Title: Networking brain and silicon spiking neurons with nanoscale memristors: first steps, next challenges and perspectives for brain-machine interfaces

Abstract

Neural interfaces for recording and stimulation of brain neurons are experiencing a dramatic development, boosting large-scale and high-density implementations that represent an ideal bi-directional gateway to micro- and nanoelectronic devices emulating fundamental properties of neurons, such as action potential firing and synaptic plasticity. Thus, in perspective, a new concept of brain-machine interfacing may emerge where brain and silicon neurons are physically connected for seamless spike-based computation, and differently from current signal processing approaches based on Von Neumann machines. As a first step in this direction, we will present results in vitro from the RAMP project (http://www.rampproject.eu/) where nanoscale memristors are used as part of synaptic-like elements between biological and very-large integration spiking neurons. We show that memristors can mimic synapses in compressing information on spikes occurrence and with minimal power consumption and emulate plasticity across an elementary biohybrid network.