Python Tools for Neuromorphic Systems Configuration

E. Neftci, F. Stefanini, S. Sheik, E. Chicca, G. Indiveri

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In the past recent years several research groups have proposed neuromorphic Very Large Scale Integration (VLSI) devices that implement event-based sensors or bio-physically realistic networks of spiking neurons. It has been argued that these devices can be used to build event-based systems, for solving real-world applications in real-time, with efficiencies and robustness that cannot be achieved with conventional computing technologies.

In order to implement complex event-based neuromorphic systems it is necessary to interface the neuromorphic VLSI sensors and devices among each other, to robotic platforms, and to workstations (*e.g.* for data-logging and analysis). This apparently simple goal requires painstaking work that spans multiple levels of complexity and disciplines. Within this context, we developed a framework named pyNCS (python Neuromorphic Cognitive Systems) to simplify the configuration of multi-chip neuromorphic VLSI systems and the definitions of network architectures [1].

In pyNCS, emphasis is given on modularity and applicability to general multi-chip systems. A set of XML files describes the neuromorphic setup and the chips, which greatly simplifies the specification of neuromorphic setups of any kind.

The pyNCS framework is developed entirely in Python, and features practical address specification definition (for the translation between raw (hardware) and neural addresses); abstraction of neurmorphic neural populations and connections by dedicated software classes; spiketrain analysis and plotting (via NeuroTools); real-time chip activity monitoring; communication of hardware events over a network interface; systematic tuning of the network parameters and inter-operability with pyNN (in progress).

References

[1] Sadique Sheik, Fabio Stefanini, Emre Neftci, Elisabetta Chicca, and Giacomo Indiveri. Systematic configuration and automatic tuning of neuromorphic system. In *International Symposium on Circuits and Systems, ISCAS 2011*. IEEE, 2011. submitted.