

A type-2 fuzzy community detection model in large-scale social networks considering two-layer graphs

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Abstract

This paper mainly aims to identify communities with different interactions between nodes in complex networks. Community detection algorithms partition vertices into densely-connected components in a complex network. In recent researches, a node is related to multiple aspects of relationships resulting in new challenges in social networks. The two aspects of relationships could be shown as a two-layer graph which comprises two graphs dependent on each other; and each graph shows a specific aspect of the interaction. In this research, a new community detection model is proposed based on the possibilistic c-means clustering model considering two-layer graphs (PCMTL) in order to detect overlapping communities based on the two-layer graphs using both structural and attribute similarities in large-scale social networks. The nodes are assigned to communities by upper and lower membership values that are indicative of the degree of belonging to the communities through type-2 fuzzy membership values, and the suggested values of interval type-2 fuzzy membership determine how a node belongs to a community with regard to two different aspects of interactions in a two-layer graph. Moreover, according to the proposed model, a validity index is introduced to assess the suggested model in comparison to the approach existing in the literature. Ultimately, two artificial and two real large-scale social networks are used to validate the performance of the suggested model.

Keywords: Community detection, Overlapping communities, Structural/attribute similarities, Two-layer graph, Type-2 fuzzy clustering.