

A glimpse on the EdgeAI project: Technologies for Optimized Embedded Processing

Invited Paper

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1 AT-THE-EDGE AI: THE EDGEAI PROJECT

At-the-edge Artificial Intelligence (AI) empowers Machine Learning (ML) and Deep Learning (DL) at the network's periphery, closer to sensors and actuators, for localized data collection and processing, reducing latency, enhancing data privacy and security, and diminishing the need for cloud connectivity. However, this poses challenges related to the execution of a complex computing workload on resource-constrained platforms. Thus, it requires dealing with diverse technologies and optimizing energy usage.

The EdgeAI project (<https://edge-ai-tech.eu/>), a joint effort of 42 partners, part of the Key Digital Technologies (KDT) Joint Undertaking (JU), aims to face such challenges, to play a pivotal role in Europe's digital evolution towards smarter processing solutions at the edge. It focuses on creating fresh electronic parts and systems, refining processing setups, improving connectivity, and developing software, algorithms, and middle-layer technologies.

2 EDGEAI APPLICATIONS

The main aim of EdgeAI is to advance solutions across various layers of AI technology, culminating in the creation of real-time performing multimodal edge AI implementations for diverse industrial sectors. The EdgeAI project partners work to demonstrate the applicability of the developed approaches in 20 demonstrators across five industrial value chains:

- digital industry,

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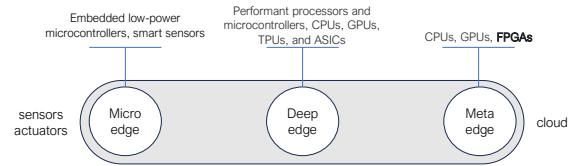


Figure 1: EdgeAI vision of the computing continuum.

- energy,
- agri-food and beverage,
- mobility, and
- digital society,

considering performance, security, trust, and energy efficiency demands inherently in each of these demonstrators. EdgeAI is designed to provide benefits across industrial sectors, to significantly contribute to the ubiquitous adoption of at-the-edge AI in society.

3 COMPUTING ASPECTS IN EDGEAI

The EdgeAI vision spans across the the whole computing continuum, as represented in Figure 1, comprising:

- the micro-edge (processing units in embedded microcontrollers, sensors, and actuators, etc.)
- the deep-edge (processing units providing extended processing power, in gateways, mobile phones, programmable logic controllers, etc.)
- the meta-edge (on-premises high-performance edge processing microservers combining different microcontrollers and processors for specific operations).

To this aim, different research tasks focus on a wide scope of heterogeneous processing platforms, aiming to amalgamate different computing solutions such as central processing units, graphics processing units, tensor processing units, application-specific integrated circuits, neuromorphic processing units, system-on-chip (SoC). The EdgeAI strategic goals are realised through a set of objectives. These objectives reflect the way in which EdgeAI consortium delivers processing solutions for AI at the edge addressing the design stack and middleware across the target industrial sectors:

- Objective 1 (O1) - Develop secure AI-based edge platforms for end-to-end hardware/software (HW/SW) solutions addressing the AI design stack and middleware (MW).
- Objective 2 (O2) - Provide scalable edge AI-based energy-efficient techniques, methods and frameworks supporting different OSs and hardware platforms.

- Objective 3 (O3) - Advance multi-core SoC and SoM AI-based designs with hybrid architectures, embedded systems, and IoT devices designed for industrial environments.
- Objective 4 (O4) - Integration of scalable and modular AI Co-design: hardware/software, algorithms, topologies into novel AI open architecture platforms.
- Objective 5 (O5) - Implementation of reconfigurable AI-based architectures for increasing the re-use, updatability, upgradability, and service life of AI.

- Objective 6 (O6) - Provide trustworthy and explainable edge-AI by design solutions with real-time operation capabilities and dynamic online learning.

Publications deriving from the project are available at:

https://zenodo.org/communities/edgeai_project/. The scope of the project presentation at the workshop will cover aspects related with computing techniques and methods, ranging from hardware to software, frameworks, and applications.