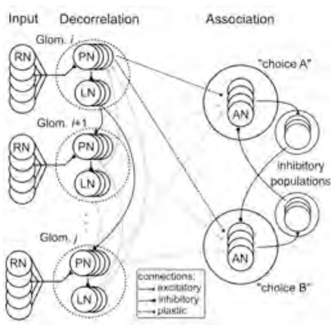
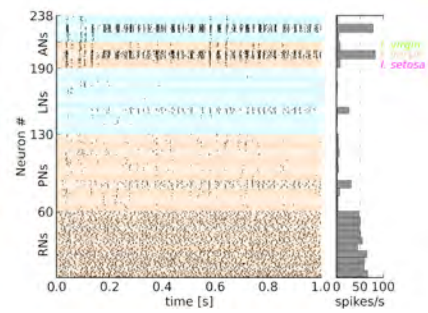
Computational Neuroscience Seminar

Multivariate Data Classification on Neuromorphic Hardware





Michael Schmuker

Bernstein Center for Computational Neuroscience Berlin
http://biomachinelearning.net/

Monday, October 14, 2013
4:00-5:00pm
Fung Auditorium, Powell-Focht Bioengineering Building
University of California San Diego

Abstract: Computational neuroscience has uncovered a number of computational principles employed by nervous systems. At the same time, recent neuromorphic hardware provides a fast and efficient substrate for implementations of complex neuronal networks. The current challenge for practical neuromorphic computing applications lies in the identification and implementation of functional algorithms solving real-world computing problems. Taking inspiration from the olfactory system of insects we constructed a generic spiking neural network for the classification of multivariate data, a common problem in signal and data analysis. Our network combines the parallel processing of multiple input dimensions, their decorrelation through lateral inhibition, and supervised learning of data classification. The network runs on an accelerated mixed-signal neuromorphic hardware system. When challenged with real world data sets the network achieves classification performance on the same level as a Naive Bayes classifier. Analysis of the network dynamics shows that stable decisions in output neuron populations are reached within less than 100ms of biological time, which compares well to the time-to-decision reported for the insect nervous system. The network tolerates the variability of neuronal transfer functions and trial-to-trial variation that is inevitably present on the hardware system. Our work provides a proof of principle for the successful implementation of a functional spiking neural network on a configurable neuromorphic hardware system that can readily be applied to real-world computing problems.

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