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Title: Advanced Circuit Architectures and Systems for Distributed Intelligence

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Abstract: The rapid proliferation of edge devices, cyber-physical systems, autonomous platforms, and large-scale IoT infrastructures has fundamentally transformed how intelligence is computed and deployed. Traditional centralized cloud-based AI architectures are increasingly limited by latency, bandwidth, privacy, energy efficiency, and reliability constraints. As a result, distributed intelligence—where sensing, learning, inference, and decision-making are performed collaboratively across networked nodes—has emerged as a critical paradigm shift. While significant progress is made in creating smart AI algorithms and systems that can learn from each other, but there's still a big hole when it comes to the underlying technology that makes it all work. Basically, the circuits and systems that are developed aren't really built for this kind of distributed intelligence, where lots of devices are working together and sharing information in real-time. Most of the current hardware is just adapted from old centralized computing systems, which aren't ideal for collaborative, on-device, and federated intelligence. Hence there is a need for major innovations at the circuit and system level to make distributed intelligence scalable, secure, energy-efficient, and fast.



URL: <https://ieeexplore.ieee.org/document/11677081>

