University of California, Irvine
Statistics Seminar

Stochastic Neurons and Synapses Enable Power-Efficient Brain-Inspired Learning Machines

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(Bldg. #314 on campus map)

Brain-inspired computing strives to synthesize artificial neural systems that mimic the brain's cognitive and adaptive abilities to investigate the mechanisms of neural computation and guide novel, ultra-low power computing technologies. An ongoing challenge is to devise general and computationally efficient models of inference and learning which are compatible with the spatial and temporal constraints in the brain. Principles in statistical machine learning, a field that is continuously breaking new grounds in tackling complex cognitive tasks at unprecedented proficiencies, can provide invaluable guidance at tackling this challenge. Using these principles, I will show how the stochastic nature of biological neurons and synapses can provide the blueprint for inference and learning machines. Learning is achieved by local synaptic plasticity rules that implement gradient-based methods reaching performances that are comparable with equivalent machine learning algorithms. The event-driven nature of neural computation combined with the locality of these plasticity rules enable extremely sparse and efficient communication. Together with the recent breakthroughs in deep recurrent neural networks and the synthesis of cognitive capabilities in neuromorphic hardware, these advances can enable the self-organization of pattern recognition, attention, working memory and action selection mechanisms, which promise transformative neural emulations capable of near human-level cognitive tasks at brain-level performance and power.

For directions please refer to http://www.ics.uci.edu/about/visit/formation please contact Lisa Stieler at lstieler@uci.edu