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Link prediction in complex networks based on an information allocation index

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HIGHLIGHTS

- A generalized information-theoretic model has been proposed.
- The concept of information allocation has been proposed and introduced to link prediction.
- A new index with better overall performance has been designed.

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ABSTRACT

An important issue in link prediction of complex networks is to make full use of different kinds of available information simultaneously. To tackle this issue, recently, an information-theoretic model has been proposed and a novel Neighbor Set Information Index (NSI) has been designed. Motivated by this work, we proposed a more general information-theoretic model by further distinguishing the contributions from different variables of the available features. Then, by introducing the resource allocation process into the model, we designed a new index based on neighbor sets with a virtual information allocation process: Neighbor Set Information Allocation Index(NSIA). Experimental studies on real world networks from disparate fields indicate that NSIA performs well compared with NSI as well as other typical proximity indices.

1. Introduction

Link prediction in complex networks, which aims at estimating the existence likelihood of a link based on available information [1–3], has received extensive attention from researchers in disparate scientific fields in recent years due to its theoretical and practical significance [4–6]. Link prediction can find applications in many areas. For example, in biological networks such as food webs, protein–protein interaction networks and metabolic networks, the existence of a new link has to be determined by experiments, which can be very costly if we blindly check all possible interactions. However, the costs can be sharply reduced if we focus on the most likely existing interactions provided by accurate prediction [7,8]. In online social networks, link prediction can help users to find new friends by recommending promising friendships to them [9,10]. Besides, it also plays an important role in evaluating network evolving mechanisms [11]. Although many models have been proposed to mimic the evolution of real world networks [12–15], it is usually very difficult or even impossible to fairly evaluate which one is the best. In this situation, link prediction can provide the likelihood of the currently observed network driven by each model, thus makes it possible to quantitatively compare their goodness [11].

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