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Harnessing the power of AI for robotics

In the second funding phase, “Cognitive Robotics” is expanding the research spectrum of the Fraunhofer AI Innovation Center.

As a part of Cyber Valley, the AI Innovation Center “Learning Systems” operated by Fraunhofer IAO and Fraunhofer IPA supports companies in their efforts to exploit the economic potential of AI. Across a total of 44 projects, feasibility studies and solutions for practical applications have already been developed. With total funding of EUR 23 million, the “Cognitive Robotics” center at Fraunhofer IPA will expand the organisation’s service portfolio in this area from 01 March 2021.

Since November 2019, the Stuttgart-based Fraunhofer Institute for Industrial Engineering IAO and Fraunhofer Institute for Manufacturing Engineering and Automation IPA have formed part of Cyber Valley, the largest research cooperation network in Europe for Artificial Intelligence (AI), with the AI Innovation Center “Learning Systems”. For companies located in Baden-Württemberg, the center represents the main point of contact for application-oriented AI research, implementing research and transfer projects for production and services. It also acts as an interface between industry and basic research within the existing Cyber Valley consortium, which comprises several research institutes located in the Stuttgart-Tübingen area in addition to reputable industrial partners. Furthermore, the AI Innovation Center facilitates technology transfers to industrial settings by leveraging the strengths of existing partners.

Broad spectrum of AI and robotic technologies

As part of the virtual S-TEC summit held on 25 February 2021 under the motto “AI – Made in the Ländle”, Dr Nicole Hoffmeister-Kraut, Minister of Economic Affairs, Labour and Housing for the state of Baden-Württemberg, announced additional financial backing for the AI Innovation Center: “The combination of Artificial Intelligence and robotics opens up major opportunities for the economy of Baden-Württemberg. By expanding the Innovation Center, we are making a decisive contribution to strengthening the long-term development and successful commercialisation of these key technologies in our state. Our overall aim is to transform the latest research expertise into innovative products and business models even more effectively and rapidly. In so doing, our intention is to also contribute to ensuring that the economy is in a position to overcome the negative impacts of the coronavirus pandemic as quickly as possible, before ultimately emerging even stronger from the crisis.”

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In the second funding phase, the center will be expanded to include Fraunhofer IPA services in the area of "Cognitive Robotics". Rebranded as the AI Innovation Center "Learning Systems and Cognitive Robotics", the facility will now also support companies in their efforts to fully exploit the potential of service and industry robotics in addition to finding answers to megatrends such as demographic change, individualisation, sustainability and digitalisation. The center will focus on generating technological developments from four key research areas:

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- **Human-machine interactions:** By enabling machines to perceive, understand, imitate and actively support humans, machines will become intuitive and easy to operate.
- **Cyber-physical robot systems:** Services should help to put existing robot systems into operation more quickly, make them more precise and enable them to be programmed and commissioned more easily.
- **Perception and interaction:** With the help of AI, robots should be able to carry out tasks autonomously even in unstructured and partially unknown environments.
- **Networked robotics:** Networking serves the purposes of knowledge transfer, mutual learning and teamwork among robots, but also between humans and robots.

Helping companies to exploit technological benefits

All of these developments help to facilitate, simplify and render more economical an initial foray into the world of robotics in addition to the further development and quality improvement of existing applications. "With cognitive robotics, we are developing pioneering automation solutions for production processes as well as the retail, healthcare and agricultural sectors", comments Dr Werner Kraus, Head of the Robot and Assistive Systems department at Fraunhofer IPA and Co-Director of the AI Innovation Center. The institute is therefore underlining its aim to become one of the leading institutes for cognitive robotics in the Fraunhofer-Gesellschaft.

As of now, any interested companies can submit applications to the AI Innovation Center for project funding in the area of AI for services and production as well as cognitive robotics. In so doing, they can determine the potential of the technologies for their individual application. The application deadline closes on 18 March 2021. All further information can be found on the website.

Practical applications of AI: 13 application projects completed

The topic of "Learning Systems" and the direct cooperation with industrial firms as well as networking and knowledge transfer within Cyber Valley remain important components of the AI Innovation Center. Since October 2019, Fraunhofer's expert AI teams have already implemented 13 different AI applications in the form of prototypes as part of 'exploring projects'. These cover a broad spectrum of application scenarios for AI: from text mining and processing for legal documentation and demand forecasts for an online bookseller or the combined automation solution for quality control and robot-supported packing all the way through to hazardous goods analyses.

These application examples show that AI offers added value in a multitude of different areas. "For this, we are not only using the latest technology in the area of machine learning, but also prioritising efforts to ensure that these processes are robust and reliable and, in particular, we improve the ways in which these can be explained and understood", comments Prof. Marco Huber, Head of the Center for Cyber Cognitive Intelligence at Fraunhofer IPA and Co-Director of the AI Innovation Center. He continues: "After all, this is often the primary basis for ensuring that the technology is actively embraced." Dr Matthias Peissner, Head of the Human-Technology Interaction research unit at Fraunhofer IAO, also explains: "The Center offers companies a safe space to test ideas for AI applications without any financial risk. In this way, they learn to appreciate and exploit the potential of machine learning."

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Studies on human-centric AI at the interface of business and elite-level research

A total of ten studies developed at the AI Innovation Center provide an overview of which industries and topics are particularly well-suited to innovative AI applications for operational practice and how these can be effectively implemented. Over the next few weeks, these will gradually be made available on the website of the AI Innovation Center free of charge.

Beyond Baden-Württemberg: AI Innovation Center goes Europe

The AI Innovation Center implements the European AI strategy. It is embedded and well-connected in the European AI and robotics ecosystem to make the strategy useable for SME in Baden-Württemberg. In this context, trustworthy AI is the key requirement for the use of these technologies.

The unification of AI and cognitive robotics under the umbrella of the AI Innovation Center can be seen as a prototype of the AI, data and robotics partnership for the next framework program Horizon Europe. The Strategic Research, Innovation and Deployment Agenda (SRIDA) defined by networks and associations like BDVA, euRobotics, ELLIS, EurAI and CLAIRE, which was released in 2020, includes contributions from the AI Innovation Center. The cognitive robotics work plan develops solutions for the technical challenges outlined in the SRIDA such as perception, physical and human action and interaction. With dedicated transfer measures, these developments are made accessible to SME.

Another example is the corporation in the EU funded project ELISE (European Learning and Intelligent Systems Excellence). ELISE includes 105 organizations in Europe to connect top researchers with the application problems of SME with open calls. Here, Fraunhofer is engaged in the setup of a startup network and the onboarding of further SME within the open call to investigate AI use cases, e.g., in production, quality control and robotics.

In 2019, Germany and France submitted the Roadmap for a Research and Innovation Network on Artificial Intelligence between the two governments. The AI Innovation Center is the partner institute of the MIAI in Grenoble, one of the four AI centers in France. The partnership is dedicated to human robot collaboration and Industry 4.0.

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Finally, the center is also active on the global level with the Global Partnership on Artificial Intelligence (GPAI). Prof Bauer from Fraunhofer IAO is co-chairing the working group on the "Future of Work". This group of international experts will contribute to the collective understanding of how AI can be used in the workplace to empower workers and increase productivity.



Technologies for cognitive robots enable for example precisely tailored automation solutions for logistics. Source: Fraunhofer IPA/Photo: Rainer Bez

Further information and all application documents:

www.ki-fortschrittszentrum.de

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In cooperation with:

S-TEC Stuttgart Technology and Innovation Campus

Fraunhofer, the University of Stuttgart and the state of Baden-Württemberg have initiated S-TEC to drive forward future-relevant research topics and bring them quickly to market. The campus hosts lighthouse research, industry-on-campus projects, start-ups, as well as education and training. S-TEC links companies with the thematically broad research landscape in Stuttgart. The campus is organized in centers according to future-relevant research topics with a high technical innovation character, such as the AI Innovation Center "Learning Systems and Cognitive Robotics".



Cyber Valley

Cyber Valley is Europe's largest research consortium in the field of artificial intelligence with partners from science and industry. The state of Baden-Württemberg, the Max Planck Society with the Max Planck Institute for Intelligent Systems, the Universities of Stuttgart and Tübingen, as well as Amazon, BMW AG, Daimler AG, IAV GmbH, Dr. Ing. h.c. F. Porsche AG, Robert Bosch GmbH, and ZF Friedrichshafen AG are the founding partners of this initiative. Moreover, Fraunhofer-Gesellschaft has joined Cyber Valley as a partner. Cyber Valley also receives support from the Christian Bürkert Foundation, the Gips-Schüle Foundation, the Vector Foundation, and the Carl Zeiss Foundation.



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The Fraunhofer-Gesellschaft, headquartered in Germany, is the world's leading applied research organization. With its focus on developing key technologies that are vital for the future and enabling the commercial exploitation of this work by business and industry, Fraunhofer plays a central role in the innovation process. As a pioneer and catalyst for groundbreaking developments and scientific excellence, Fraunhofer helps shape society now and in the future. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 75 institutes and research institutions throughout Germany. The majority of the organization's 29,000 employees are qualified scientists and engineers, who work with an annual research budget of 2.8 billion euros. Of this sum, 2.4 billion euros are generated through contract research.