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Unsupervised Particle Tracking with Neuromorphic Computing

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We study the application of a spiking neural network architecture for identifying charged particle trajectories via unsupervised learning of synaptic delays using a spike-time-dependent plasticity rule. In the considered model, the neurons receive time-encoded information on the position of particle hits in a tracking detector for a particle collider, modeled according to the geometry of the Compact Muon Solenoid Phase-2 detector. We show how a spiking neural network is capable of successfully identifying in a completely unsupervised way the signal left by charged particles in the presence of conspicuous noise from accidental or combinatorial hits, opening the way to applications of neuromorphic computing to particle tracking. The presented results motivate further studies investigating neuromorphic computing as a potential solution for real-time, low-power particle tracking in future high-energy physics experiments.

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