LABORATORY OF COMPUTATIONAL NEUROSCIENCE (LCN)

Prof. Wulfram Gerstner
EPFL – IC & SV– LCN
SG –AAB119 (Bâtiment SG-AAB)
Station 15
CH - 1015 LAUSANNE, Switzerland

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Wednesday, May 23rd, 2012
10h30, Room SV 2615

Computational Neuroscience Seminar

Volker PERNICE,

Bernstein Center Freiburg

From networks to spike train covariances and back

Spike train covariances are a widely studied phenomenon due to their ubiquity and their relation to neural network dynamics and function. In a framework of linearly interacting Hawkes processes, the origin of covariances can be attributed to direct and indirect connections. Simulations of networks of leaky integrate-and-fire neurons show that the linear framework can be used to approximately describe also the dynamics of more complicated neuron models. The applicability of a linear description is limited by the stability of the corresponding linear system.

The inverse problem of inferring network structure from covariances can generally not be solved unambiguously, because indirect connections give rise to covariances. However, using sparseness as a constraint, a natural approach is to search for the minimal network of linear couplings consistent with measured covariances. The resulting estimate of the underlying network is directed, even if only a symmetric matrix of count covariances is known. The reconstruction appears to be most successful if connections are neither exceedingly sparse nor dense. Time dependent coupling kernels can be obtained if the full matrix of covariance functions is known, as can be demonstrated from simulated spike trains.