

Pro²Future :: Cognitive and Sustainable Products and Production Systems of the Future

Programme: COMET – Competence Centres for Excellent Technologies

Programme line: COMET-Centre K1

Type of project: Streaming AI



STREAMING AI

FEDERATED ON-DEVICE AI FOR DIGITAL TRANSFORMATION IN INDUSTRY

StreamingAI serves as a strategic research initiative for energy-efficient, federated and device-integrated AI in Upper Austria and Austria. The project raised the TRL of federated, streaming-based and energy-efficient perception on embedded and neuromorphic systems. Whilst large language models are heavily data-, energy- and cloud-centric, StreamingAI addresses the class of AI that is essential for industrial, safety-critical and sustainable applications: on-device AI with continuous learning under resource constraints.

StreamingAI demonstrates the transformation of fundamental research into industrial applications, going beyond incremental improvements to existing approaches:

- i. **Reference architecture for streaming-based federated perception.** The project develops and validates a modular reference architecture for federated learning over continuous data streams, taking into account node heterogeneity and energy consumption.
- ii. **Integration of incremental learning and federated learning.** StreamingAI demonstrates that incremental online learning (few-shot, continual learning) and federated learning can be methodologically combined and showcases the value of these approaches for industry.
- iii. **Energy-centred systems research.** StreamingAI treats energy efficiency as a key optimization parameter. Through integrated energy measurement, learning and inference processes are made quantitatively comparable and optimized.
- iv. **Neuromorphic knowledge representation for streaming perception.** Spiking neural networks with adaptive and multi-compartment neurons (e.g., SE-adLIF, MC models) enable highly energy-efficient yet powerful local perception models. Particularly relevant is their capability for rapid learning from few examples.

SUCCESS STORY



Impact and Effects

Austria StreamingAI provides the scientific basis for a competitive advantage through energy-efficient, on-premises AI systems in (Upper) Austria, without permanent reliance on the cloud. The project demonstrates possible ways of making this advantage tangible and usable.

Europe The demonstrated use cases will, in the medium term, enable a reduction in energy consumption, bring AI support directly to workers and machines, extend the service life of existing hardware, and highlight the potential for Europe should it be able to assume a leading technological role in neuromorphic hardware.

Skills Shortage StreamingAI supports companies with young professionals via automated assistance systems that help with perception and decision-making tasks.

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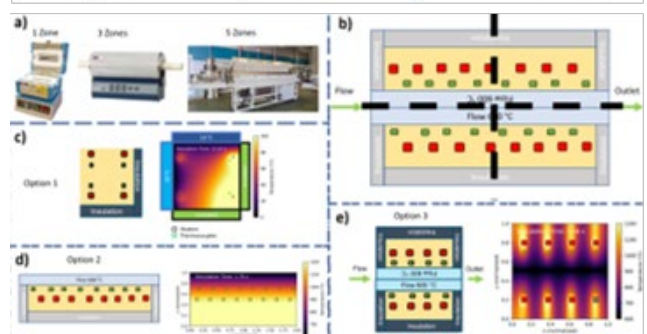
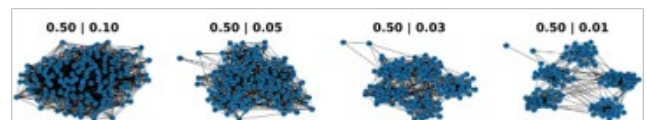
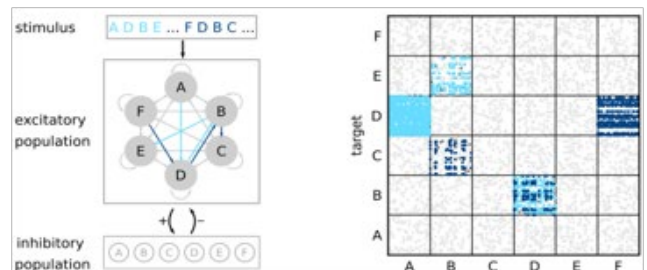
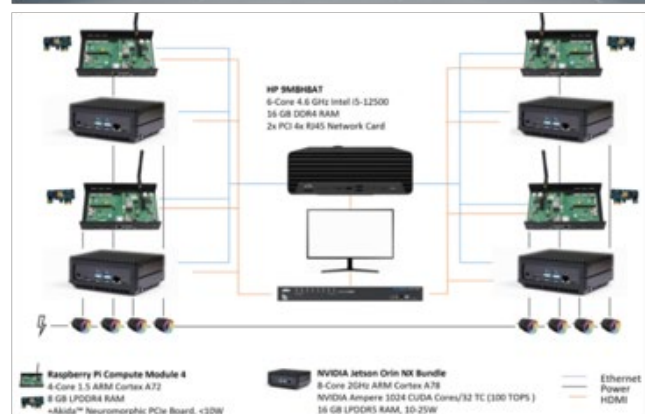



Fig.1 Results from three practical implementation scenarios that demonstrate the viability of StreamingAI for the UA Industries.

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