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Kalman Filter on IBM's TrueNorth

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As High Energy Physics (HEP) experiments extend the range of attainable luminosities to produce more particle tracks per bunch crossing than ever before, reconstructing the tracks produced in detectors from such interactions becomes more challenging and new methods of computation and data-handling are being explored.
Additionally, understanding portability of HEP algorithms to future commodity computing architectures is necessary to project future computing costs. A key algorithm in track reconstruction in multiple HEP experiments over the past 50 years is the Kalman filter. Implementing this algorithm in a neuromorphic architecture represents a first step in understanding the benefits and limitation of introducing such a device into the computational resources available to HEP experiments.

This talk will outline the first instance of a Kalman filter implementation in IBM's neuromorphic architecture, TrueNorth, for both parallel and serial spike trains. The implementation is tested on multiple simulated systems and its performance is evaluated with respect to an equivalent non-spiking Kalman filter. The limitations of implementing algorithms in neuromorphic neural networks are explored with respect to data encoding, weight representation, latency, and throughput.

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