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Pressemitteilung

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Resource-aware Edge AI enables AI applications on mobile devices

DFKI and Inria launch joint FAIRe project Artificial intelligence (AI) is finding increasingly diverse applications in the physical world, especially on embedded, cyber-physical devices with limited resources and under demanding conditions. This type of AI is referred to as "Frugal AI" and is characterized by low memory requirements, reduced computing power, and less data use. The FAIRe (Frugal Artificial Intelligence in Resource-limited Environments) project of DFKI and the French computer science institute Inria is developing a comprehensive approach for all abstraction layers of AI applications at the edge.

Edge devices such as driver assistance and infotainment systems in cars, medical devices, exploration, manufacturing or service robots, and, last but not least, cell phones have nowhere near the resources of huge cloud data centers that modern machine learning applications require. The challenge is dealing with limited computing power, storage space, and power supply.

However, due to restricted connectivity in remote locations, underwater or in space, and security or privacy concerns, e.g., in domestic and industrial environments, it is desirable for these devices to process data directly rather than sending it to the cloud. Edge computing can also save energy that would otherwise have to be used for data transfer. The concept of Frugal AI is used to ensure that the computing processes on edge devices are faster, more comprehensive, and more efficient.

FAIRe aims to enable the deployment of AI applications on mobile devices through an innovative approach to reduce model size and computational overhead through network quantization, network architecture optimization, compute stream optimization, and finally, network execution on low-power high-performance hardware (e.g., RISC-V or FPGA). FAIRe develops a holistic approach at all abstraction levels of an AI application that addresses the different layers of implemented, running AI systems: the actual AI algorithms, the hardware they run on, and the compiler layer in between, which is responsible for translating AI algorithms as efficiently as possible for a given hardware. To demonstrate this approach in practice, the project team led by Prof. Dr. Christoph Lüth from DFKI's Cyber-Physical Systems research department is conducting a case study on human-robot interaction (HRI) that covers all of these aspects.

The case study will use interaction with a human to illustrate how the different layers of abstraction work together and how robotic systems can learn in a resource-aware and continuous manner. In this scenario, an intelligent robot interacts with a human over an extended period of time to continuously assist the human with specific tasks. During this interaction, the robot adapts to unknown contexts. The case study results are intended to demonstrate the broad applicability of the AI algorithms developed in FAIRe and point beyond the specific scenario.

Edge AI projects such as FAIRe contribute to making AI applications widely usable on mobile devices and open up new potential for applications.

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Human-machine systems, such as the robotic arm from the AdaMeKoR project shown here, form the basis of the demonstrator in the FAIRe project. DFKI, Christian Mandel