



NYU-ECNU Institute of Mathematical Sciences at NYU Shanghai

WEEKLY SEMINAR

Topic: Optimal Heterogeneity for Coding in Spiking Neural Networks

Speaker: Dr. Jorge Mejias, Postdoctoral Associate at New York University

Time: 14:30-16:30, 30 October 2013

Venue: Room 153, Geography Building, 3663 Zhongshan Road North, Shanghai
(华东师范大学中山北路校区, 地理楼 153 室)

ABSTRACT OF THE TALK

When modeling many natural networked systems, the nodes of the network are often treated, for simplicity, as if they were identical. This is also the case when building models of neural networks: each neuron in the network is described using the same parameter values, so that the dynamics of each individual neuron is the same as the dynamics of its neighbors. However, real neurons display intrinsic differences in their properties --even neurons belonging to the same class and located in the same brain area. Moreover, the effect that such heterogeneity might have in the dynamics of the neural network has not been fully understood up to date. Here, I present a theoretical and numerical study of the implications of heterogeneity in the dynamical properties of neural populations. We find that the presence of heterogeneity in neural properties allows for an easier network synchronization, and the degree of heterogeneity is also nonlinearly related to the resulting mean activity of the neural network. In addition, we find that a moderate level of heterogeneity is able to optimize the transmission of information across neural populations, employing either rate coding or temporal coding -- two well-known information transmission strategies used by neurons. Our results indicate that, far from being a nuisance, neuron-to-neuron heterogeneity plays an active role in neural computations and it optimizes the transmission of information in neural populations using coding strategies thought to occur in many brain areas.

BIOGRAPHY

Dr. Jorge Mejias received a Physics Degree and a Master in Mathematical Biology from the University of Granada, Spain. He also obtained a PhD in Computational Neuroscience from the same university in 2009, under the supervision of Prof. Joaquin Torres. During his PhD training, he also enjoyed several research stays at the University of Paris V, working under the supervision of Prof. Nicolas Brunel. After a three-year postdoctoral stay in the lab of Prof. Andre Longtin in the University of Ottawa in Canada, he is now a postdoctoral associate at New York University, working in the group of Prof. Xiao-Jing Wang on large-scale brain models and related Computational Neuroscience problems.