

Making AI Manageable By Engineers

Reliable and Safe AI Systems for Engineers Are Lacking – Competence Center Now Offers Support for Companies

Artificial intelligence (AI) can be found in smartphones, search machines, or navigation systems. It makes everyday life easier. Potential applications of AI in the engineering sector are numerous, examples being smart factories or autonomous vehicles. However, processes to make the behavior of these systems plannable and their decisions reproducible are still lacking. This will be changed by the “Kompetenzzentrum für KI-Engineering” (CC-KING, competence center for AI engineering) managed by the Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (IOSB). The partners are Karlsruhe Institute of Technology (KIT) and the FZI Research Center for Information Technology.

Classical engineering is characterized by plannability. As early as in the design phase, developers know how the individual components and the complete system will behave later on. Systems containing artificial intelligence (AI) or machine learning (ML) components, however, are not that plannable. As they are data-driven, they develop further during their runtime and will reach their final functionality during operation only. This makes the reliable management of exceptional situations very difficult and also economic profit can hardly be determined in advance. For this reason, use of smart systems by companies is prevented by the fact that they are not as calculable as classical engineering systems.

CC-KING now pools IT and engineering competencies in Karlsruhe to facilitate AI use in practice. In close cooperation with industry, the Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB, FZI Research Center for Information Technologies, and KIT study fundamental aspects, methods suited for practice, and concrete application problems.

Fundamental Methodological Aspects

The (non-) predictability of the behavior of learning systems is a central topic of AI engineering. “AI engineering is aimed at making AI and



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ML useable by engineers, comparable to classical engineering. It is still a very young discipline that bridges the gap between AI fundamental research and engineering sciences,” says Professor Jürgen Beyerer, Scientific Director of the Competence Center, Managing Director of Fraunhofer IOSB, and Professor at KIT. “Research will focus on predictability as well as on the safety of AI-based systems, explanation of their decisions, and incorporation of prior and expert knowledge in data-driven approaches.” The goal is to develop a standard procedure for AI engineering to ensure usability of AI technologies by large and heterogenous teams.



“As a technology hub with a long tradition in engineering sciences and IT, Karlsruhe offers optimum prerequisites for the Competence Center,” Beyerer emphasizes. The Baden-Württemberg Test Area for Autonomous Driving and the Research Factory that is currently being built in Karlsruhe will be used as real-world labs for applications in the mobility and industrial production sectors. “Under these conditions, AI engineering may become the unique selling point of German AI.”

Advice and Learning Lab for Small and Medium-sized Enterprises

CC-KING will seek to make the use of AI components manageable by small and medium-sized enterprises. “Even highly innovative medium-sized companies are often lacking AI competence. This gap is difficult to close, because AI experts are rare and often not familiar with typical applications,” Beyerer says. CC-KING offers concrete support to companies that may unbureaucratically order so-called QuickChecks or TransferChecks. A consultation office and an AI Engineering Learning Lab for training staff are currently being established.

If interested, companies can contact the CC-KING coordination office of Fraunhofer IOSB (by mail to: kompetenzzentrum@ki-engineering.eu or by phone to the project assistant 0721/6091-290). In August 2020, the Baden-Württemberg Ministry for Economic Affairs, Labor, and Housing approved funding of CC-KING to the tune of EUR 3 million.

Contributions of the Partners

Fraunhofer IOSB as coordinating consortium partner contributes its wide IT competence in industrial automation and control technology as well as in the areas of AI and ML. “In the past three years, we have already developed a tool-based approach to AI engineering in indus-

trial production within our project “M4P – Machine Learning for Production,” says Dr. Julius Pfrommer, Head of the research group at IOSB and Scientific-technical Director of CC-KING. “This tool helps us apply AI methods in a plannable and reproducible way. The AI algorithms are of crucial importance, but often represent a fraction of the solution only.” Work rather focuses on deep integration of tools existing in engineering in AI methods. “In this way, AI can also work well in areas where no or only few data are available.”

An ideal test environment for AI use in industrial production will be the Karlsruhe Research Factory that is presently being built by the Fraunhofer Society and KIT. It will start operation in 2021.

“Challenges of AI- or ML-based systems are plausibility and flexibility,” says Michael Beigl, Professor for Pervasive Computing at KIT. According to the smart data expert, who coordinates KIT’s activities in CC-KING, also reproducibility of decisions of AI systems has to be improved. Another subject of research is the integration of AI methods and systems, such as the Smart Data Innovation Lab (SDIL), in existing models, simulators, and expert knowledge in the engineering sector. “At KIT, we develop methodologies and problem solutions for this purpose,” Beigl says. In addition, KIT institutes contribute tools and components.

Among them are the model approach to AI engineering, assistance functions for knowledge acquisition and optimization of AI components, or the application of AI and ML methods in case of limited resources. The FZI Research Center for Information Technology coordinates this work package and the application domain “Mobility” of the Competence Center. In addition, FZI as an institution for close-to-practice knowledge and technology transfer contributes its know-how of mobility research and artificial intelligence, in particular of embedded AI and AI methods. For tests and demonstrations of the AI methods to be implemented by the Competence Center, the Baden-Württemberg Test Area for Autonomous Driving and the FZI House of Living Labs will be used.

More about the KIT Information · Systems · Technologies Center:
<http://www.kcist.kit.edu>

Being “The Research University in the Helmholtz Association,” KIT creates and imparts knowledge for the society and the environment. It is the objective to make significant contributions to the global challenges in the fields of energy, mobility and information. For this, about 9,300 employees cooperate in a broad range of disciplines in natural sciences, engineering sciences, economics,

and the humanities and social sciences. KIT prepares its 24,400 students for responsible tasks in society, industry, and science by offering research-based study programs. Innovation efforts at KIT build a bridge between important scientific findings and their application for the benefit of society, economic prosperity, and the preservation of our natural basis of life. KIT is one of the German universities of excellence.

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