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NEUROPIX: A neuromorphic computing framework for pixelated detector data processing

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We propose the NEUROmorphic computing framework for PIXelated detector data processing (NEUROPIX) framework, which will create a path for hardware development, enabling the development of integrated circuit (IC)-based neuromorphic platforms that can perform powerful classification, interpolation, and anomaly-detection tasks with low latency and power. We base this framework on spiking neural networks (SNNs), a type of network closely related to biological examples of neural networks, which can perform complex tasks with fewer parameters and connections—and, therefore, lower power—than other types of networks. Our goal is to provide the software infrastructure for the simulation, training, and deployment to field-programmable gate arrays (FPGAs) and advanced systems on integrated circuits (ASICs) of SNN algorithms for edge processing of pixel detector data and extraction with low latency of complex quantities, such as beam luminosity and position, that are relevant for experiments at particle colliders. Our work will demonstrate the need for this type of solution in modern detector systems; justify investment in a large-scale, neuromorphic hardware platform with increased polyvalence and processing capabilities; and motivate the integration of such systems in future HEP detectors.

Type of presentation (in-person/online)

in-person presentation

Type of presentation (I. scientific results or II. project proposal)

II. Presentation on project proposal

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