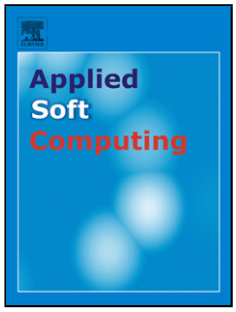

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Multi-objective community detection algorithm with node importance analysis in attributed networks

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Highlights

- Multi-objective setting to reveal different types of community properties.
- Incorporating nodes' attribute information to use stronger discrimination power.
- Estimating the nodes interactions to shape more meaningful communities.
- Outperforming rival algorithms remarkably in terms of homogeneity and modularity.

Abstract

Community detection is the act of grouping similar nodes while separating dissimilar ones. The utility of conventional algorithms are limited as they consider a structure based, single objective formulation in which, nodes are treated with the same importance. However, in real networks such as LinkedIn, nodes are not only connected through their structural properties, but also using their associated attributes. In addition, in real networks nodes interact, and this interaction causes some nodes be more important than others. However, conventional algorithms for community detection, do not consider the interactions exists amongst nodes and therefore their utility is limited. To overcome such limitations, this paper introduces a novel Multi-objective Attributed community detection algorithm with Node Importance Analysis (MANIA). The proposed algorithm considers, (i) two objective functions to evaluate the suitability of communities from structure and attribute perspectives, (ii) incorporates nodes' attribute information to benefit from their stronger discrimination power and (iii) estimates nodes' importance using, convergence degree and topology potential field. To prove the efficiency of MANIA, its performance is experimentally tested and compared against other novel community detection algorithms using five real-world datasets in terms of homogeneity and modularity objective functions. The comparisons indicate that MANIA detects more meaningful and interpretable communities and significantly outperforms the rivals.

Keywords: Harmony search; Multi-objective community detection; Node importance analysis; Pareto envelop-based selection algorithm; Topology potential field.