Exploring Network Communities with Random Walks ADITYA
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Physics, Rutgers University — Communities within a network are sets of nodes
such that the nodes within each set are connected more densely internally than
with nodes outside the set. Community structures are very common in real-world
networks such as social or biological networks. Detecting community structures is
equivalent to clustering which is of interest in many areas of science. We propose a
computationally efficient method, based on random walks, for community detection
and clustering on undirected networks with weighted or unweighted edges. The
method employs first-passage properties of random walks on networks, providing key
statistics of network community structure such as the number of communities and
the size of each community. Our method provides a complete hierarchy of clusters
which is determined by the strengths of connections between them. Surprisingly,
some of the key statistics can be obtained after exploring only a small fraction of
nodes which is relevant to very large real-world networks. We have used this method
to cluster biological networks such as gene co-expression networks.

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