Intelligent Signal Processing by Neuromorphic Silicon Photonics

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Abstract | State-of-the-art AI algorithms, by and large, are implemented using neural networks, a computational architecture inspired by the neuro-synaptic architecture of the brain. Many new applications nowadays need neural networks to deliver gigahertz bandwidth and low-latency computing. These applications have tight requirements for high throughput, low energy, and low latency. There, the implementation of neural network algorithms in real-time remains a major challenge. Neuromorphic (i.e., neuron isomorphic) photonics [1] promises to tackle these challenges by developing radical new hardware platforms capable of emulating the neural structure of the brain using photonic devices and waveguides. Photonics has unrivaled capabilities for interconnects and communication that may overcome the bandwidth and interconnectivity tradeo®s that electronics essentially su®ers from. As a consequence, algorithms operating on neuromorphic photonic hardware may be able to overcome electronic performance bottlenecks and gain advantages in terms of speed, latency, and power consumption while addressing intellectual