Bocconi

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Zoom meeting
(Streaming in Bocconi University
Room 3-E4-SR03
Via Röntgen 1, Milano, 3° floor)

Mechanisms for the brain-wide dynamics of functional networks through communication subspaces

Speaker

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Abstract

Recent neural recordings with high density probes have shown that neural activity spans a number of dimensions much lower than the number of recorded neurons. This low-dimensional dynamics can be persistent in time for some areas while transient in others. Strikingly, co-activated areas change on task demands, generating functional networks that correlate with behavior and internal processes across the brain. What are the mechanisms for the brain-wide dynamics of functional networks? We hypothesized that low-dimensional neural activity is routed through communication sub-spaces that can flexibly configure functional networks.

Here we present a theoretical framework where we explore this hypothesis in multiregional network models of the mammalian cortex. We model each brain region as a recurrent neural network with a mixture of symmetric, asymmetric, and random connectivity. Depending on the alignment of the long-range projections with the local symmetric and asymmetric connectivity, multiple functional networks can be embedded in the multi-regional dynamics. The dynamics of the functional networks can be persistent or transient depending on this alignment. Importantly, we show that low-dimensional dynamics can be flexibly routed by sub-cortical inputs that effectively create communication sub-spaces aligning the local symmetric and asymmetric connectivity depending on task demands. We applied our framework to the mouse, monkey, and human anatomical data recapitulating several known results on brain-wide activity in electrophysiological and imaging experiments.

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