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Topological structure in the study of ablation and desynchronization in neural networks.

Here we explore burst-synchronizing neural networks using tools from simplicial homology. We show that the algebraic and topological features of a biological neural network can provide helpful information about which synapses might be important in maintaining the synchrony of the network and which can be removed with negligible impact on the behavior of the system. We do this by constructing a simplicial complex from the connection matrix of a given neural network and by looking at the structure of this network in this new perspective we can see which synapses can be ablated but still preserve the homology of the simplicial complex and explore how synapses essential to the homology of the complex may also play an important role in maintaining the synchrony of the network. In collaboration with Prof. Sarah Day and Prof. Drew LaMar we model the synchronized bursting behavior of the pre-Bötzinger complex and demonstrate examples of how the topological features of the network may tell us how the organization of connections is essential to the system's global behavior. (Received July 27, 2018)