The Road Ahead

Why Large Driving Models are Redefining Mobility

Juan Carlos Aguilera

Northwestern
Kellogg
School of Management

AI + Future of Mobility Club

Juan Carlos Aguilera

7+ Autonomous Mobility

Product Manager

Autonomous Vehicles Integration

MOIA

TECH MBA

ie

JOHN DEERE

Product Manager

Adv Engineering

B.Sc. Robotics Engineering

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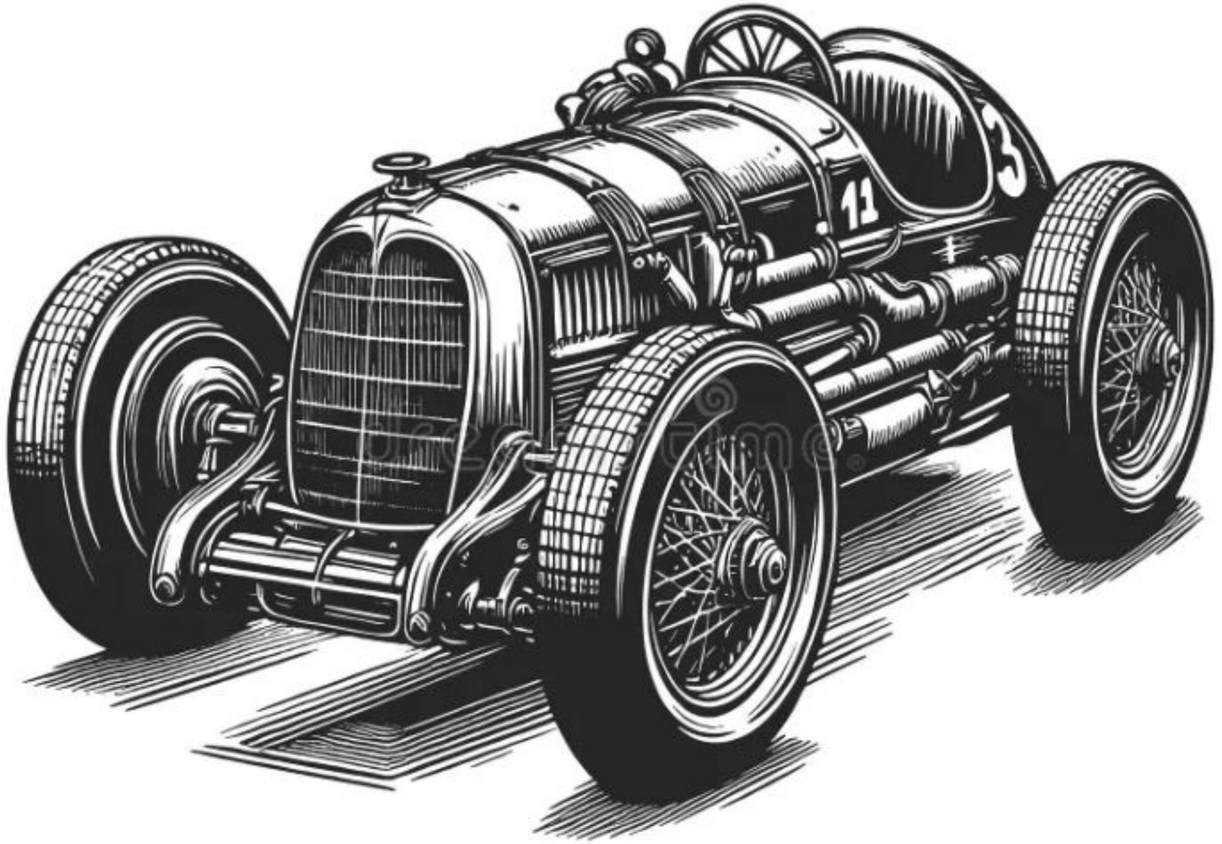
Introduction



REALLY AUTONOMOUS?

WAYMO

SAE INTERNATIONAL

SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™

mobileye

Eyes-on Hands-on	Eyes-on Hands-off	Eyes-off Hands-off	No driver (Robotaxi)
Driver Present			Tele-Operations

NOT SO AUTONOMOUS

TRULY AUTONOMOUS

REALLY AUTONOMOUS?

TESLA

SAE INTERNATIONAL

SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™

mobileye

Eyes-on Hands-on	Eyes-on Hands-off	Eyes-off Hands-off	No driver (Robotaxi)
Driver Present			Tele-Operations

NOT SO AUTONOMOUS

TRULY AUTONOMOUS

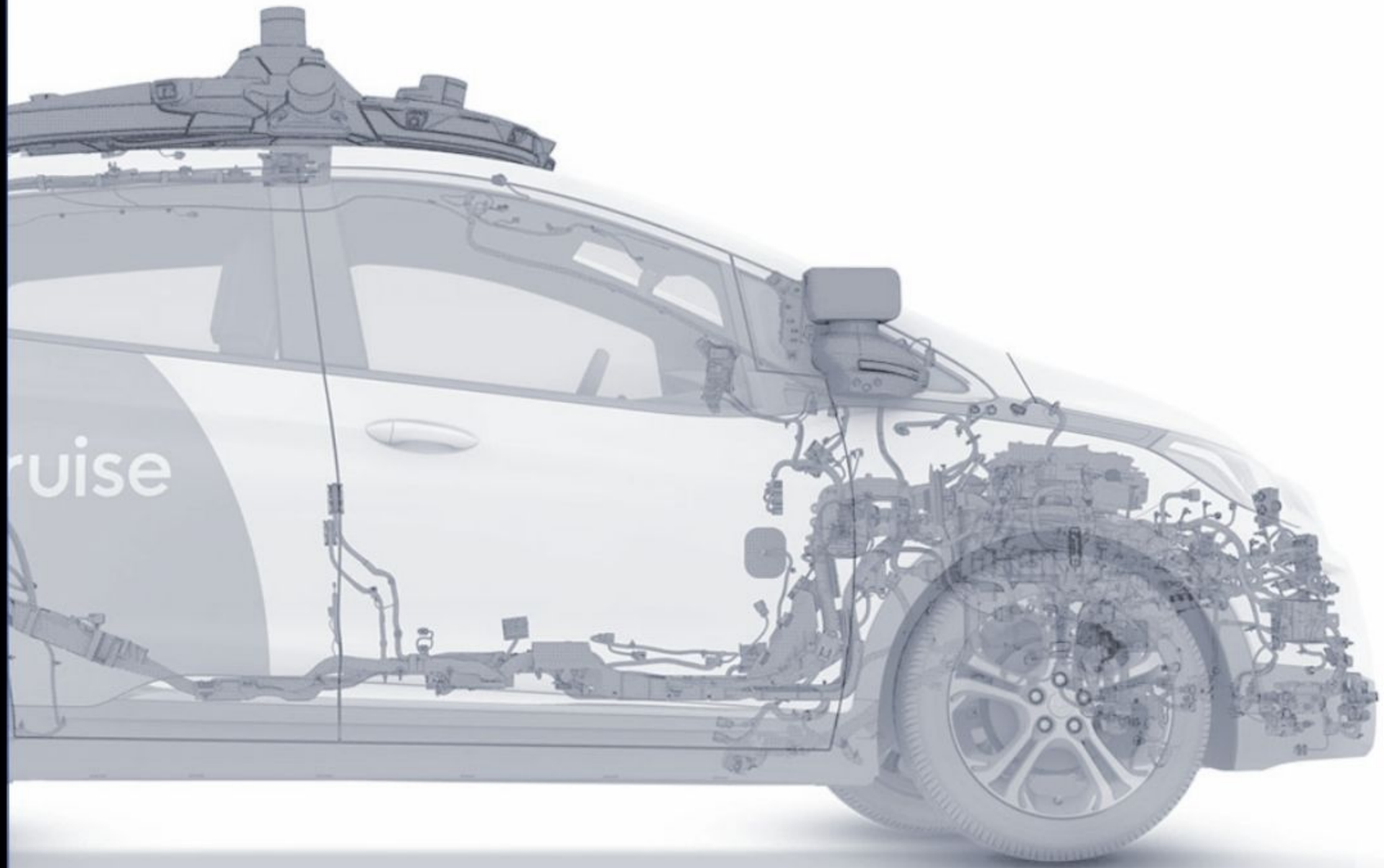
HISTORY

THE PIONEERS

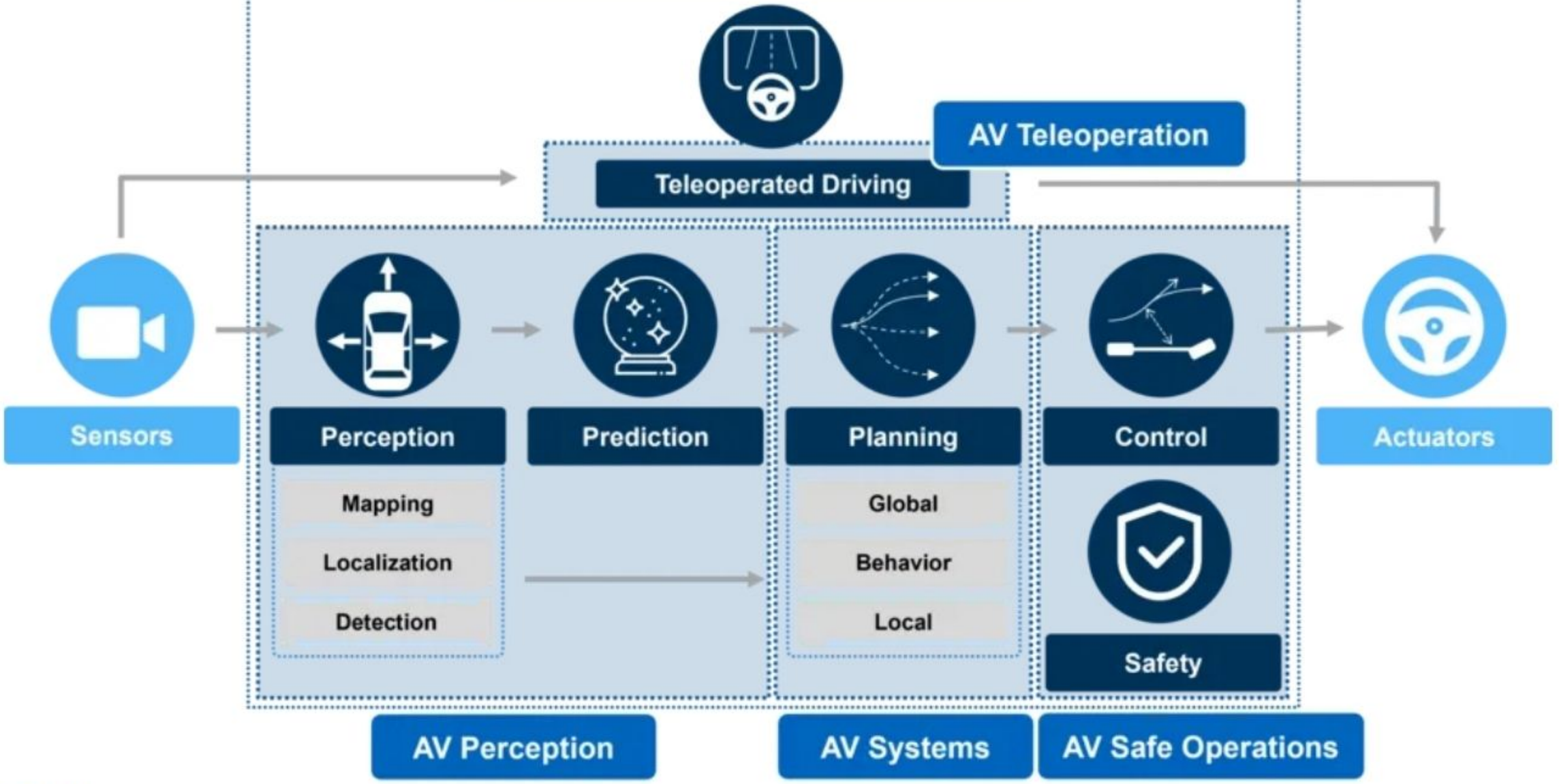
1st generation companies. Some of them no longer around.

2

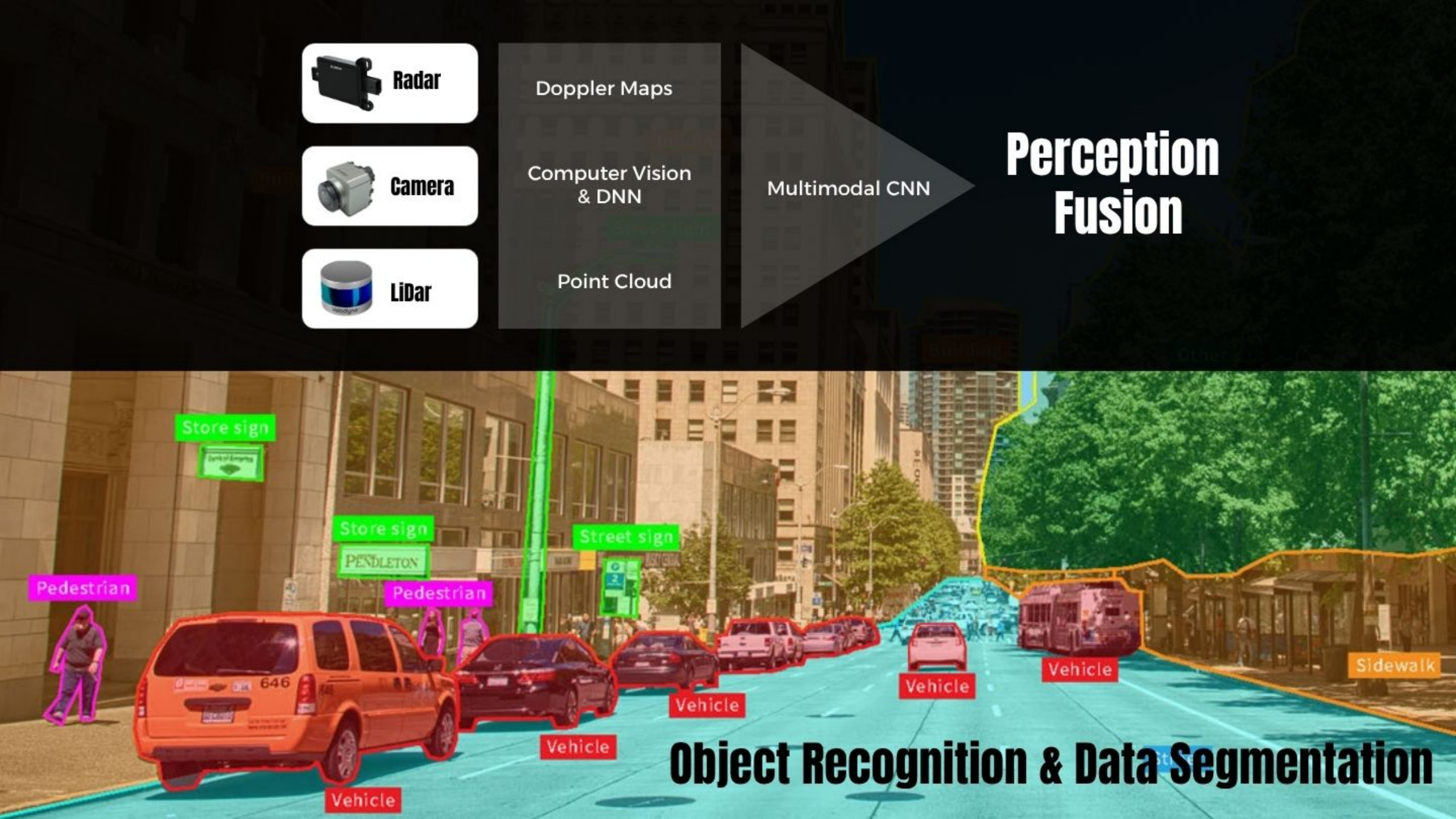
Modular Architecture



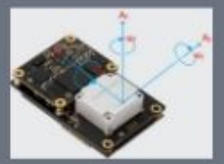
AV SOFTWARE STACK



Source TUM


Radar
Camera
LiDar
Doppler Maps
Computer Vision & DNN
Point Cloud
Multimodal CNN
Perception Fusion
Store sign
Store sign
Street sign
Pedestrian
Pedestrian
Vehicle
Vehicle
Vehicle
Vehicle
Vehicle
Sidewalk
Object Recognition & Data Segmentation

Vehicle Position



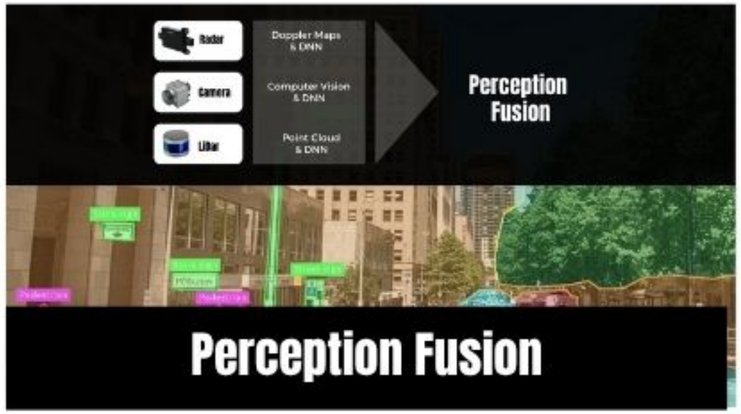
IMU

GNSS

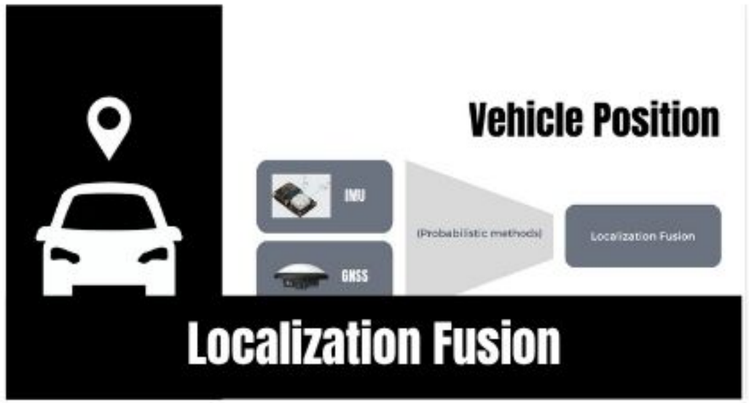
(Probabilistic methods)

Localization Fusion

GNSS: Global Navigation Satellite Systems
IMU: Inertial Measurement Unit *



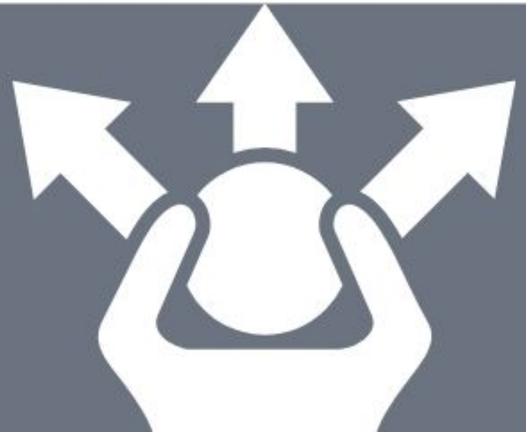
Environmental Information



Vehicle Positon Information

Local Planning

Decisions



Driving Decision Making

Current Competitors

Checkpoint: Clarification Questions

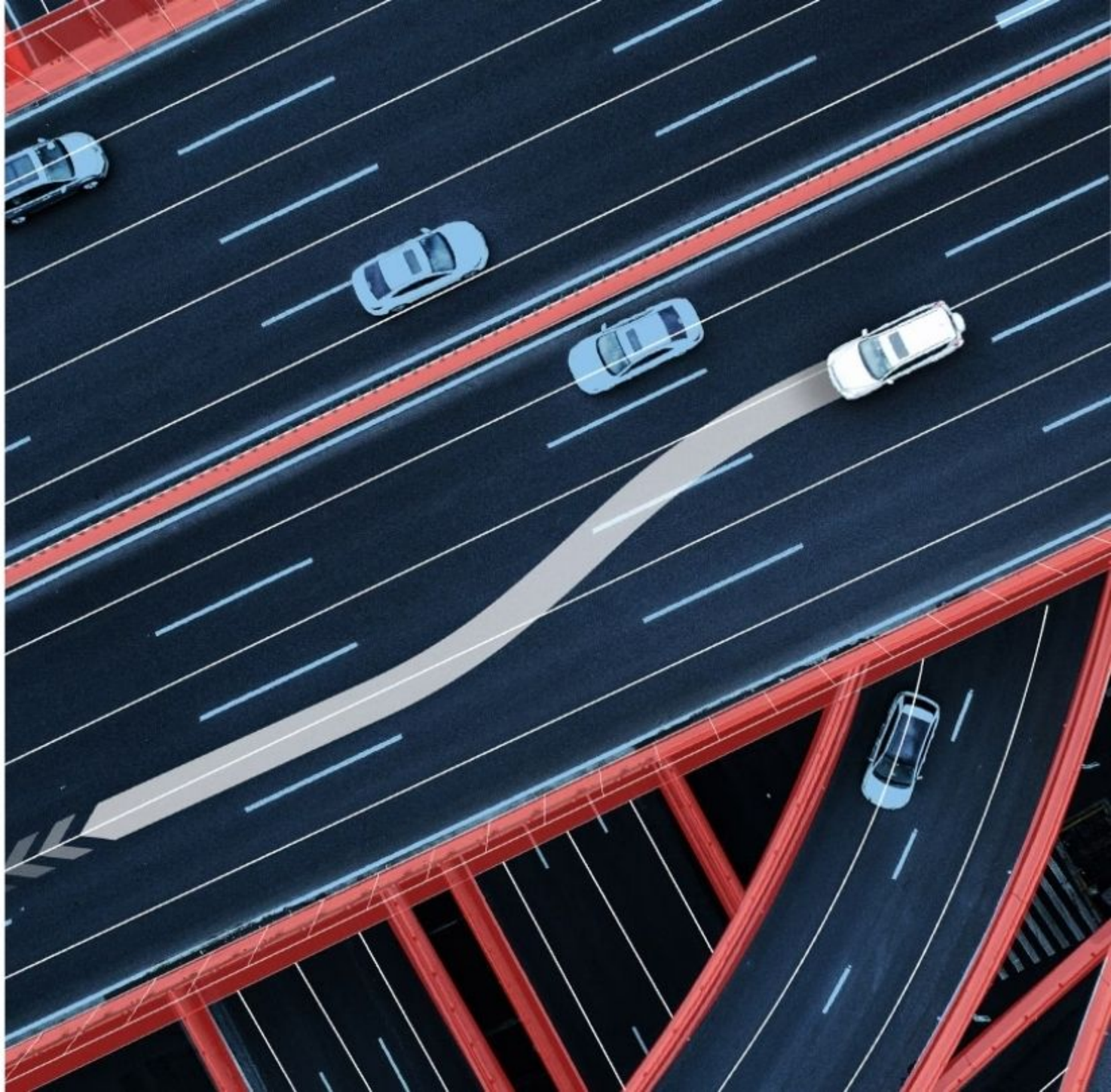
1-2 Questions (Max 5mins)

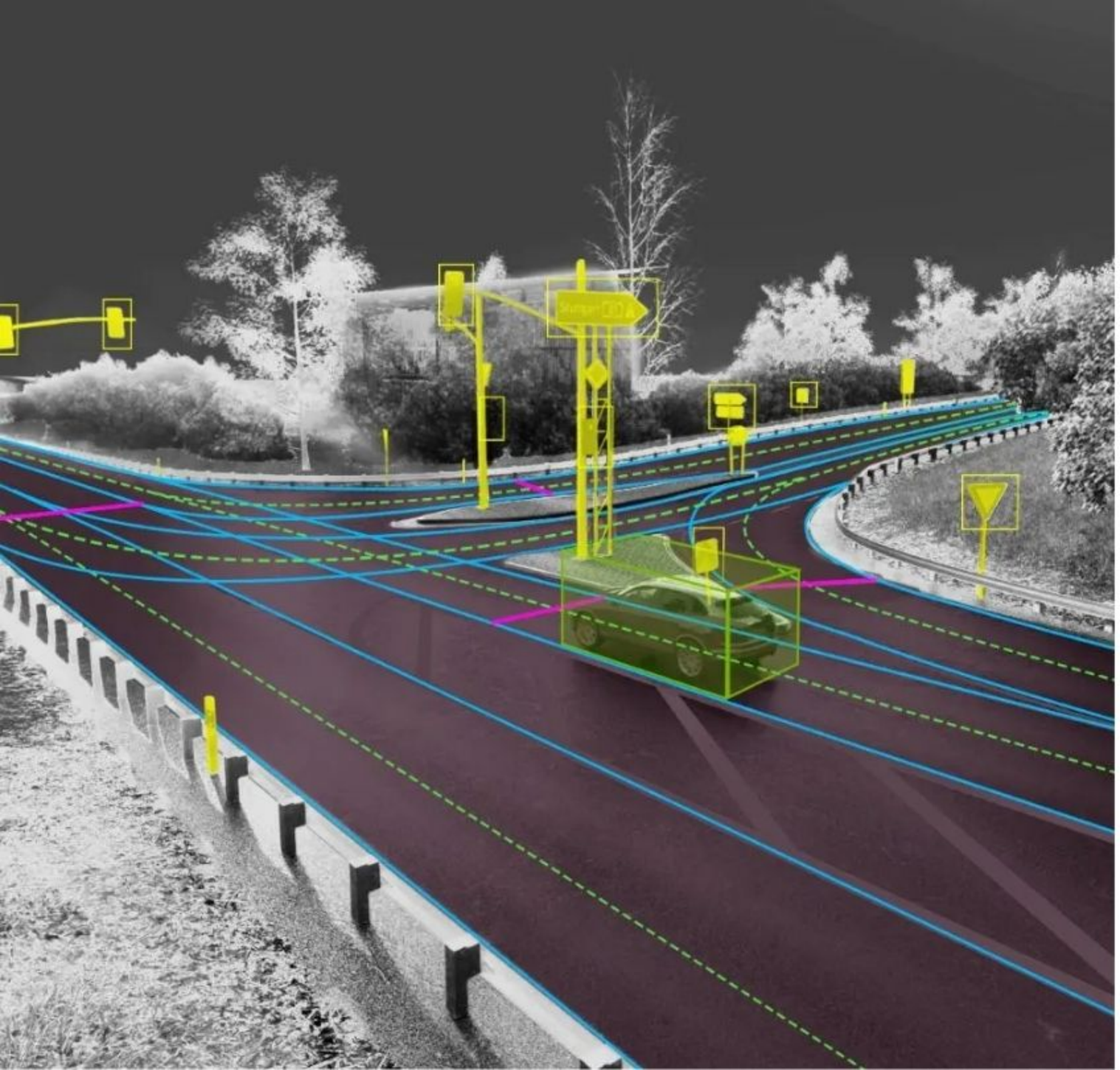
3

Navigation & Routing

Local Planning

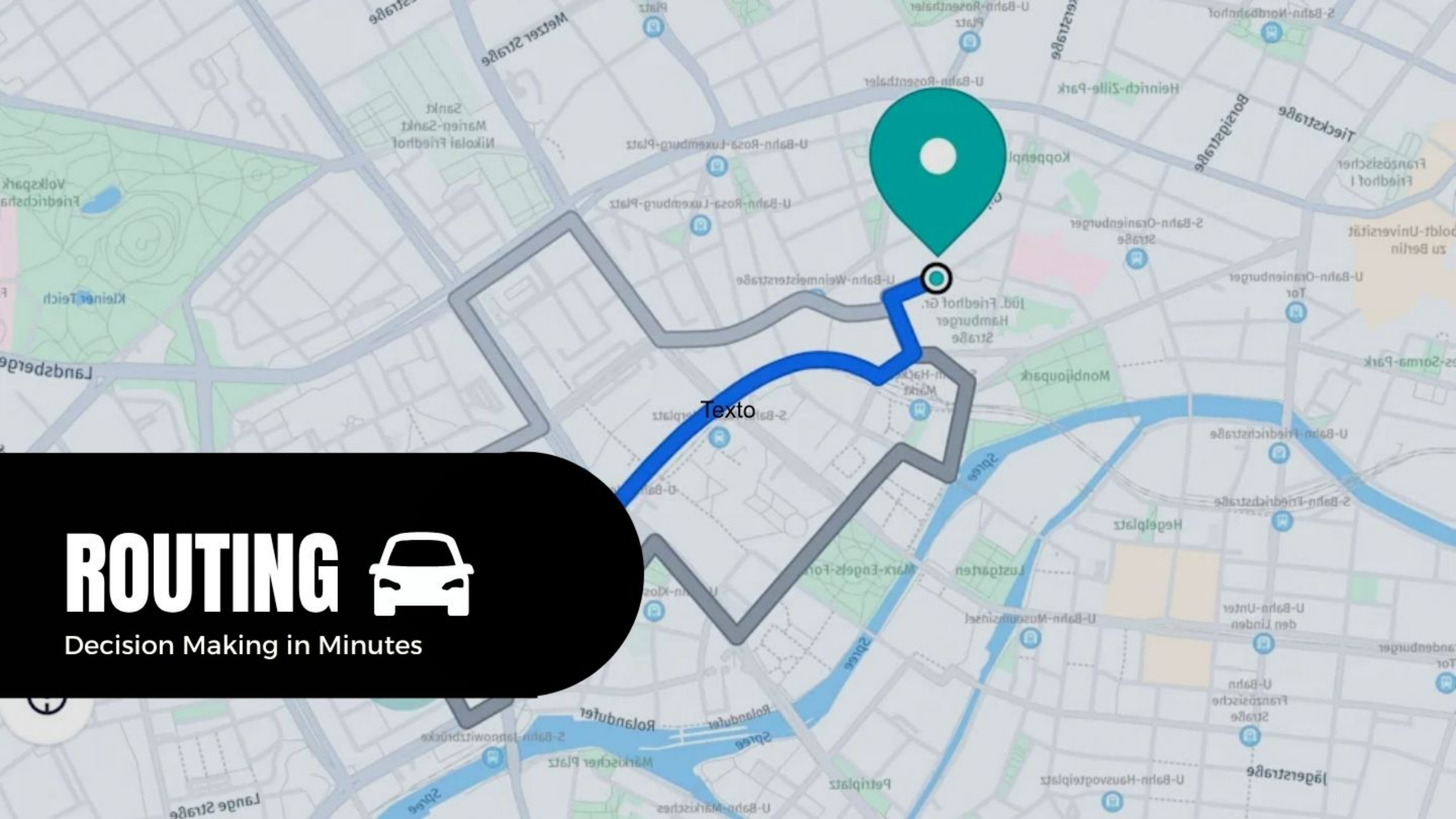
Decision Making in Miliseconds





Global Planning

Decision Making in Seconds

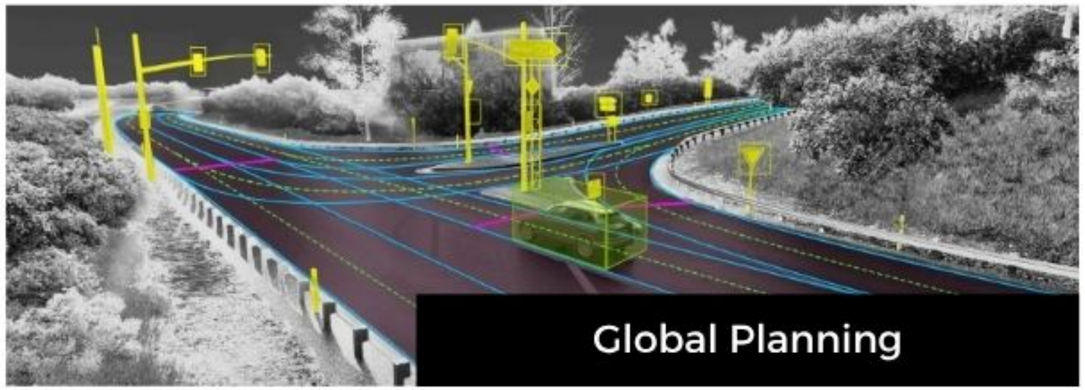


ROUTING

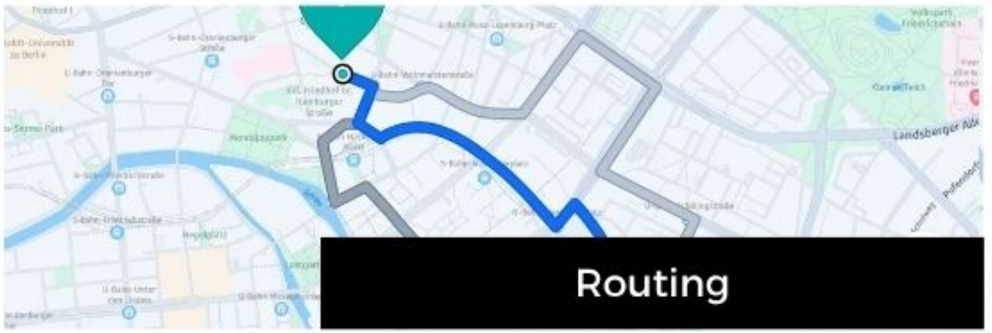
Decision Making in Minutes

Navigation

Local Planning



Global Planning



Routing

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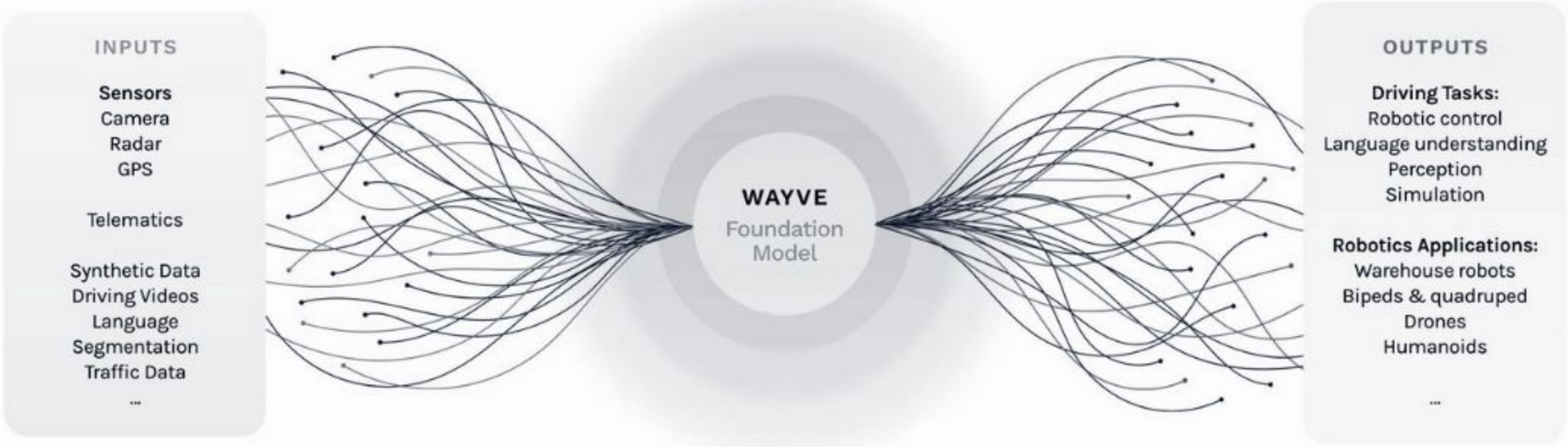
End 2 End Architecture



2017

Transformers Architecture

Attention is all you need

Birds Eye View Representations

Learning Bird's-Eye-View Representation from Multi-Camera Images via Spatiotemporal Transformers

2020

2020

Self & Weakly Supervised Learning

SimCLR: Simple Framework for Contrastive Learning of Visual Representations

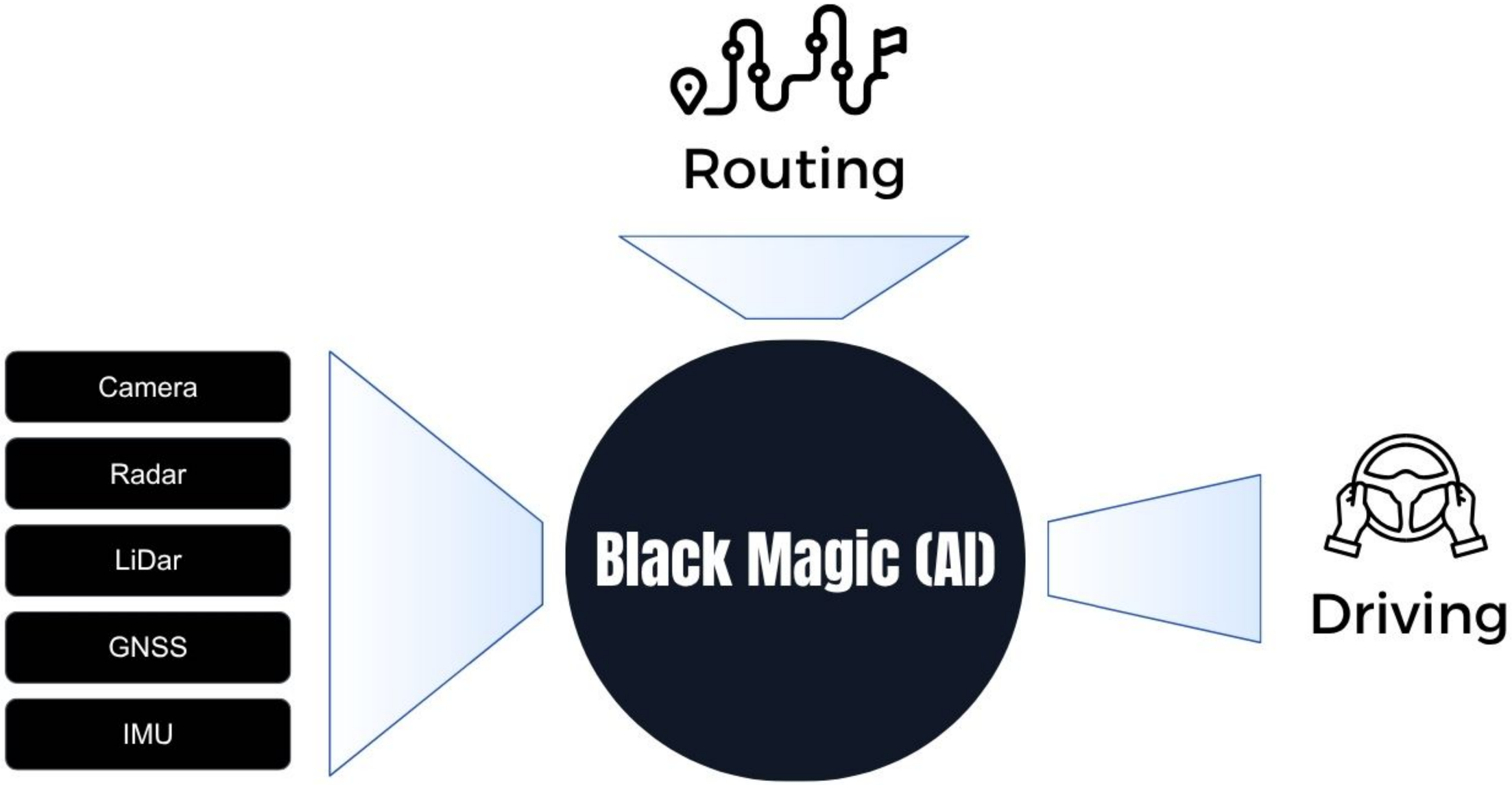
MoCo: Momentum Contrast, scalable contrastive framework.

BYOL: Bootstrap Your Own Latent

Diffusion & Generative Planning Models

Diffusion based planning for Autonomous driving with flexible guidance.

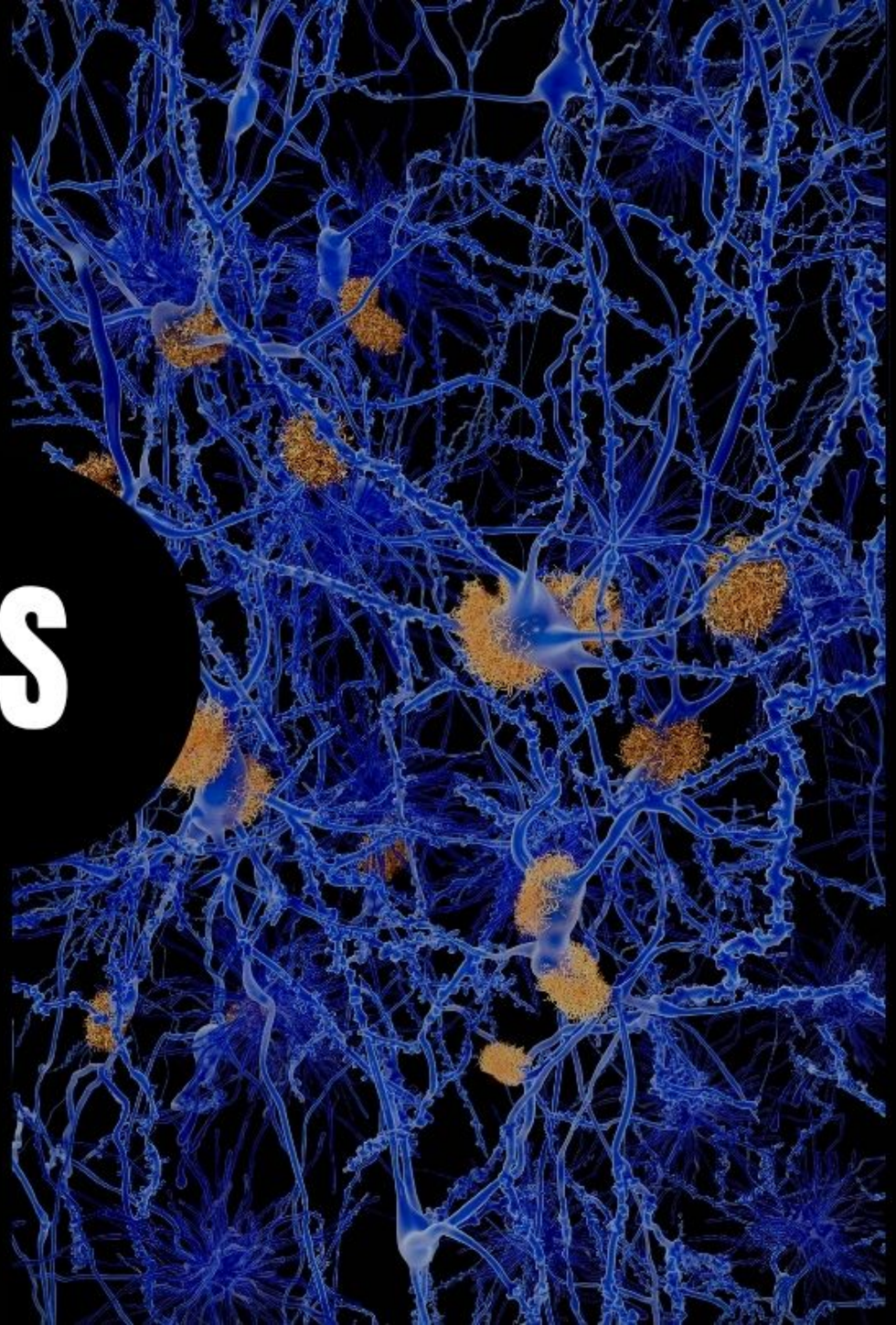
2021


Routing
Camera
Radar
LiDar
GNSS
IMU
Black Magic (AI)
Driving

Main Players

End 2 End

VS



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Comparison

Modular ⟷ End 2 End

- Transparent & interpretable ✅
- Safety & regulatory validation easier ✅
- Mature, proven robotics techniques ✅
- Redundancy & fallbacks per module ✅

- ✅ Optimization / System learns holistically
- ✅ Scales with more data
- ✅ Faster adaptation to new geographies
- ✅ Handles unstructured environments better

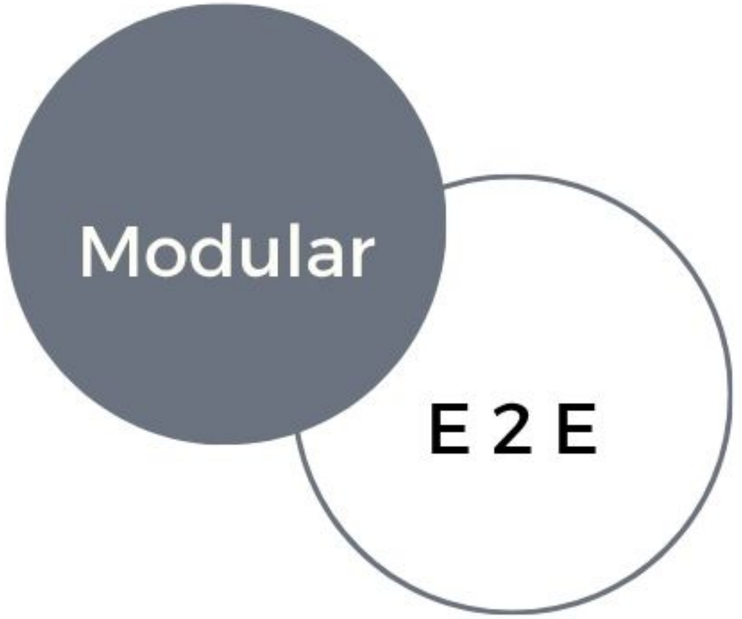
- Integration complexity ❌
- Suboptimal global performance ❌
- Heavy engineering overhead ❌
- Slower to scale ❌

- ❌ Harder to interpret/debug
- ❌ Safety validation/regulatory approval harder
- ❌ Requires massive datasets + compute clusters
- ❌ Risk of overfitting to training distribution

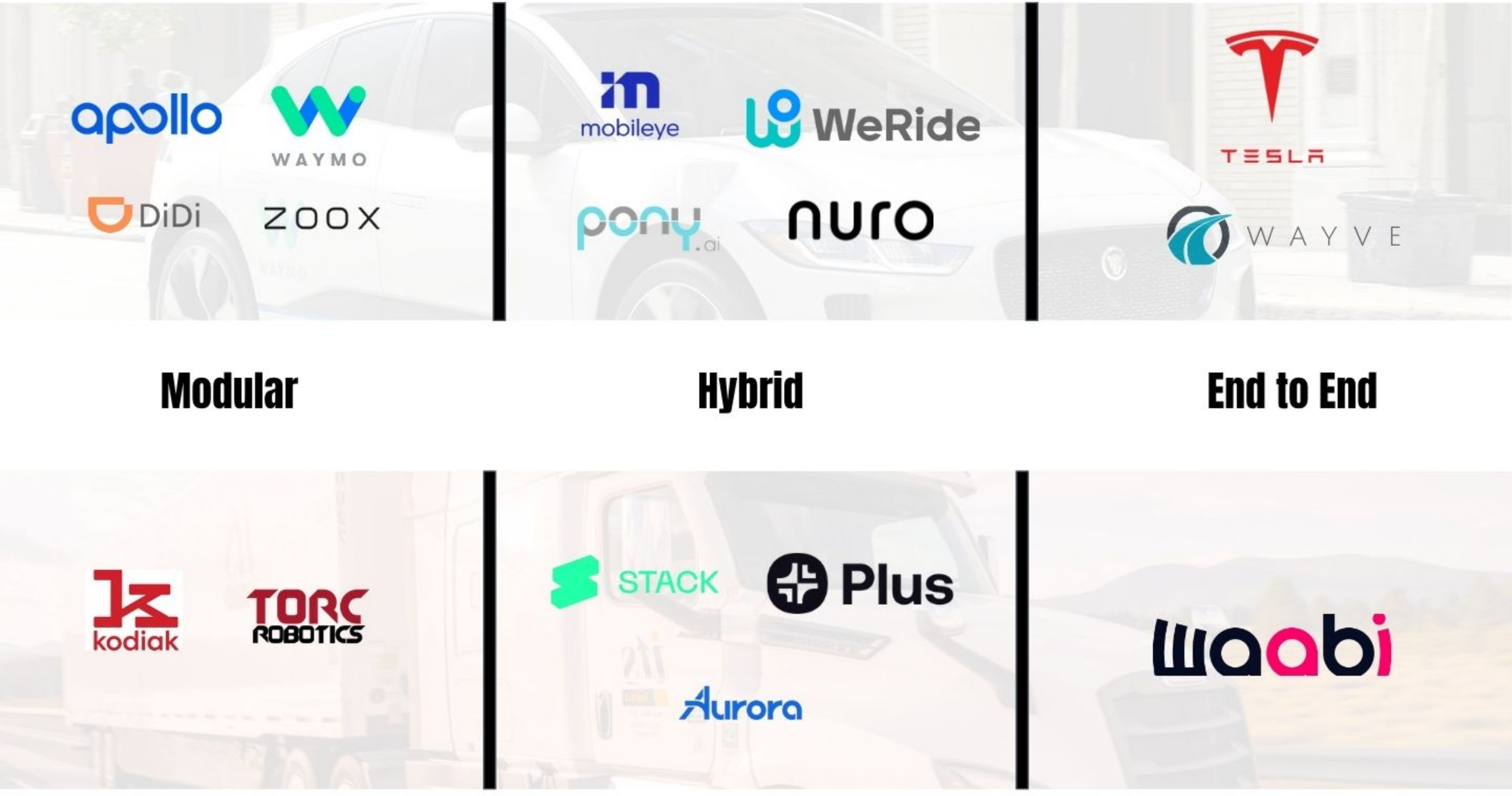
Industry Trends

Transition --> (E2E)

Transparency
Safety
Certifiability



Hybrid


apollo
WAYMO
DiDi
ZOOX
mobileye
WeRide
pony.ai
nuro
TESLA
WAYVE
Modular
Hybrid
End to End
kodiak
TORC ROBOTICS
STACK
Plus
Aurora
waabi

Has Waymo Gone End-to-End AI?

Is E2E AI so revolutionary that even Waymo is shifting strategy? In theory, any robotaxi company struggling with modular AI, E2E can "give them another bite at the apple," says Phil Koopman.

JUNKO YOSHIDA
SEP 24, 2025

14 1 4 Share

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Business Opportunities

Insurance & Risk analysis

AV & Route Risk Analysis

Liability Identification

Insurance

Validation & Certification of E2E Models

Certifiability

Interpretability, Explainability

Validation & Testing

Cybersecurity solutions & compliance

Fleet Operations & Management

AD Fleet Management

Fleet Operations, Incident Response

Training

Juan Carlos Aguilera

Autonomous Mobility Expert

Q&A