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SEIT 1386

STRUCTURES JOUR FIXE

ANA MILLAN

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“Interplay between structure and
function during brain development”

08 November 2019 11:30 AM

Room 106, Philosophenweg 12
Contact: office@structures.uni-heidelberg.de



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ABSTRACT

Brain networks are highly dynamic in time, with connections being created and removed according to physiological activity. This is of major relevance during infancy and adolescence, when an extensive process of synaptic pruning takes place in the brain. Synaptic pruning plays a major role in brain development, where it is believed to provide an optimal compromise between network efficiency and energy consumption, and it may have large implications on high-level brain functions and on the emergence of some neurodevelopmental disorders such as autism and schizophrenia. Here we present a co-evolving model of brain development and synaptic pruning that couples a classical attractor neural network with a preferential attachment model for network evolution.

The proposed model reproduces experimental profiles of synaptic density and shows the emergence of a feedback loop between activity and structure that strongly increases noise tolerance. Moreover, the inclusion of a transient time of high connectivity, as it occurs during brain development, enhances the memory capabilities of the system. Here I will present the emergent behavior of the system and its possible implications for brain development and its emergent cognitive capabilities.

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FEDERICO BATTISTON

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“New emergent behavior in
networks with higher-order
interactions”

08 November 2019 11:30 AM

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ABSTRACT

Networks constitute the backbone of many complex systems, on top of which collective behavior can emerge: from epileptic seizures in the human brain to the viral spread of rumours in a social network. When are simple network representations not enough? In this talk I introduce classes of higher-order models of networks, richer architectures which allow to consider the temporal and multiplex dimensions of relationships, and to go beyond simple pairwise interactions.

Building on my contributions to the field, I focus on how to measure multiplexity in real-world systems from the micro to the macro scale, with examples from social, transportation and biological networks. I will then provide a short perspective on dynamical processes on higher-order networks, searching for new emergent collective behavior and warning against overly optimistic statements associated to the multiplex, temporal and non-dyadic nature of interactions.

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