replacing MAR16-2015-001901 Abstract Submitted

for the MAR16 Meeting of
The American Physical Society

From Maximum Entropy Models to Non-Stationarity and Irreversibility[1] RODRIGO COFRE, Department of Theoretical Physics, University of Geneva, Switzerland, BRUNO CESSAC, Inria, Neuromathcomp team, CESAR MALDONADO, Centro de Modelamiento Matematico, Universidad de Chile

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The maximum entropy distribution can be obtained from a variational principle. This is important as a matter of principle and for the purpose of finding approximate solutions. One can exploit this fact to obtain relevant information about the underlying stochastic process. We report here in recent progress in three aspects to this approach.

1- Biological systems are expected to show some degree of irreversibility in time. Based on the transfer matrix technique to find the spatio-temporal maximum entropy distribution, we build a framework to quantify the degree of irreversibility of any maximum entropy distribution.

2- The maximum entropy solution is characterized by a functional called Gibbs free energy (solution of the variational principle). The Legendre transformation of this functional is the rate function, which controls the speed of convergence of empirical averages to their ergodic mean. We show how the correct description of this functional is determinant for a more rigorous characterization of first and higher order phase transitions.

3- We assess the impact of a weak time-dependent external stimulus on the collective statistics of spiking neuronal networks. We show how to evaluate this impact on any higher order spatio-temporal correlation.

[1]RC supported by ERC advanced grant "Bridges", BC: KEOPS ANR-CONICYT, Renvision and CM: CONICYT-FONDECYT No. 3140572

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Date submitted: 05 Nov 2015 Electronic form version 1.4