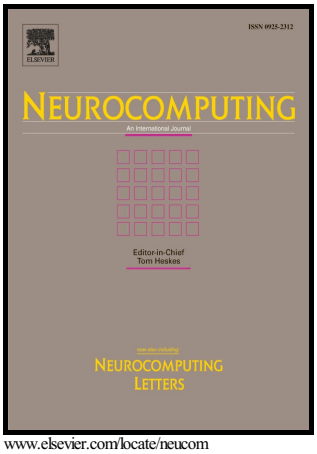

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Modeling Affections with Memristor-Based Associative Memory Neural Networks

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Abstract:

Implementing compact and energy-efficient synaptic elements using nanoscale memristors has elicited widespread interest in building neural network circuits. Not only can the memristive neural network offer powerful computation capability, but it also exhibits intelligent behaviors such as cognition and associative memory. In this paper, a memristor-based associative memory neural network (M-ASNN) with properties of associative memory and memory losing is designed and further used to reflect some human affections in social relationships. Specifically, a voltage-controlled memristor model with a programming threshold and forgetting property is proposed and employed as the 1M (memristor) electronic synapse. Such a memristor synapse can learn and store information, and is plastic to the activities of its presynaptic and postsynaptic neurons, like biological synapses. Furthermore, an M-ASNN consisting of the memristor synapse as well as inhibitory and excitatory neurons is built to model the forming, keeping and losing of some affections in social relationships. Finally, an analog implementation of the M-ASNN based on PSPICE is presented and simulated. The novel modeling and implementation of human affections using memristor devices may create new opportunities for affection computing as well as applications of memristive neural networks.

Keywords: Memristor; associative memory; memory losing; PSPICE analog implementation