Artificial Neurons Based on Memristors for Spiking Neural Networks

Authors : Yan Yu, Wang Yu, Chen Xintong, Liu Yi, Zhang Yanzhong, Wang Yanji, Chen Xingyu, Zhang Miaocheng, Tong Yi **Abstract :** Neuromorphic computing based on spiking neural networks (SNNs) has emerged as a promising avenue for building the next generation of intelligent computing systems. Owing to its high-density integration, low power, and outstanding nonlinearity, memristors have attracted emerging attention on achieving SNNs. However, fabricating a low-power and robust memristor-based spiking neuron without extra electrical components is still a challenge for brain-inspired systems. In this work, we demonstrate a TiO₂-based threshold switching (TS) memristor to emulate a leaky integrate-and-fire (LIF) neuron without auxiliary circuits, used to realize single layer fully connected (FC) SNNs. Moreover, our TiO₂-based resistive switching (RS) memristors realize spiking-time-dependent-plasticity (STDP), originating from the Ag diffusion-based filamentary mechanism. This work demonstrates that TiO2-based memristors may provide an efficient method to construct hardware neuromorphic computing systems.

Keywords : leaky integrate-and-fire, memristor, spiking neural networks, spiking-time-dependent-plasticity **Conference Title :** ICAIE 2022 : International Conference on Artificial Intelligence and Education **Conference Location :** Singapore, Singapore

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