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Neuromorphic computing with spin-torque nano-oscillators[1]

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The brain displays many features typical of non-linear dynamical networks, such as synchronization or complex transient behaviour. These observations have inspired a whole class of models that harness the power of complex non-linear dynamical networks for computing. In this framework, neurons are modeled as non-linear oscillators, and synapses as the coupling between oscillators. These abstract models are very good at processing waveforms for pattern recognition. However there are very few hardware implementations of these systems, because large numbers of interacting non-linear oscillators are indeed. Magnetic nano-devices, and in particular spin-torque oscillators are interesting in this context because of their tunability combined with their small size, CMOS compatibility, endurance and speed [2]. In this talk, I will show different ways of leveraging the non-linear dynamics of spin-torque nano-oscillators for neuromorphic computing, and present our first experimental results of speech recognition.

[1]ERC grant bioSPINspired 682955

[2]J. Grollier, D. Querlioz, M.D. Stiles, Spintronic nanodevices for bioinspired computing, PIEEE 104, 2024 (2016)