Abstract

Network science has emerged as a fast-expanding research area in the last decade and has brought significant advances to our knowledge about the modern science of graphs. It includes the study of social networks that have gained attention from researchers due to the abundance of its data on the web. The rapid increase in the number of users to the social platforms (such as Facebook, Twitter, Instagram, and other blogs, dating sites, friends making sites) provided by the web has shown unseen human relationships and motivated the researchers to use this to extract meaningful information. This thesis deals with the two important challenges of social network analysis (also of dynamic/complex networks analysis): *Influence Maximization and Link Prediction*.

Influence Maximization is the problem of finding a small set of highly influential users in the social networks. The influence spreads according to an explicit influence propagation model. Influence Maximization is an essential component in many applications such as Network Monitoring and Viral Marketing. In this thesis, we study the Influence Maximization problem in a social network that evolves with time and proposes two new frameworks: *Link Prediction based Influential Node Tracking (LPINT)*, and *Multifeature based Influential Nodes Tracking (MINT)*.

Link prediction aims to predict the missing interactions in evolving networks that may appear in the future. It has practical importance in various real-world applications, ranging from friendship recommendation, knowledge graph completion, target advertising, and protein-protein interaction prediction. In this thesis, we present two models for link prediction in dynamic social networks. The first model uses conditional temporal Restricted Boltzmann Machine for predicting the links that may appear in the network by considering the evolutionary networks' temporal and structural patterns. The second model presents a modified Latent Dirichlet Allocation and Hidden Naive Bayesian (HNB)-based link prediction technique named *Popularity, interests, location used hidden Naive Bayesian-based (PILHNB) model* for link prediction in dynamic social networks by considering behavioural controlling elements like relationship network structure, nodes' attributes, location-based information of nodes, nodes' popularity, users' interests, and learning the evolution pattern of these factors in the networks. Extensive experiments are performed over various real social network datasets to demonstrate the effectiveness of the proposed methods over the existing ones.

Keywords: Online Social Networks, Influence Maximization, Link Prediction, Latent Dirichlet Allocation, Hidden Naive Bayesian, Restricted Boltzmann Machine.