Topological organization of neural networks

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Neural networks serve as data summaries and dynamic models of neural activity in the brain. Recently, methods from topological data analysis have been used to gain insights into the structure of such networks, using various types neural activity data. In this talk, we will turn our attention to how network structures uncovered by topological methods might shape dynamics. We will illustrate these ideas in the context of threshold-linear networks of simple neurons, whose dynamics are controlled purely by the pattern of connectivity as defined by a directed graph. This enables us to study directly the role of connectivity in shaping network dynamics, without worrying about effects stemming from the intrinsic properties of neurons. Here we find some interesting connections between topologically-relevant features of the network structure and its dynamic attractors. We also identify some aspects of the connectivity that are not picked up by standard tools, but may be amenable to new types of topological analyses.