관찰되지 않은 네트워크에서 노드 쿼리 도움 기반 영향력 최대화

Node Query-Aided Influence Maximization in Unobservable Networks

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Abstract

The influence maximization (IM) problem aims at identifying a set of seed nodes in the sense of maximizing the influence spread in a network. More recently, researchers have paid attention to a more challenging IM problem where the structure of the underlying network is initially unknown. In this paper, we present IM-META, an end-to-end framework for effectively solving the IM problem in unknown networks using node queries aided by nodal metadata.

Ⅰ. Introduction

In real-world applications of influence maximization (IM) [1], we often encounter the case where the network structure is initially unknown [2]. In such a case, an influence maximizer may identify a set of the most influential seed nodes by exploring only a part of the underlying network given a small budget for node queries. Motivated by the fact that collecting metadata of nodes such as node features is much more cost-effective than investigating the relationship between nodes via queried nodes in many practical situations, we introduce an end-to-end framework for effectively solving the IM problem in unknown networks.

Ⅱ. Methodology

In our study, we aim at retrieving information from jointly discovering a sequence of node queries and a set of nodes maximizing the influence spread. Unlike the conventional setting of IM [1], our problem is ill-defined due to the uncertainty of the unexplored part that is not obtained from node queries. To resolve this issue, we design a framework making full use of the available nodal metadata by iteratively performing three steps: 1) learning the relationship between collected metadata and edges via a Siamese neural network model, 2) constructing a reinforced weighted graph by selecting only a limited number of confident edges, and 3) discovering the next node to query using the proposed topology-aware ranking strategy balancing between degree centrality of a target node and its geodesic distance to potential seeds. The finally reinforced weighted graph is used as input of a modified greedy IM algorithm, which aims to find a set of seed nodes.

Ⅲ. Experimental Results

Fig. 1 shows the performance comparison between our proposed IM-META and competitive methods, namely Rand, NF-only, and CHANGE with respect to the expected influence spread σ, using four real-world networks (i.e., CS, Physics, Douban, and Ego-Facebook) given the number of node queries, T. The result illustrates the superiority of our method.

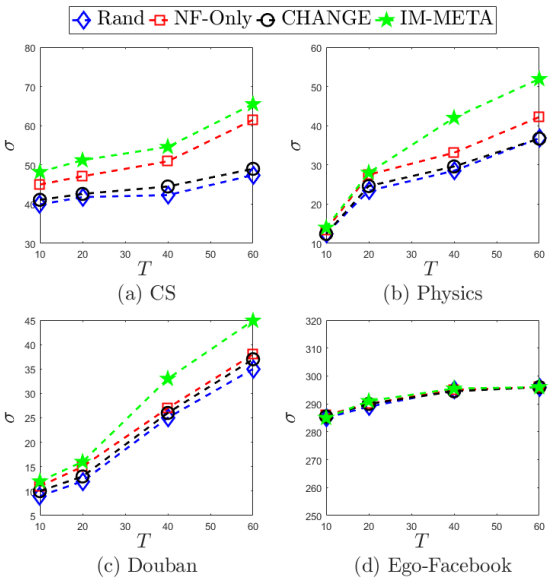

Figure 1. Experimental results

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