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Ranking the spreading capability of nodes in complex networks based on link significance

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Abstract: Evaluating the spreading capability of nodes in complex networks is highly significant for understanding the spreading behavior in complex networks. Recent studies showed that the degree centrality and the coreness centrality can effectively evaluate the spreading capability of nodes. However, specific network topologies significantly decrease the effectiveness of these two metrics. In this paper, we propose a new method called LS method. The LS method distinguishes the importance of the different edges of the node during the spreading process and figures out a new way to rank the spreading capability of nodes. Simulation experiments on real networks show that the proposed method is more efficient and more versatile than the degree centrality and the k-shell decomposition algorithms. Unlike other improved methods, the LS method does not need to compute any empirical parameter, which means the LS method is more efficient than these improved methods.

Keywords: spreading capability, complex network, link significance

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1. Introduction

The main purpose of different networks – the Internet, human social networks, mail communication networks, scientific collaboration networks [1-4] – is to connect human beings. The goal of these networks is to spread and expand – whether it is information, ideas, disease, or computer virus. Traditional techniques of network analysis have given rise to different metrics for measuring the importance of a node in terms of how influential a node is.

The most common measure for measuring the importance of a node is the centrality, such as the degree centrality [5], betweenness centrality [6,7], closeness centrality [8] and eigenvalue centrality [9,10]. The spreading capability of a node is used to quantify the influence of the node in spreading process, and nodes with high centrality are considered to have high spreading capability. Other algorithms such as the HITS algorithm [11], the PageRank algorithm [12,13] and the LeaderRank algorithm [14] have also applied to measure the spreading capability of nodes in directed networks. Degree centrality is a simple and effective way among these measures. But the degree centrality only counts the number of neighbors a node has, and does not take into account the importance of these neighbors – this might affect the spreading capability of a node. For example, a node connected to three nodes

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