10TH SINO-GERMAN AUTOMOTIVE CONGRESS · WOLFSBURG 2026

Perception Systems for Physical AI

Radar-first perception for software-defined vehicles — at the edge, private by design

Ernesto Horne, PhD

Co-founder & CTO · Hatticore GmbH

From Visual AI to Physical AI

AI has learned to understand images and language. Next, it has to act in the physical world — and the software-defined vehicle is where most people will meet it first.

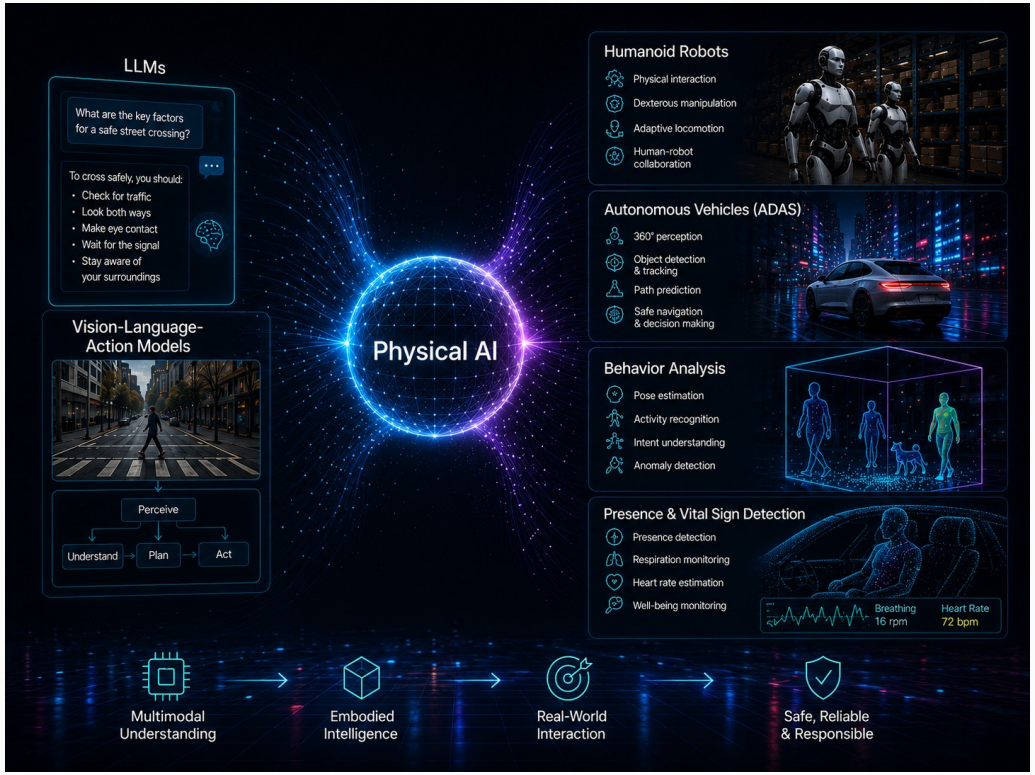
LANGUAGE AI
Text & reasoning

↓

VISION AI
Images & video

↓

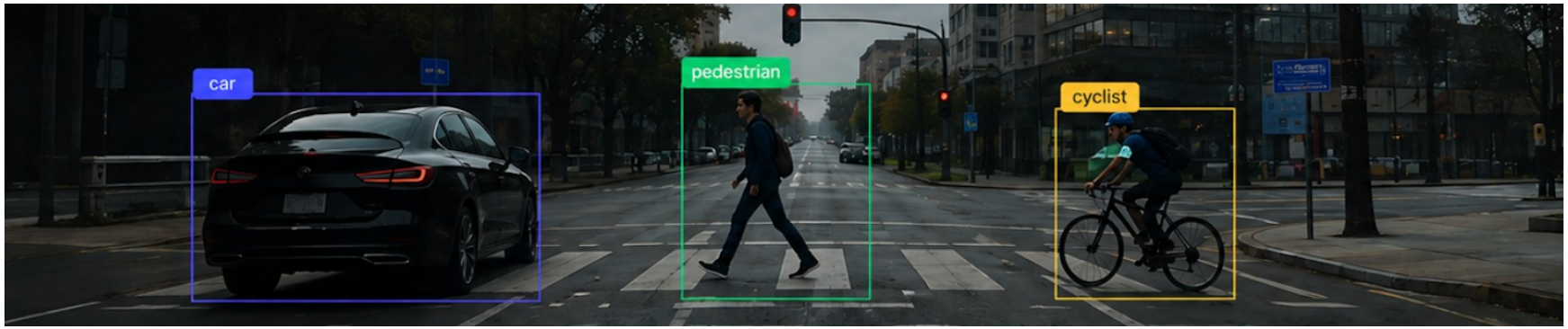
PHYSICAL AI
The real, moving world



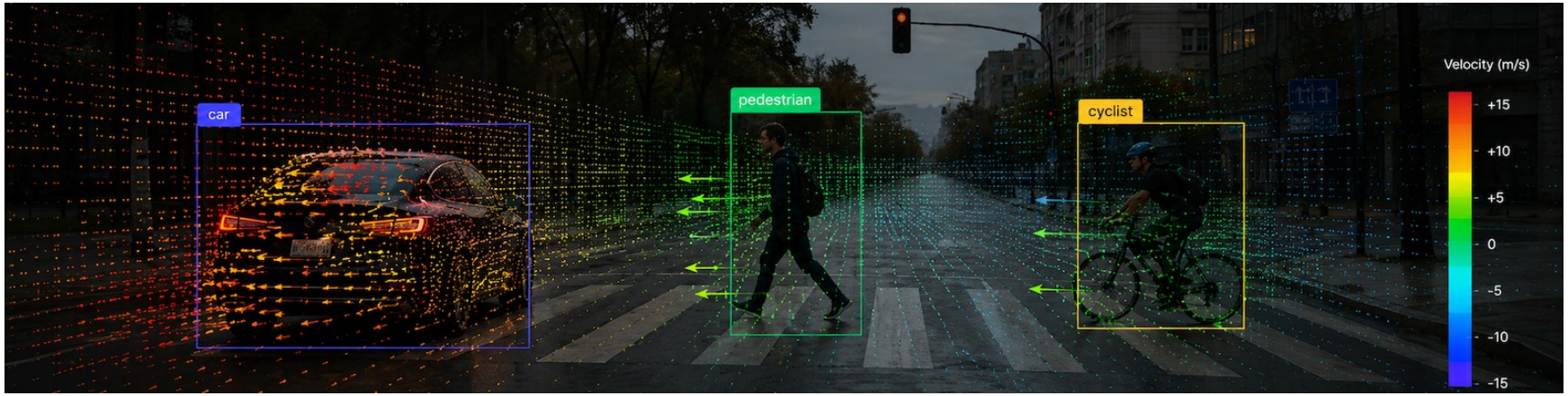
Physical AI can only be as intelligent as its perception of the physical world.

Seeing is not understanding

● CAMERA — SEMANTIC UNDERSTANDING



● MULTI-SENSOR/RADAR — PHYSICAL UNDERSTANDING



Can AI predict what will happen next from appearance alone? ***Not always.***

Software-defined vehicles change what perception has to deliver

● ENERGY & COMPUTE

Always-on functions compete for the same budget

- Dozens of functions share central compute
- Always-on sensing must not drain the battery

→ **Event-driven inference at the sensor — central compute wakes only when it matters**

● DATA & PRIVACY

What happens in the cabin is personal data

- GDPR in Europe; PIPL and automotive data rules in China
- Both favour data minimisation and processing in the vehicle

→ **No camera images, no faces — privacy by design, at the sensor**

● SOFTWARE LIFECYCLE

New functions arrive over the air, years after start of production

- Sensor hardware stays fixed for 10–15 years on the road
- New value has to come from software

→ **Same radar, new perception functions by software update**

In a software-defined vehicle, perception becomes a software layer — and it has to run at the edge.

Building the perception layer for Physical AI

PIPELINE

Physical Sensors — Radar · Camera · UWB · Audio

↓

Signal Processing

↓

Machine Learning

↓

Object-Centric Representation

↓

Physical AI Models

↓

Decision Making

APPLICATION DOMAINS

- Automotive
- Healthcare
- Security
- Industrial Automation

99.8%
life-presence detection accuracy, validated across 15,000 real-world scenarios

We enhance physical sensor measurements before they reach Physical AI models.

One radar core for the driver, the cabin and everyone around the car

INSIDE THE VEHICLE

- Camera-free in-cabin monitoring
- Occupant presence & classification
- **Driver vital signs & attention —** supports EU General Safety Regulation

OUTSIDE THE VEHICLE

- Pedestrian & cyclist detection and classification
- Motion & intent interpretation — not just detection
- Robust in fog, rain, darkness and dust
- Designed for automotive-grade radar hardware

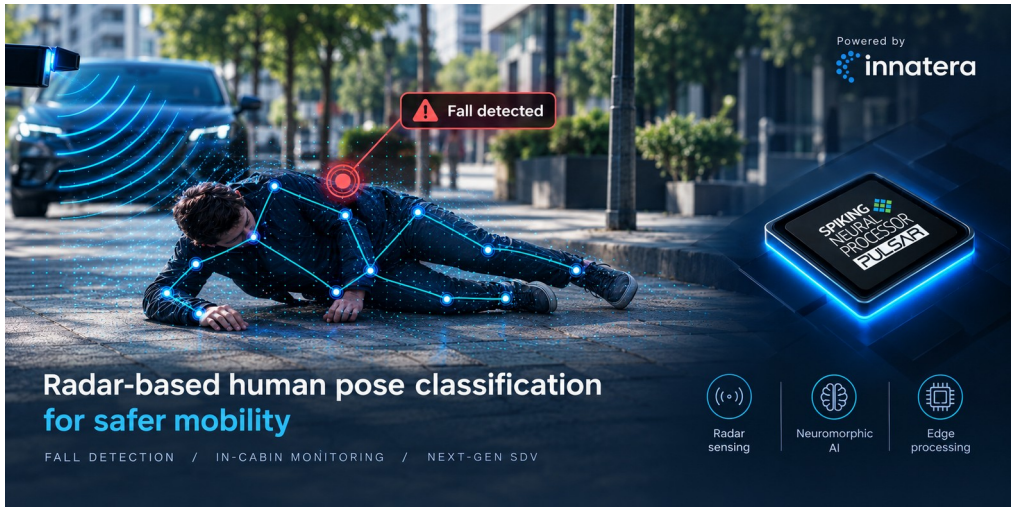
One object-centric core: radar sees motion and trajectory, inside and outside the vehicle.

Always-on human pose sensing at the edge: radar AI on Innatera's Pulsar neuromorphic chip

● PERSON POSE CLASSIFICATION — HATTICORE × INNATERA

mmWave radar → Detections & motion features → **Spiking NN on Pulsar** → Pose / posture event

- **Ongoing: radar-based fall detection** on Innatera's Pulsar neuromorphic microcontroller
- Event-driven spiking inference at the sensor — **always-on at very low power**
- **Privacy by design:** no camera, no images — only posture and motion events leave the sensor



INSIDE THE VEHICLE

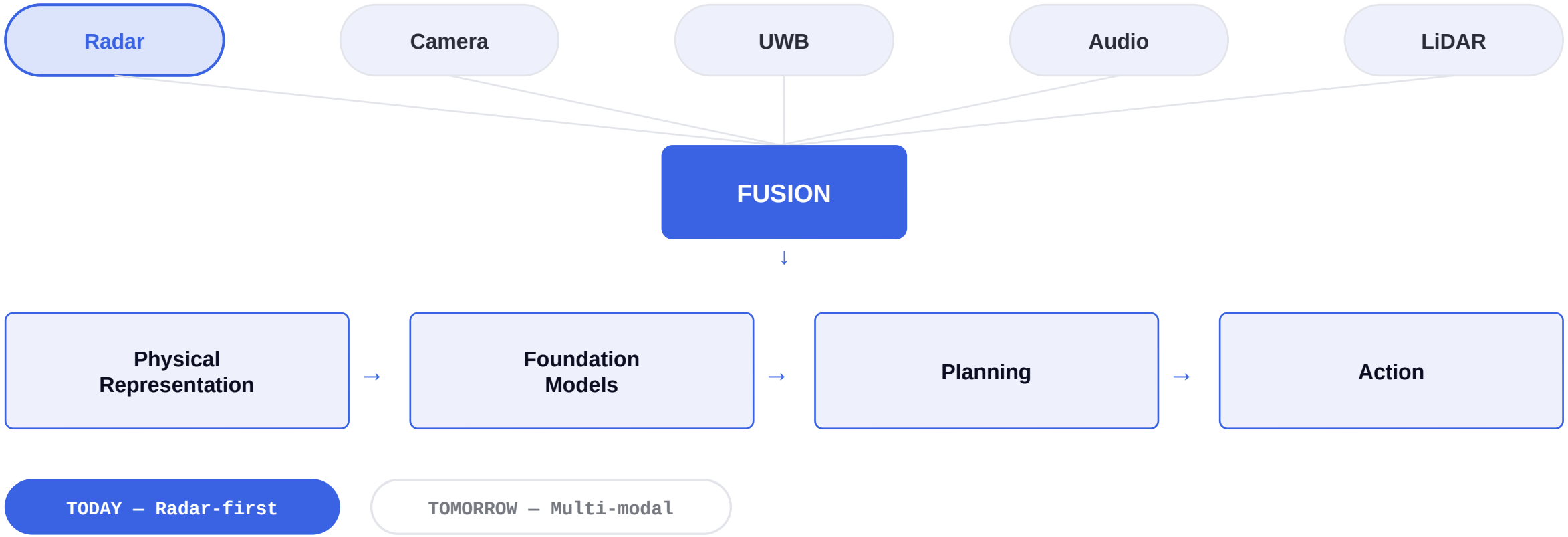
- Occupant posture & out-of-position detection for adaptive restraints
- Driver incapacitation — slumped or collapsed driver
- Gesture- and posture-aware HMI for the software-defined cabin

OUTSIDE THE VEHICLE

- Fallen pedestrian or cyclist detection after an incident
- Body-pose intent cues — e.g. about to step onto the road
- Low-power perimeter sensing at parked vehicles & EV chargers

Developed for fall detection — the same low-power pose pipeline can transfer to the cabin and to the street.

From radar AI to multi-modal physical intelligence



We are already developing multi-modal perception, where AI combines several sensing modalities before taking a decision.

A hardware-agnostic perception layer between silicon and the SDV platform

WHERE WE SIT IN THE SDV STACK

Vehicle functions
Cabin · safety · HMI · comfort

SDV platform
OS · middleware · central compute · OTA

Hatticore perception layer
Signal processing · object-centric AI · sensor fusion

Sensors & silicon
Radar front ends · MCUs · neuromorphic processors

Compatible with TI · Infineon · NXP radar chipsets · ongoing work on Innatera Pulsar

HOW PARTNERS WORK WITH US

Perception software
For OEMs, Tier 1s and integrators — on-device inference

Reference hardware
Radar kits & integration modules, so pilots start in weeks

R&D & validation
Datasets, simulation and prototype-to-validation engineering

We don’t replace your sensor supplier or your platform — we make the data between them understandable.

How we collaborate with partners in Germany and China

01 · EVALUATE

Technology evaluation

A defined use case, assessed jointly on the partner’s scenarios and hardware

02 · CO-DEVELOP

Joint development

Engineering and integration of perception functions into the partner’s platform

03 · LICENSE

Licensing

Perception software licensed for series programmes, with long-term support

04 · RESEARCH

Research partnerships

Joint research with universities and institutes, incl. publicly funded programmes

WHAT WE CONTRIBUTE

- Depth in radar/multi-sensor physics and signal processing
- Edge AI — including neuromorphic computing
- Private by design: no camera images, processed on-device

COMPLEMENTARY PARTNERS

- Carmakers and Tier 1 suppliers
- Semiconductor and platform companies
- Engineering firms and research institutes — in Germany and China

Every collaboration starts from a shared use case and clearly defined success criteria.

HATTICORE

Enhancing Physical Sensing for the Next Generation of AI

We look forward to working with German and Chinese partners on the perception layer of software-defined vehicles.

Founded 2025 in Berlin — privacy-by-design perception for automotive, healthcare, security, and industrial automation.

linkedin.com/company/hatticore · hatticore.ai · Berlin, Germany