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Targeted Control of Complex Networks JIANXI GAO, Center for Complex Network Research and Department of Physics, Northeastern University, Boston, Massachusetts 02115, YANGYU LIU, Center for Cancer Systems Biology, Dana-Farber Cancer Institute, Boston, Massachusetts 02115, RAISSA M. D'SOUZA, Complexity Sciences Center,Department of Mechanical and Aerospace Engineering, and Department of Computer Science, University of California, Davis, CA, ALBERT-LASZLO BARABASI, Center for Complex Network Research and Department of Physics, Northeastern University, Boston, Massachusetts 02115 — Network controllability is typically formulated as the ability to drive an entire network from any initial state to any desired final state in finite time, using a minimum number of inputs. However, in many circumstances it is neither feasible nor necessary to control the entire network. This prompts us to explore how to efficiently control a subset of nodes in a network, i.e., "targeted controllability." We develop an alternate "k-walk" theory based on the fact that a single node can control a set of nodes provided the path length from the control node to each target node is unique. For the general case, we develop a greedy algorithm, based on k-walk theory, to identify the approximate minimal set of necessary driver nodes. We demonstrate that partial controllability has fundamentally different features when compared to full controllability. For example, we find that degree heterogeneous networks can be partially controllable with higher efficiency than degree homogeneous networks. Moreover we show that the structures of many real-world networks are highly efficient for targeted control.

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