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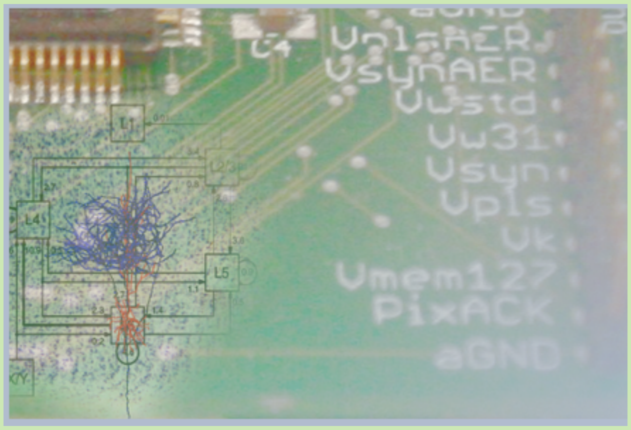
Friday, October 13, 2017
Sakamaki A103
2:30-3:30

Manoa lecture series on Machine Learning and Computational Neuroscience:

Neuro-computing and neuromorphic information processing systems

Artificial computing systems are vastly outperformed by biological neural processing ones for many practical tasks that involve sensory perception and real-time interactions with the environment, especially when size and energy consumption are factored in. One of the reasons is that the architecture of nervous systems, in which billions of neurons communicate in parallel mainly via asynchronous action potentials, is very different from that of today's mainly serial and synchornous logic devices and systems. Recent machine learning algorithms have taken inspiration from the nervous system to develop neuro-computing algorithms that are showing state-of-the-art performance in pattern recognition tasks. In parallel, different types of brain-inspired hardware architectures are being developed that reproduce some of the principles of computation used by the nervous system. These architectures represent a promising technology for both implementing the latest generation of neural networks, and for building faithful models of biological neural processing systems.

In this tutorial I will cover the design of spiking neuron circuits, synapses that exhibit biologically plausible dynamics and spike based learning mechanisms. I will present examples of spike-based neural network architectures that can be used to implement real-time models of cortical circuits and show examples of applications that can best exploit their ultra-low power real-time signal processing and learning properties.



Giacomo Indiveri is a Professor at the Faculty of Science of the University of Zurich, Switzerland, and director of the Institute of Neuroinformatics of the University of Zurich and ETH Zurich. He was awarded an ERC Starting Grant on "Neuromorphic processors" in 2011 and an ERC Consolidator Grant on neuromorphic cognitive agents in 2016. His research interests focus on spike-based learning and selective attention mechanisms. His research and development activities focus on the full custom hardware implementation of real-time sensory-motor systems using analog/digital neuromorphic circuits and emerging VLSI technologies.