Neuromorphic perceptual devices toward artificial intelligence

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Abstract

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Sensory neurons form an interface between the external physical reality and inner perception. This interface enables sensory information to be organized identified, and interpreted through perceptual learning—the process whereby the sensing abilities improve through experience.[1] Hardware representations that emulate the functionality and/or structuralism of the neural circuits would potentially address current unmet needs in software representations.[2, 3] Although most of the bioinspired hardware representations do not access data directly, biological systems collect, refine and process data from the real-world, while organizing, identifying, and interpreting information as abstractive perception.[4, 5] Here, a neuromorphic perceptual device that can integrate and differentiate the spatiotemporal features of sensory patterns for recognition is shown. The system comprises sensing, transmitting, and processing components that are parallel to those found in a sensory neuron. Bioinspired sensors convert physical stimuli into electric signals, which are transmitted to a synaptic transistor through interfacial ionic/electronic coupling via a soft ionic conductor. The integrated currents could differentiate the temporal interaction between the stimuli, which could be utilized for recognition. This work represents a step toward the design and use of neuromorphic electronic skin with artificial intelligence for future robotics and prosthetics.

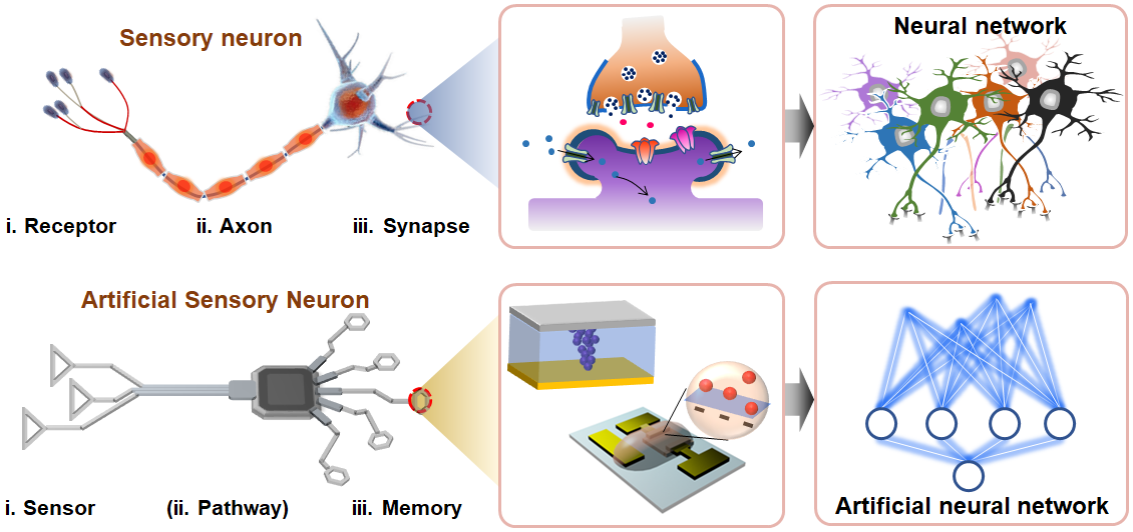

Figure 1: The comparison of artificial sensory memory and sensory neuron. The artificial sensory memory could be acted as the building block of the sensory processing artificial neural network, just as the sensory neuron in the neural network that collects, refines and preprocesses sensory information and transmit them to high order neurons for further processing.

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