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GEFÖRDERT VOM
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PoC Implementation of Neuromorphic Wireless Cognition: Gesture Recognition for Robotic Control

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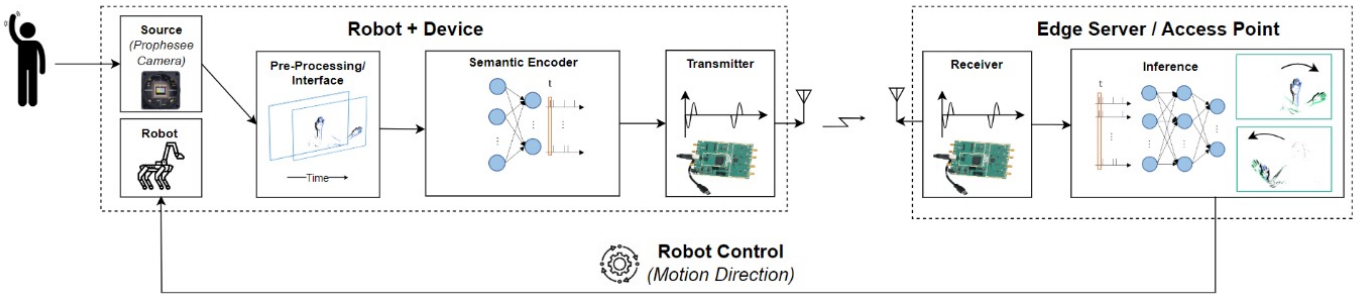
How could neuromorphic computing be integrated into device-edge co-inference in realistic scenarios?



Demo setup: (a) Architecture of device-edge co-inference for robotic control via gesture recognition, which integrates a neuromorphic sensor (event-based camera) capturing movements, on-device neuromorphic processor performing joint feature extraction (i.e. semantic coding) and channel coding, impulse-radio-based transmission/reception over a wireless channel, and neuromorphic processor for edge inference; (b) an illustration of the lab setup.

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KEY FINDINGS

Neuromorphic computing is emerging as a brain-inspired paradigm for low-power artificial intelligence on edge devices through event-based data processing. In the context of edge intelligence, the integration of neuromorphic computing and wireless communication provides a unique opportunity for the development of goal-driven, specialized, and hardware-constrained wireless cognition. In this paper, we present a proof-of-concept (PoC) implementation of an architecture for semantic-aware device-edge co-inference that integrates neuromorphic sensing, computing and impulse radio. To demonstrate the concept, we present a demo setup for gesture recognition in a robotic control application, as illustrated in (a). In the considered architecture, learning is performed in an end-to-end fashion via the directed information bottleneck principle, which allows to trade classification accuracy for communication overhead and implementation complexity.

Y. Ke, M. Heshmati, Z. Utkovski, J. Dommel and S. Stanczak, "PoC Implementation of Neuromorphic Wireless Cognition: Gesture Recognition for Robotic Control," 2024 IEEE International Conference on Machine Learning for Communication and Networking (ICMLCN), Stockholm, Sweden, 2024, pp. 1-2, doi: 10.1109/ICMLCN59089.2024.10624692. (won the best demo award)