Dynamics of cooperative neuronal networks depending on their associated graphs.

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Abstract

We investigate the dynamics of abstract neuronal networks modelled as impulsive differencial equations on arbitrarily large dimensions, mutually coupled by impulses. In particular, we study the dynamics that is induced
by the graph of impulsive interactions, for certain classes of graphs.
The methodology of research is mathematical with rigorous proofs based on the mathematical theory of dynamical
systems and the theory of graphs.

The main tool we use is the consideration of the pulses ocurring in the whole network during certain time interval. For strongly connected graphs we prove that every neuron fires infinitely many times.
For complete graphs we find an optimal lower bound on the network size that ensures the existence
of the so called "grand coalition". Also, if the graph is not complete but each neuron has enough
connections, the grand coalition is still present. Finally, we construct extensions from the strongly
connected and star-shaped graphs that also imply the existence the grand coalition.

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