

## Impact of Non-Ideal Resistive Synaptic Device Behaviors on Neuromorphic System Performances

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**Abstract:** Nanoscale resistive memories have been proposed to emulate the synapses for neuromorphic computing. The crossbar array architecture with resistive synaptic devices is attractive for on-chip acceleration of weighted sum and weight update in the neuro-inspired learning algorithms. However, the nanoscale devices suffer from non-ideal effects such as limited precision and device variations, etc. This work will study their impact on neuromorphic system performances. Specifically, a device-algorithm co-simulation framework has been developed to quantify of the non-ideal synaptic device effects on the learning accuracy at the system-level. Benchmark is performed on multilayer perceptron algorithm for MNIST handwritten digits recognition. Key factors that affect the learning accuracy such as limited precision, nonlinearity in the weight update, limited on/off ratio, and device variations have been identified, and mitigation strategies have been proposed.