Article

Influence Maximization in Multilayer Social Networks Using Node Representation and Deep Neural Networks

Abstract: Studies have shown that individuals within a society frequently interact and influence one another. Research indicates that only a small fraction of individuals have significant social influence. In recent decades, identifying the most influential individuals in societies, referred to as influence maximization, has garnered considerable attention. Researchers use graphs, commonly known as networks, to model societies, their members, and the relationships between them. Some studies propose approximation algorithms for maximizing social influence.

In this research, we employ deep neural networks to approximate the influence of each node in every layer of multilayer network. The architecture utilized in this work is inspired by recurrent neural networks, which take two feature vectors as input and generate the desired output. Here, the input feature vectors correspond to the nodes and layers of the network. The proposed architecture incorporates perceptron neural networks and transformer-based neural network encoder. The final output approximates the influence spread of each node within its corresponding layer. After estimating the influence of each node in each layer, the total influence spread of each node is calculated by aggregating its influence across different layers. Finally, seed set is selected from the nodes with the highest influence. Given the inherent capabilities of deep neural networks, this approach is scalable to large-scale social networks, addressing one of the key challenges in this research field.

The results, evaluations, and comparisons with other methods demonstrate that the proposed approach yields favorable outcomes, effectively tackling challenges such as runtime, hardware resource requirements, and more.

Keywords: Influence Maximization, Multilayer Social Networks, Deep Learning, Information Propagation, Transformer Neural Network