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A Link Clustering based Memetic Algorithm for Overlapping Community Detection

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Abstract: Community detection has attracted plenty of attention in the field of complex networks recently, since communities often play important roles in networked systems. Overlapping communities are one of the characteristics of social networks, describing the phenomenon that a node may belong to more than one social group. Thus, it is necessary to find overlapping community structures for realistic social network analyses. In this paper, we propose a link clustering based memetic algorithm for detecting overlapping communities. Since links usually represent the unique relationships among nodes, link clustering can find link groups with the same characteristics. As a result, nodes are naturally partitioned into multiple communities. The proposed algorithm optimizes a modularity density function which is able to identify densely connected groups of links on the weighted line graph modeling the network, and then maps link communities to node communities based on a novel genotype representation. In our method, the number of communities can be automatically determined. Experimental results on general and sparse networks show that our method can successfully detect overlapping community structures and almost all the overlapping nodes.

Keywords: Community detection; Overlapping community; Memetic algorithm; Link community.

I. Introduction

The community structure is considered to be an important attribute of real-world social networks because it usually represents for the functionality of a system. Community detection divides a network into groups of nodes, where nodes are densely connected inside but sparsely connected outside. However, it is well known that people in social networks naturally have the characteristics of multiple community members. For example, a person is usually associated with social groups such as family, friends, and college; researchers may be active in several areas. Kelley *et al*. [1] and Reid *et al*. [2] showed that the overlapping is indeed a significant feature of many real-world social networks. For this reason, there is growing interest in studying overlapping community detection algorithms that can identify a set of

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