Memristive Materials and Devices for Neuromorphic Computing

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Memristive devices\(^1\) have become a promising candidate to enable efficient computing\(^2\) for the big data and IoT era\(^3\). Such computing can be implemented on a Resistive Neural Network\(^4\) with memristive synapses\(^5\) and neurons\(^6\) or a Capacitive Neural Network\(^7,8\) with memcapacitive synapses and neurons. I will first briefly introduce the promises and challenges of memristive materials and devices for such applications and then discuss examples with different levels of bio-inspiration: first, deep learning accelerators\(^9\) with supervised online learning\(^10\), second, neuromorphic computing for pattern classification with unsupervised learning\(^6\); last, other computing applications, such as reinforcement learning\(^11\) for decision making, artificial nociceptors for robotics\(^12\), provable key destruction\(^13\) and true random number generators\(^14\) for cybersecurity.