Controllability of complex networks

Sandro Zampieri

Università di Padova

In this this talk we will deal with the problem of controlling complex networks, that is, the joint problem of selecting a set of control nodes and of designing a control input to drive the network to a target state. We adopt the smallest eigenvalue of the controllability Gramian as metric for the controllability degree of a network, as it identifies the energy needed to accomplish the control task. In the first part of the talk we characterize the tradeoff between the control energy and the number of control nodes, based on the network topology and weights. Our bounds show for instance that, if the number of control nodes is constant, then the control energy increases exponentially with the number of the network nodes. Then, despite the classic controllability notion, few nodes cannot arbitrarily control complex networks. In the second part of the talk we propose a distributed strategy with performance guarantees for the control of complex networks. In our strategy we select control nodes based on network partitioning, and we design the control input based on optimal and distributed control techniques. For our control strategy we show that the control energy depends on the controllability properties of the clusters and on their coupling strength, and it is independent of the network dimension.