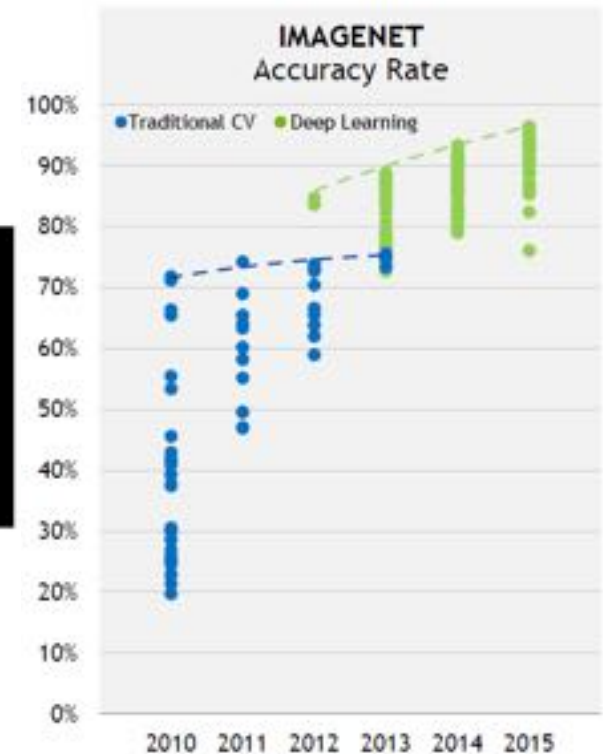
Technology: Planning (Info -> Actions)



Technology: Deep Learning



Person
Car
Motorcycle
Helmet



Levels of Automation: Dept of Transportation

HUMAN DRIVERS MONITOR THE DRIVING ENVIRONMENT

0 No Automation



1 Driver Assistance



2 Partial Automation



AUTOMATED DRIVING SYSTEM MONITORS THE DRIVING ENVIRONMENT

3 Conditional Automation



4 High Automation



5 Full Automation



Current Technical Challenges

- reliance on maps
- environments: poor weather, at night, sunlight
- more/faster learning
- driver-autonomy transitions
- security



Current Non-Technical Challenges

- trust
- regulations
- insurance
- cost
- driving abilities atrophy
- mixtures of human driven and automated cars



Key Players

- Car companies
 - Tesla, GM, Ford, Mercedes, Toyota, Volvo, ...
- Electronics/software companies
 - Google/Waymo, Uber, Nvidia, Samsung, Baidu, ...
- Startup companies
 - particularly electric vehicle (EV)
- Sensor technology
 - particularly lidar, radar



How will our lives change?

- Safer
- More time
- Enable some populations (e.g. elderly, disabled)



How will our lives change?

- More efficient cities
 - Fewer cars, garages
- Less fuel
- More green space



What jobs will be impacted?

- taxis, uber/lyft, bus, truck drivers
- shipping, delivery
- battery/storage tech
- ad/sales
- lawyers
- car support: dealers, washes, mechanics, gas stations, financing...



When will all this happen?

- Near term (structured)
 - taxis in cities
 - trucks on highways
- Longer term (unstructured)
 - multiple functions
(highway AND city)
 - L5 (no steering wheel)

