KI Fortschrittszentrum
LERNENDE SYSTEME UND KOGNITIVE ROBOTIK

Cognitive Robotics and European Robotics Forum

Fraunhofer IPA
Stuttgart, November 30th, 2023

Baden-Württemberg
MINISTERIUM FÜR WIRTSCHAFT, ARBEIT UND TOURISMUS

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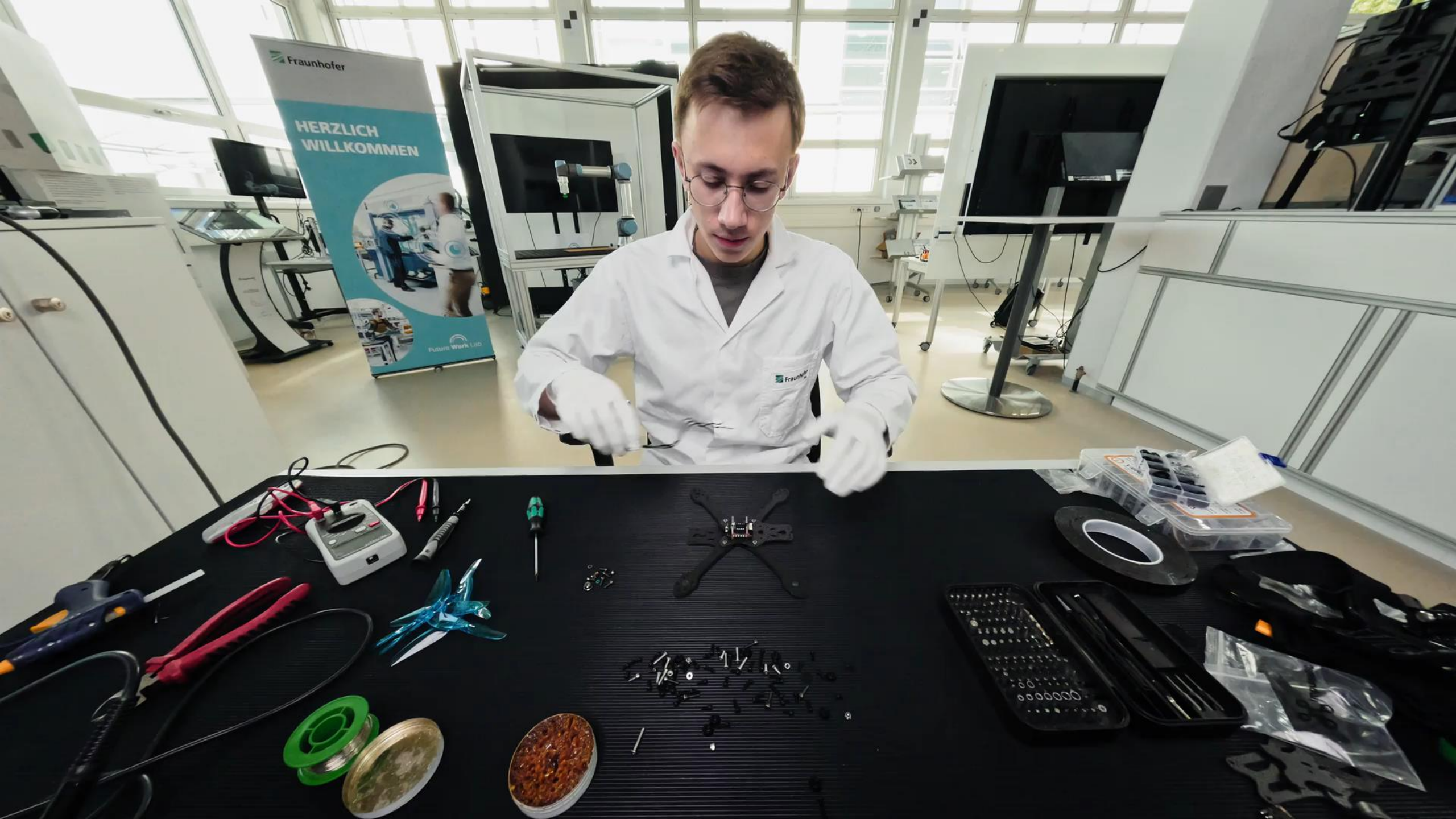
Agenda Session KI-Fortschrittszentrum

14:00-14:30	**COGNITIVE ROBOTICS AND EUROPEAN ROBOTICS FORUM | EN** Dr. Werner Kraus *Fraunhofer-Institut für Produktionstechnik und Automatisierung (IPA)*

PROGRAMM IN PWR 47, V47.02

14:30-15:00	**TEXTVERSTEHEN MIT (GENERATIVER) KI | DE** Dr. Maximilien Kintz und Dennis Klau *Fraunhofer-Institut für Arbeitswirtschaft und Organisation (IAO)*
15:00-15:30	**BRAIN-COMPUTER INTERFACES AND THEIR APPLICATION FOR HUMAN-AI-INTERACTION | EN** Dr. Mathias Vukelic *Fraunhofer-Institut für Arbeitswirtschaft und Organisation (IAO)*
15:30-16:00	**POSTER-SESSION UND PAUSE**
16:00-16:30	**KI-PROJEKTE ERFOLGREICH DURCHFÜHREN UND RISIKEN MINIMIEREN | DE** Claudia Dukino *Fraunhofer-Institut für Arbeitswirtschaft und Organisation (IAO)*
16:30-17:00	**QUANTENMASCHINELLES LERNEN | DE** Dr. Marco Roth *Fraunhofer-Institut für Produktionstechnik und Automatisierung (IPA)*
17:00-17:30	**DATA ANALYTICS AND INTERACTION DESIGN | EN** Dr. Chandan Kumar *Fraunhofer-Institut für Arbeitswirtschaft und Organisation (IAO)*

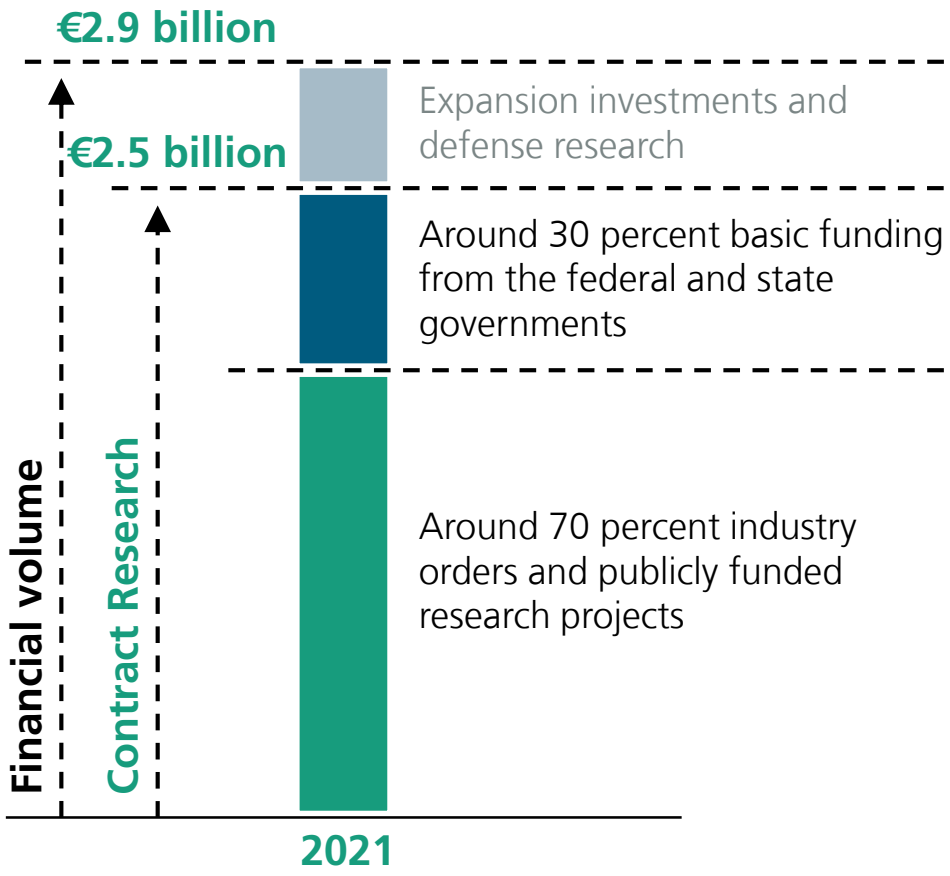

Fraunhofer
HERZLICH
WILLKOMMEN
Future Work Lab

Profile of the Fraunhofer-Gesellschaft

Application-oriented research for the direct benefit of business and for the benefit of society

30,000 Employees

76 Institutes and research facilities



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Cyber Valley

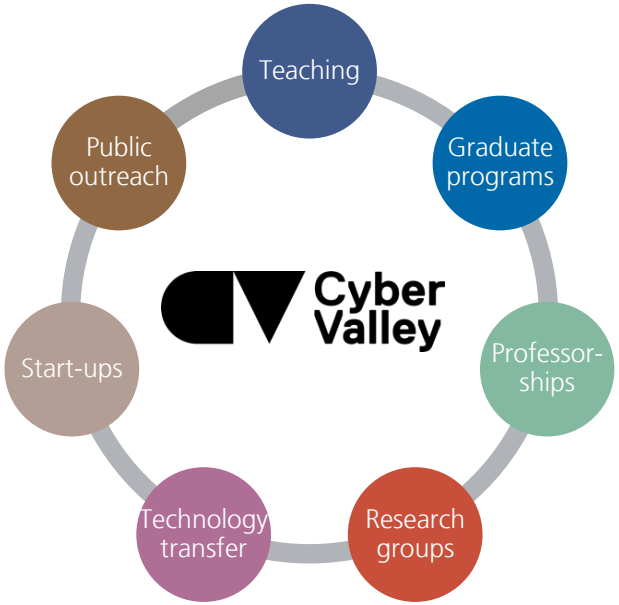
Europe's leading research network for Machine Learning (Stuttgart-Tübingen)

Objectives

- Cutting edge AI research
- Exchange between science and business
- Environment for the foundation of start-ups

Research focus

- Machine Learning
- Robotics
- Computer Vision
- Computational Neuroscience



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AI Innovation Center »Learning Systems and Cognitive Robotics«

Cutting-edge technologies for broad application

KI Fortschrittszentrum LERNENDE SYSTEME UND KOGNITIVE ROBOTIK

The AI Innovation Center brings technologies from cutting-edge research into broad industrial application.

→ https://www.ki-fortschrittszentrum.de/

Co-funded by

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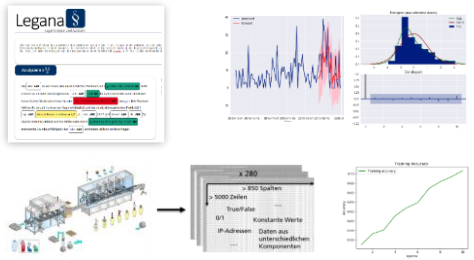
AI transfer to SMEs

- Open Lab events
- More than 200 companies actively involved, many of them SMEs from Ba-Wü
- Broad range of topics and applications:
  production, mobility, robotics, services, trade, biotech/medicine, etc.

AI use cases for firms

- **Quick checks** on feasibility and economic potential

- **Exploring projects** to develop proof-of-concept prototypes



Excellent network

Cyber Valley

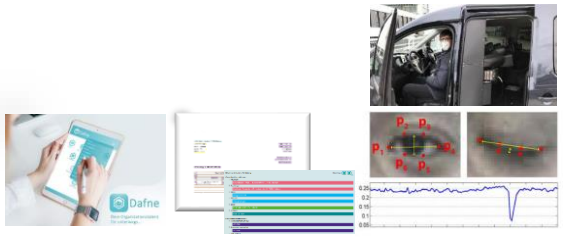
GPAI / THE GLOBAL PARTNERSHIP ON ARTIFICIAL INTELLIGENCE

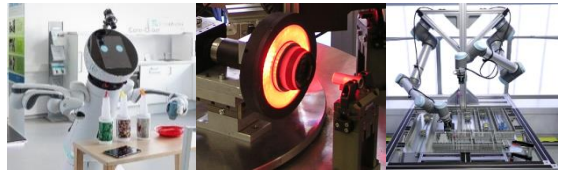
MIAI Grenoble Alpes elise

- Germany – France
- Cutting-edge research to industry
- Supraregional centres
- Global community of experts

AI technologies and demos

- Data analytics
- Speech and text processing
- Real-time classification
- Cognitive robotics
- Reliable AI
- Autonomous planning & decision-making
- Image and signal processing





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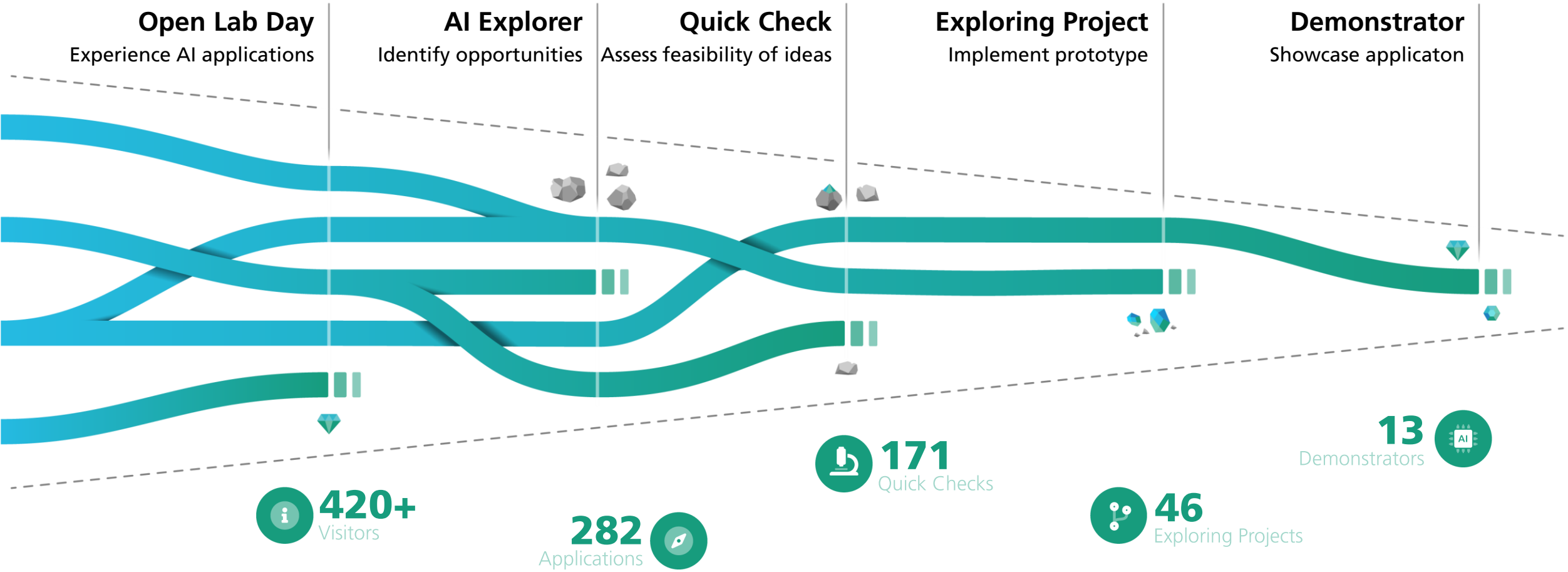
Benefit from the AI Innovation Center »Learning Systems and Cognitive Robotics«

Know and exploit the potential of AI



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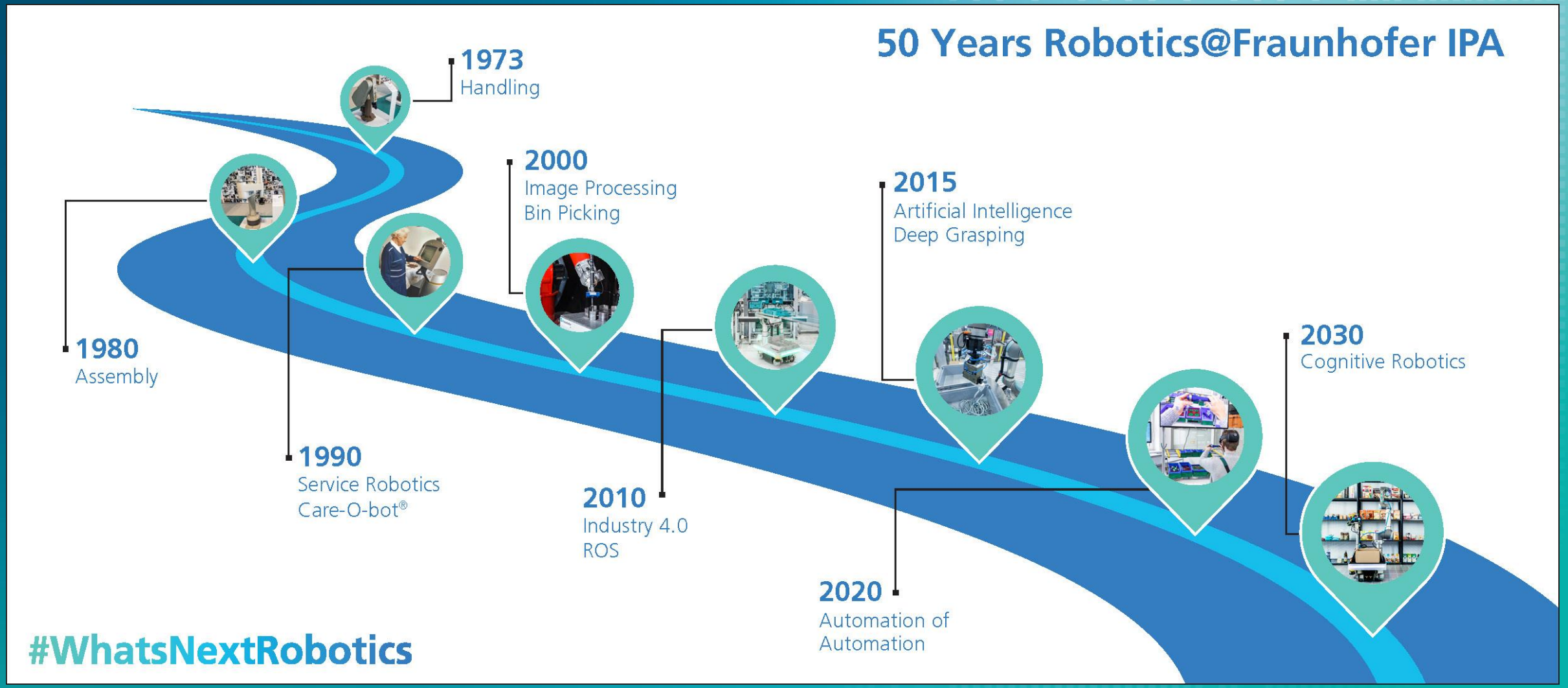
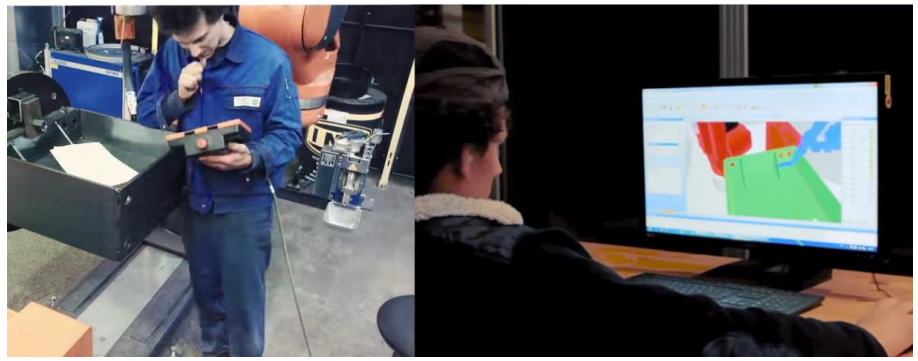
50 Years Robotics@Fraunhofer IPA



#WhatsNextRobotics

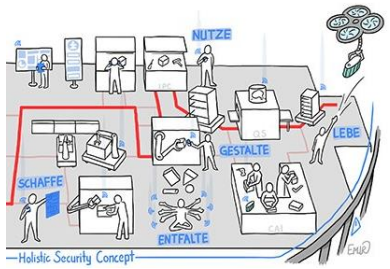
Automation of automation makes robotics also economic feasible for High Mix Low Volume

- ~50% of robot system costs are one-time efforts specific to the project (like a prototype)
- Complex automation is 80% from continuous improvement process / brown field
- Expert needed for reconfiguration and reprogramming for each new variant

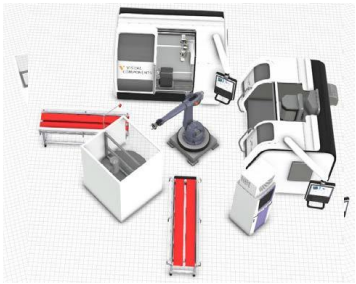


»Automation of Automation« lowers integration and reconfiguration efforts. IPA examples:

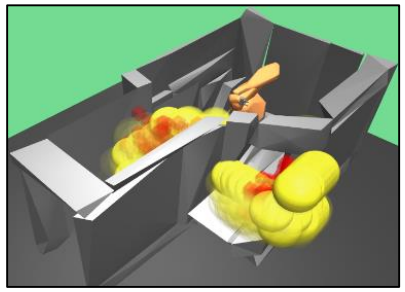
Utilization optimized matrix production



Automated layout generation



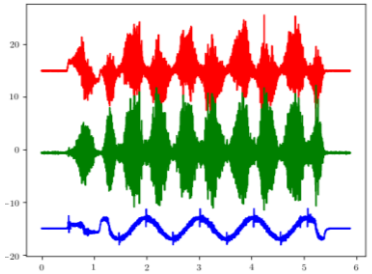
Automated risk assessment



Automated material flow with AMR

Self-configurating bin picking

Self-optimization of process parameter

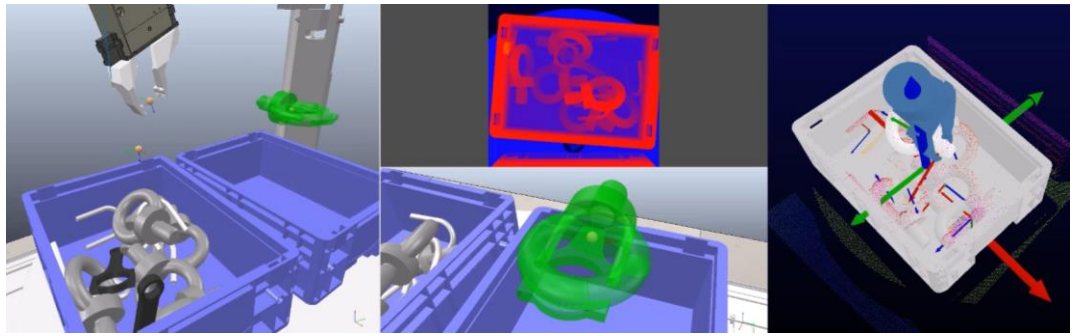


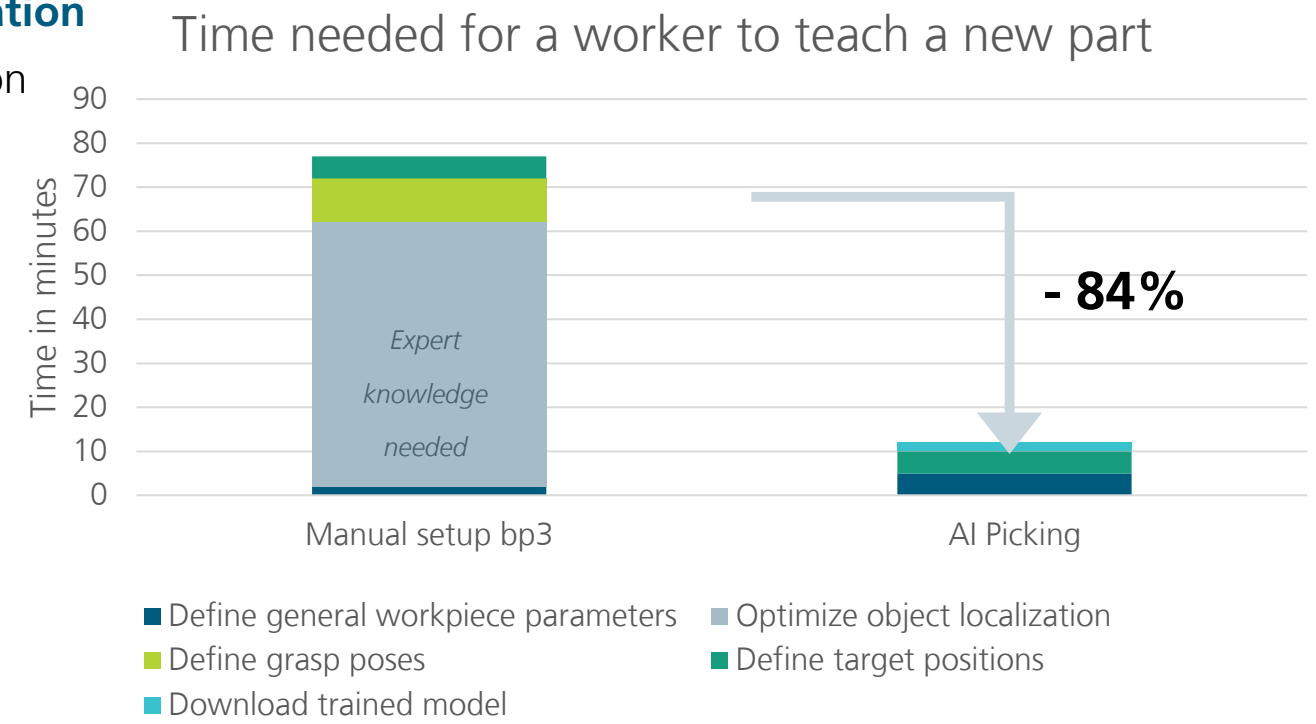
Automatic Setup of Bin Picking Applications

84% less teaching effort for a new part through self-learning

Fully Autonomous Self-configuration via AI and Simulation

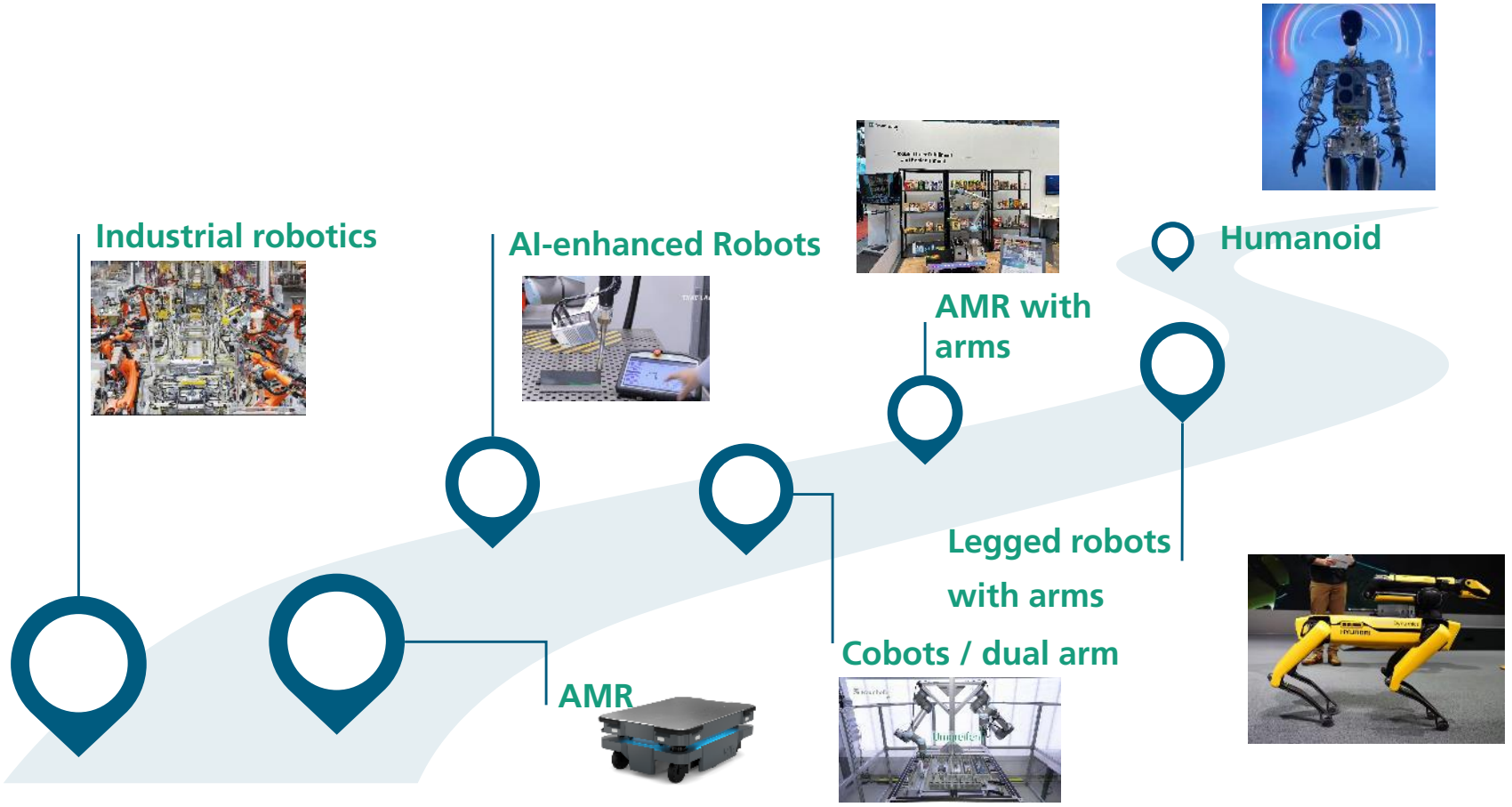
- Training of algorithms and neural networks in simulation
- Automatic parameter optimization
- Automatic generation of valid grasp poses for various gripping principles
- No expert knowledge, no real data and no annotations required
- Easy interface via web service: simple usage even for untrained users - just upload a CAD model





Cognitive robotics to increase working productivity

Humanoids involve challenges which are not solved in easier cases



Today

Perception = almost solved

Tomorrow

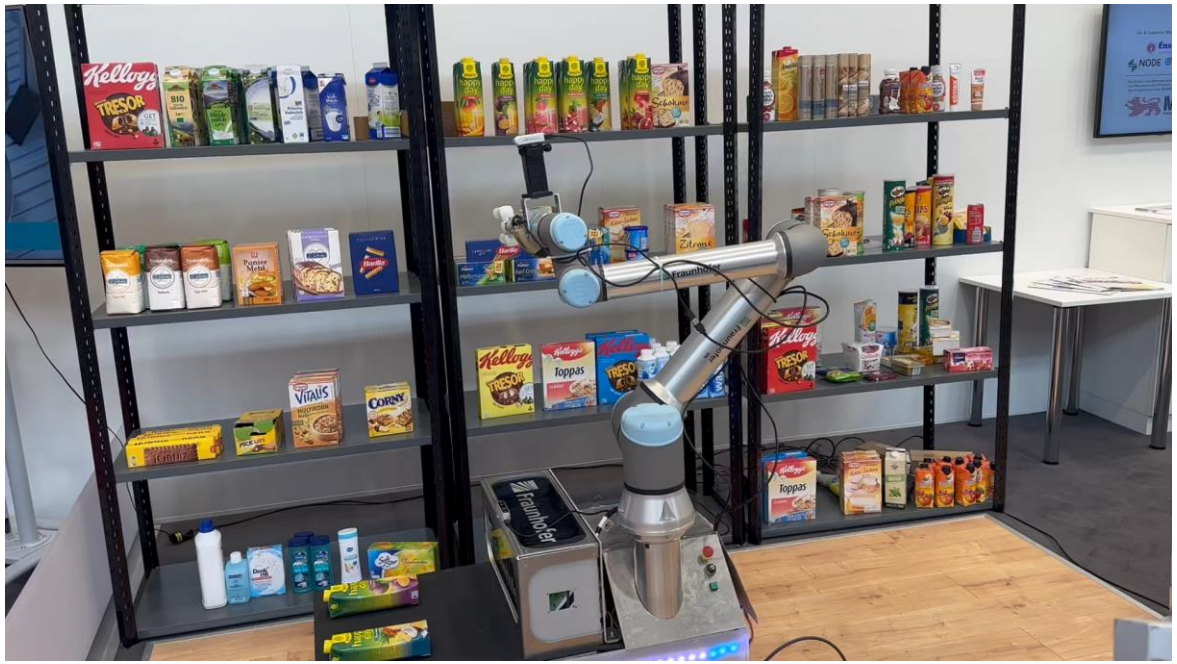
Physical interaction / dexterity = key challenge to be solved

Welding cobot shows the democratisation of robotics

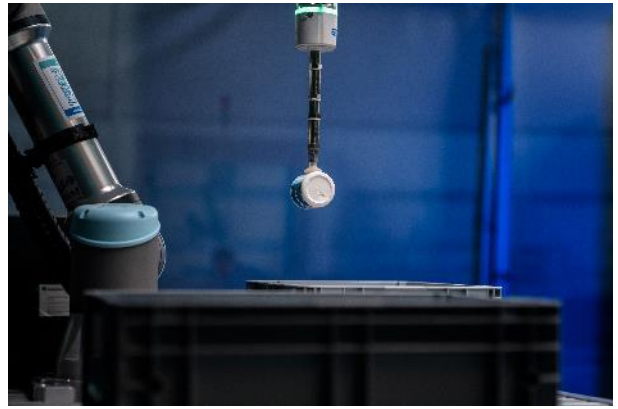
Cognitive robotics fills the labour gap

- Past solution for welding robots: scanning and programming of workpiece needed time and expertise
- Now: welding cobot uses cognitive robotics technologies to autonomously identify welding line
- No offline programming and robot expertise needed anymore
- Key: researchers with a high level of knowledge of the welding process

Use Cases for AMR with arms: rob@work and Bin Packing



rob@work: Transformer model for object and text detection



#ERF2025

Stuttgart's Bid for the #ERF2025

Boosting the Synergies Between Robotics and AI for a Stronger Europe

EUROPEAN ROBOTICS FORUM

eu ROBOTICS at the heart

Save the date: 31.03.2025 – 04.04.2025

Fraunhofer IPA

About the European Robotics Forum

The most influential meeting of the robotics community in Europe

#ERF2025

The European Robotics Forum (ERF) is one of the most influential events for the robotics and artificial intelligence community in Europe.
It is the meeting point for engineers, academics, entrepreneurs, investors, as well as end-users and policy makers in the field of robotics from all over Europe and beyond.

The ERF 2023 was held in Odense, Denmark: 4 days — 1100+ participants — 65 Sponsors and Exhibitors

The largest ERF in recorded history – We expect the ERF2025 in Stuttgart to be even bigger!

We had a perfect ERF in Odense. We take the best points out of it:

- ERF **downtown Stuttgart**, where the locals live
- **1:1 sponsoring** of the evening events by the city and local players
- Best **networking opportunities**:
  - Welcome reception with food trucks
  - Exhibition and catering area in direct vicinity

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Robotics and AI Joining Forces for the First European Robotics Forum in Germany

#ERF2025

Dr. Werner Kraus
Fraunhofer IPA

General Chair
Robotics

Rebecca Reisch
Cyber Valley

General Co-Chair
Public Engagement
Artificial Intelligence

Dr. Matthias Peissner
Fraunhofer IAO

General Co-Chair
Future of Work

Prof. Dr. Alexander Verl
University of Stuttgart

General Co-Chair
Scientific Track
Robotics

Prof. Dr. Marco Huber
University of Stuttgart & Fraunhofer IPA

General Co-Chair
Scientific Track
Artificial Intelligence

ROLE

Ecosystems to leverage industry, science, sponsors and participants

Networks of the chairing organizations:

Fraunhofer IPA
Cyber Valley
Fraunhofer IAO
Universität Stuttgart

Networks into science

MHI Wissenschaftliche Gesellschaft Montage Handhabung Industrierobotik
euROBIN

Networks into industry

IFR International Federation of Robotics
VDMA Robotics + Automation
ROS industrial
DEUTSCHER ROBOTIK VERBAND
GPAI THE GLOBAL PARTNERSHIP ON ARTIFICIAL INTELLIGENCE
PLATTFORM INDUSTRIE4.0

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Venues and main sponsors

Already 200k€ of sponsoring committed

#ERF2025

Main venue for ERF

Kultur- & Kongresszentrum Liederhalle Stuttgart

Hybrid format

VIP/GA-Reception

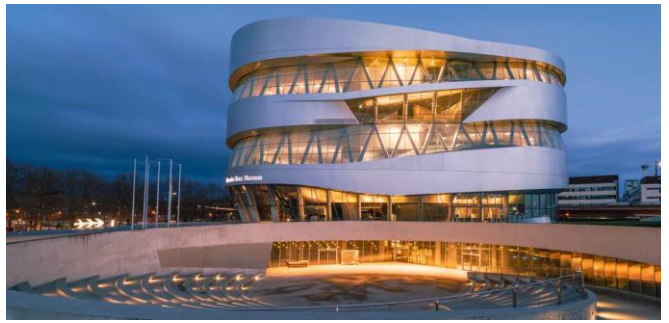
New castle

Welcome reception

Wagenhallen

Gala Dinner

Option 1: Mercedes-Benz Museum



Option 2: Waldaupark

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ERF 2025 in Stuttgart - Topics

Boosting the Synergies Between Robotics and AI for a Stronger Europe

#ERF2025

Public Engagement

Robotics and AI with Cyber Valley

Potential Site visits (extract)

Scientific track

Tech Transfer and Entrepreneurship

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Come and discover the beautiful Region of Stuttgart!

Venues

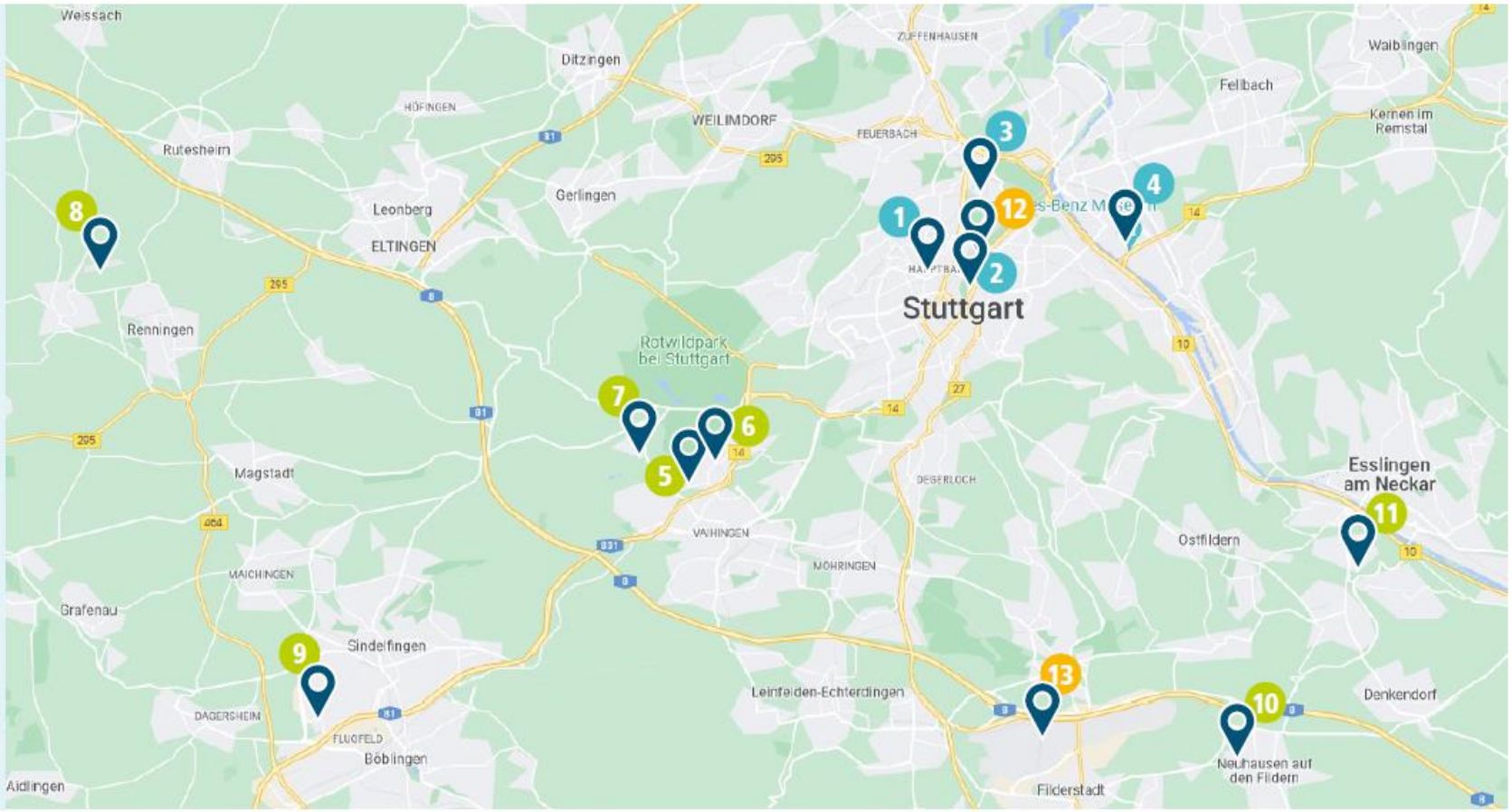
1. Liederhalle
2. Neues Schloss
3. Wagenhallen
4. Mercedes-Benz Museum

Lab Tours and Company Visits

5. Fraunhofer IPA
6. ARENA 2036
7. Max Planck Institute for Intelligent Systems
8. Robert Bosch GmbH Research Campus
9. Mercedes-Benz Factory 56
10. FANUC Technical Centre
11. Festo

Transport

12. Main Train Station Stuttgart
13. Airport Stuttgart STR



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8. In a Nutshell: Why You Should Consider Fraunhofer IPA as Organiser of the **#ERF2025** in Stuttgart

1 **Robotics Expertise:** With 50 years of experience, Fraunhofer IPA is one of the biggest innovators in the European robotics community. Our expertise and networks are the foundation for a successful **#ERF2025**.

2 **Strong AI Collaboration:** We are partnering with Cyber Valley, Europe's largest AI research collaboration, which links machine learning, computer vision and robotics. A focus will be on public engagement to address social and ethical issues related to robotics and AI technologies.

3 **Industry Hub:** Stuttgart is home to many leading robotics and automation companies like Bosch, Mercedes-Benz and FANUC. The German Robotics Association (DRV) and VDMA Robotics are also supporting the **#ERF2025**. This will allow participants to explore leading technologies from various industries.

4 **Scientific Hub:** With over 100 professors specialising in robotics and AI-related fields, Stuttgart's scientific expertise spans areas such as smart sensors, aerospace engineering, control engineering and construction for architecture. Workshops will benefit from real-world use cases based on scientific discoveries.

5 **Vibrant Community:** Stuttgart's rich industrial ecosystem fosters innovation and the implementation of new technologies. This provides an ideal platform to exchange knowledge, share best practices and drive the practical application of robotics and AI for a stronger European industry.

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Join us & become a part of the #ERF2025!

Contacts

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