



UNIMORE

UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

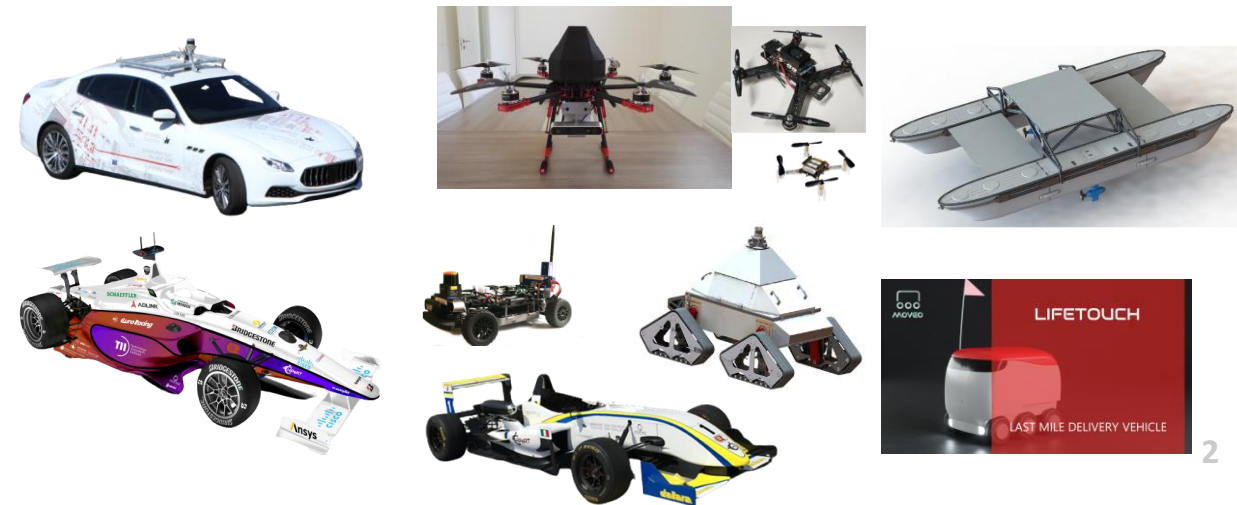
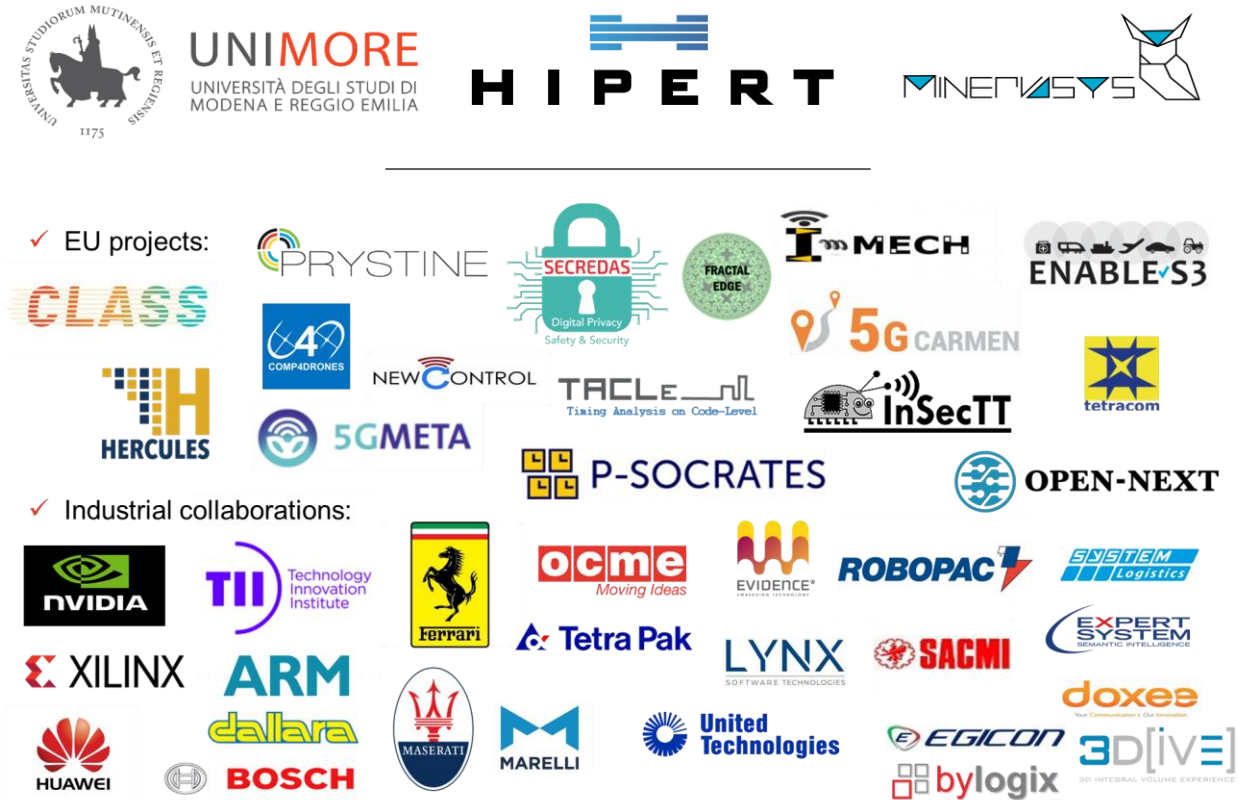
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HiPeRT Ecosystem

- High-Performance Real-Time Systems
- Embedded AI
- Autonomous Systems
 - 5 AD cars, LGV, delivery bots, aerial/(under)water drones
 - Autonomous racing: Indy Autonomous Challenge, F1/10, F SAE, Dallara F3
- ~80+ researchers/developers, 20+M€ funding



Embedding intelligence

Everything that moves will be autonomous



Scaling size of robotic controllers



History of autonomous vehicles



EESI

Environmental and Energy
Study Institute

THE ROAD TO FULL AUTOMATION

HISTORY OF AUTONOMOUS VEHICLES (AV) IN THE U.S.

1958

First car with
cruise control is
introduced

2004

DARPA Challenges are
created to incentivize
American autonomous
vehicle development

2014

Google creates first
AV prototype

2016

First known fatal accident
involving a Tesla in
autopilot mode. Other
accidents followed.

2021

Ford and GM invest
billions of dollars in
AV technology and
testing

1995

Carnegie Mellon University
Navlab project completes
cross-country trip with
"semi-autonomous" vehicle

2009

Google begins Self-
Driving Car Project

2015

Tesla introduces
autopilot software;
University of Michigan's
MCity AV Lab is launched

2018-20

AV mass transit programs
debut in numerous states;
NHTSA releases
new AV guidance

Graphic by: Sydney O'Shaughnessy
Source: [Wikipedia](#), [Reuters](#), [The Verge](#)

An expensive challenge

The Self-Driving Car Companies Going The Distance

Number of autonomous test miles and miles per disengagement (Dec 2019-Nov 2020)*

			Miles	Miles per disengagement
Waymo (Alphabet)			628,839	29,945
Cruise (GM)			770,049	28,520
AutoX			40,734	20,367
Pony.AI			225,496	10,738
Argo.AI (Ford, VW)			21,037	10,519
WeRide			13,014	6,507
DiDi Chuxing			10,401	5,201
Nuro			55,370	5,034



* Cases where a car's software detects a failure or a driver perceived a failure, resulting in control being seized by the driver.

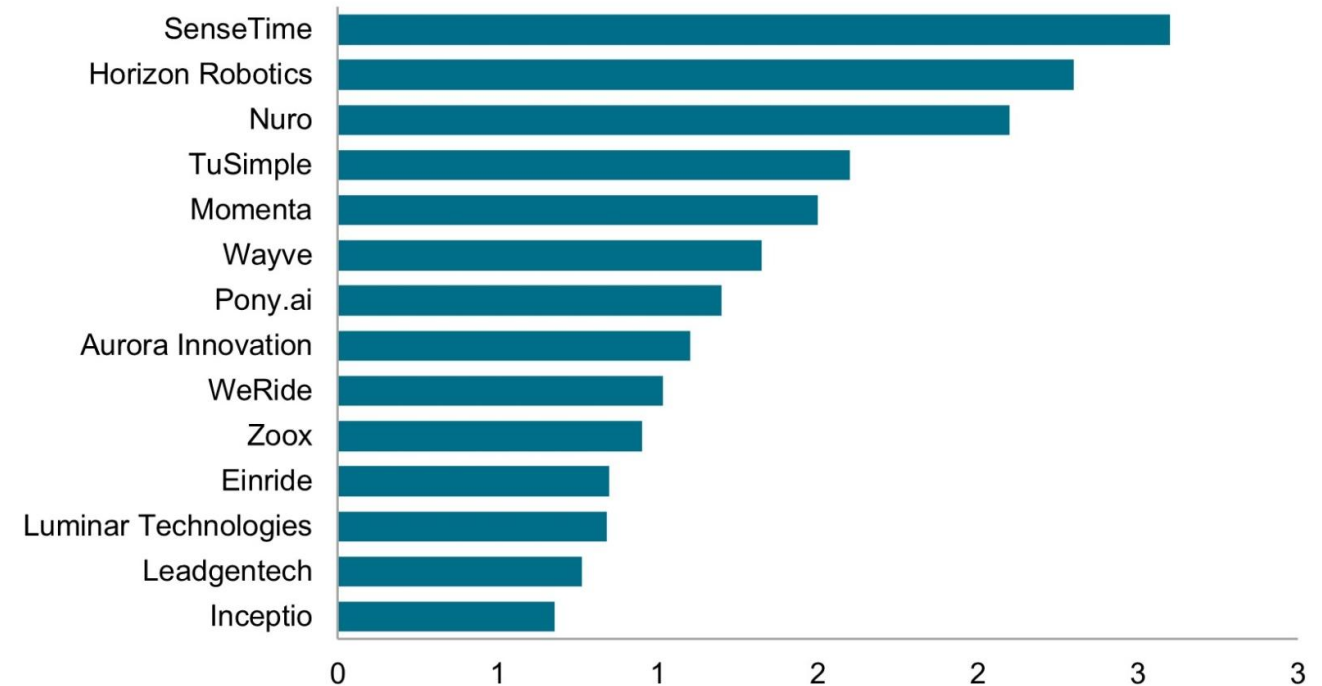
Source: DMV California, via The Last Driver License Holder



statista

Top startups in autonomous driving domain

Global startups ranked by total funding received



Data compiled June 24, 2024.

Source: S&P Global Mobility.

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■ Total funding (US\$ billion)

Autonomy as a Product and Service

Multiple robots and vehicles



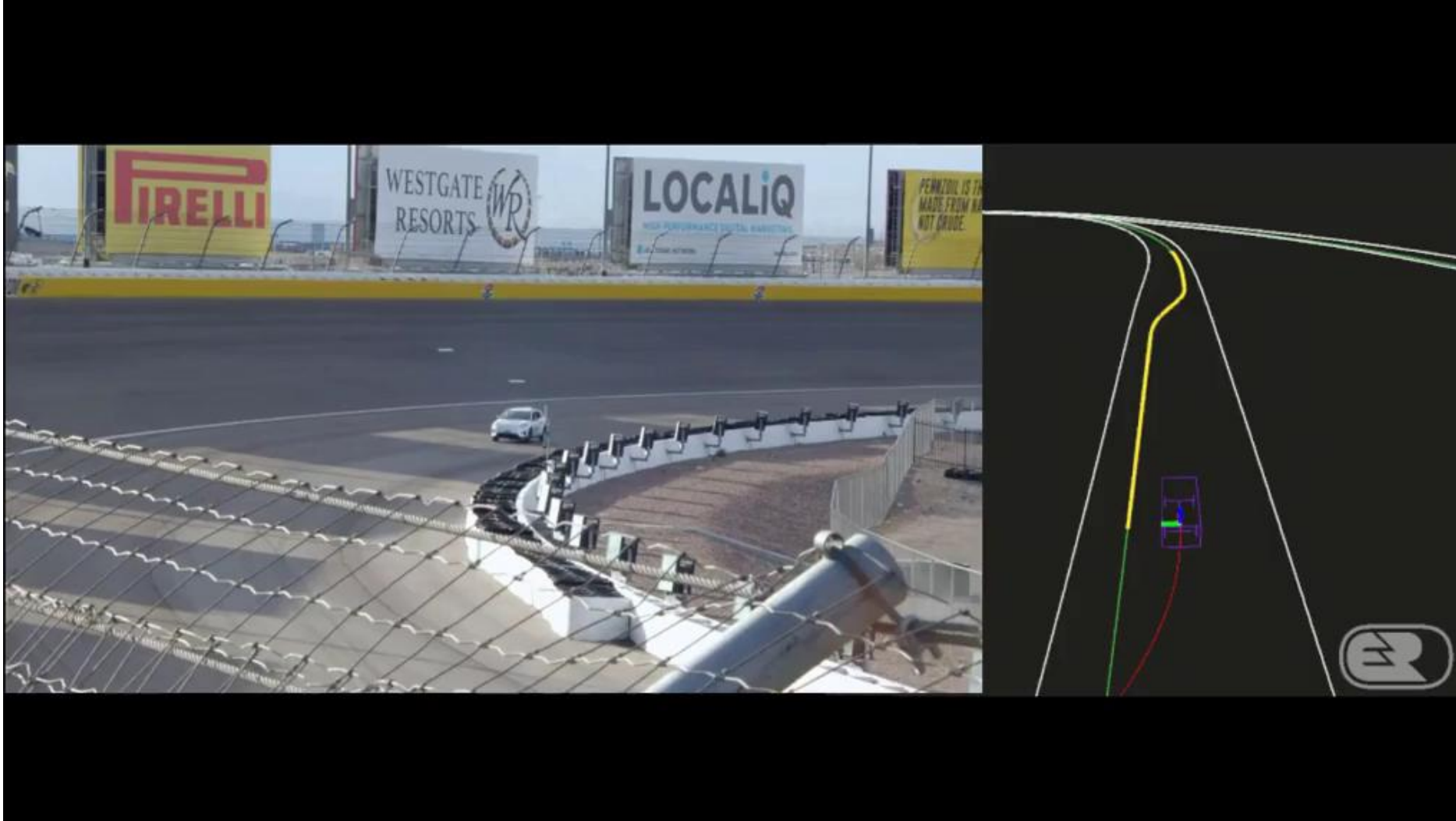


Indy Autonomous Challenge

Driverless Racing at over 270 kph



UNIMORE Racing team



07.01.2022 @
Las Vegas
Motor Speeday

Top Speed:
272 kph

Top overtaking
speed:
230 kph



Lap 7/10
3/ 2:13.436 +07.943
4/ **2:05.493**
5/ 2:27.822 +22.329
6/ 2:22.573 +17.080
7/ 2:14.630

Understeer degree

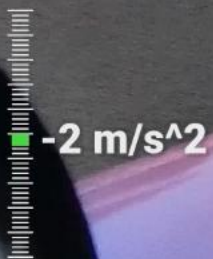


Heading error

Curr: 0.13 deg

Lateral error

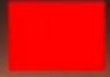
Curr: 0.01 m



-16 m/s²



AD Autonomous Racing League (A2RL)



10:08:40:20

Autonomous agriculture

Bulk spraying



Monitoring, Field Mapping/Scouting



Weeding & Seeding agriculture robot



Weed & Pest Control



Autonomous tractor

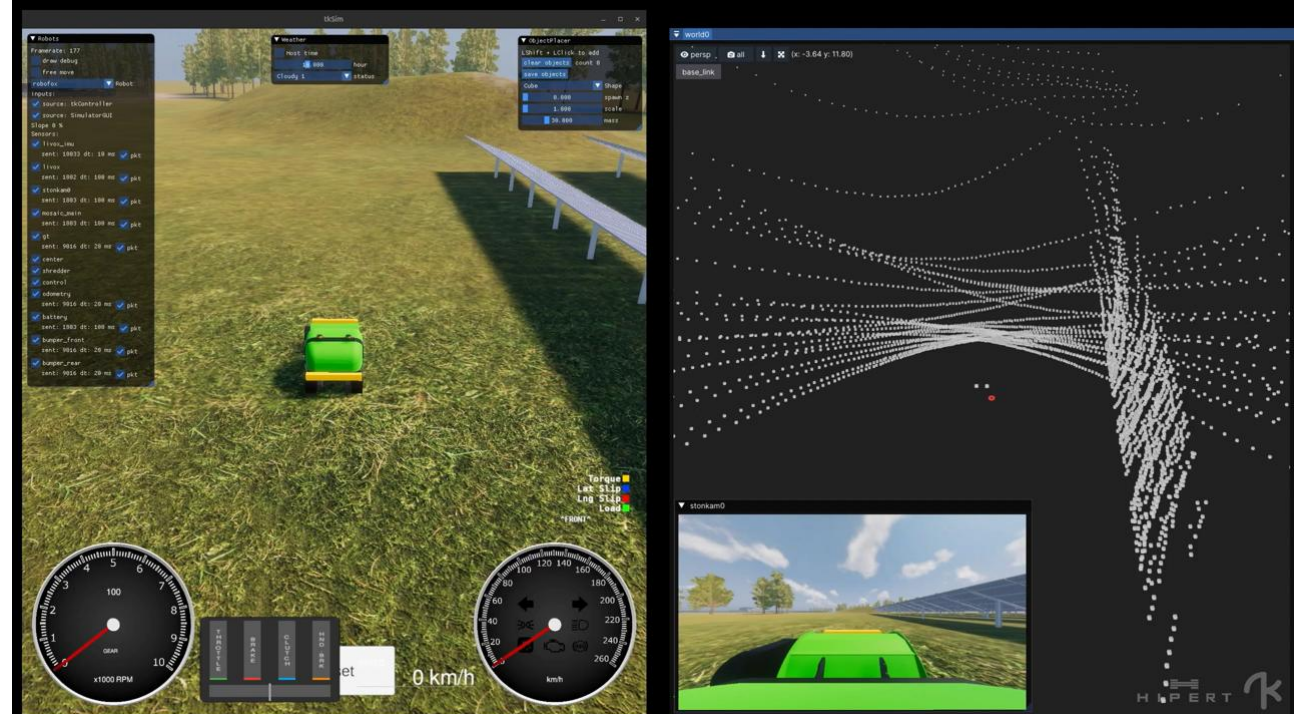


Fruit-picking robot



Safe AD stack for agri

- Natural navigation in GPS-denied fields
- Safe obstacle detection/avoidance
- Sim before you go!
 - Thousands of times...
- Easy-to-use HMI



Hipert's all terrain UGV

4 individually
actuated tracks

4 actuated Links for
improved flexibility

Electric powertrain

Long-range battery
pack

Autonomous Sensing
Kit/Platform



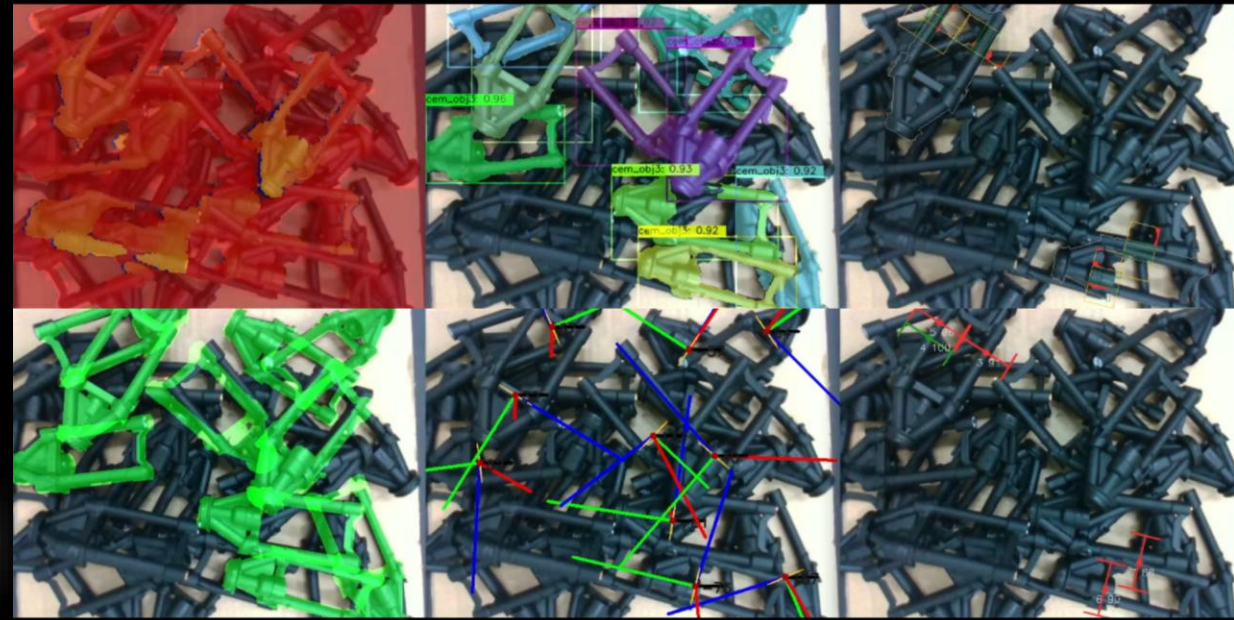
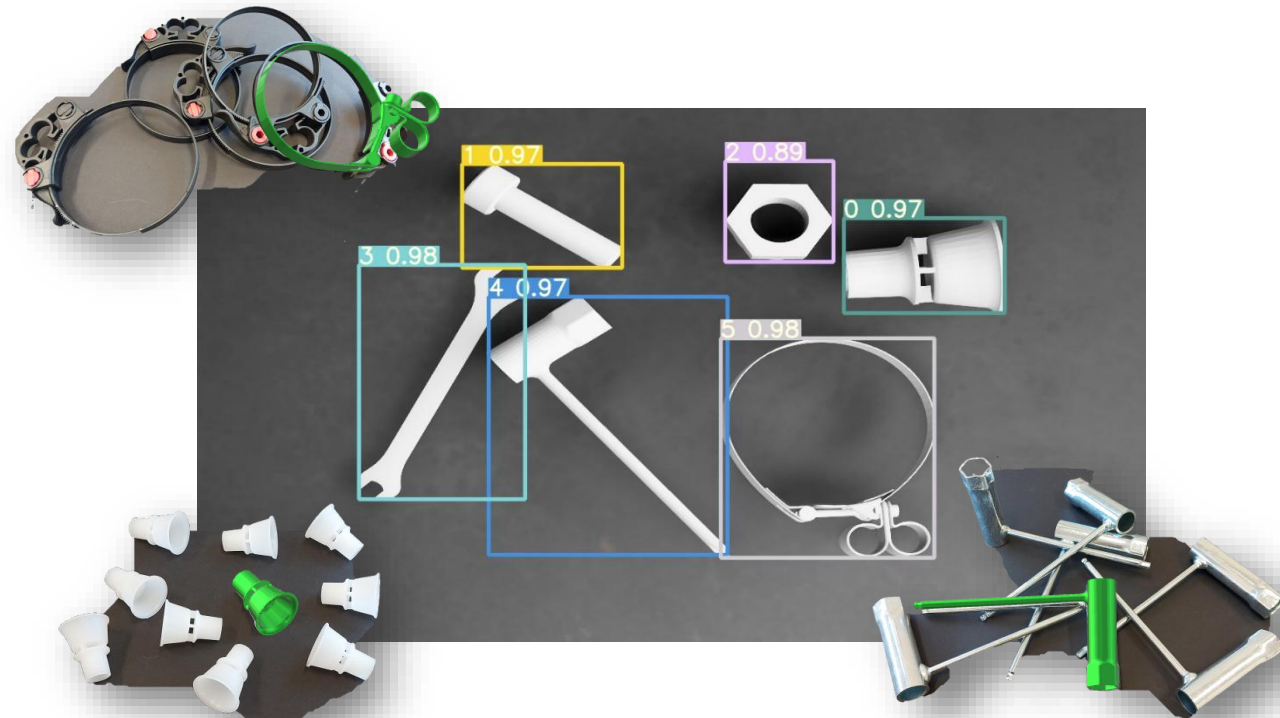
All terrain's UGV

Resilient to large obstacle



Dynamic Pick'n'Place

- Dynamic picking of objects in positions not known a priori
- Real-Time 6D pose estimation
- Planning and picking in-the-wild



From Steel to Code

Autonomous agriculture challenging classic business models

- Core value shifting from HW to SW
 - Anyone can build a robot, very few can make it operate safely in unstructured fields
 - Hardware enables autonomy. Software *creates* autonomy.
- HW reached a plateau, SW still scales (potentially exponentially)
 - Faster dev cycle, OTA, remote operation, data flywheel, retraining
 - Fast improvements in AI, perception, planning, control, HMI
 - Edge computing + AI allow real-time decision-making
- From demo to product is a long journey
 - The real barrier today isn't steel — it's algorithms.
 - Way more difficult to fit SW functionalities for large scale products



Thank you!



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