Combinatorial optimization problem and its application in some information propagation models

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Abstract: This thesis investigates combinatorial optimization problems arising in information propagation models, focusing on the development of efficient algorithms and their practical applications. We study key problems such as influence maximization, minimum seed selection, and rumor blocking within stochastic diffusion frameworks like the Independent Cascade and Linear Threshold models. Given the NP-hardness of these problems, we propose novel approximation algorithms and heuristic strategies that leverage submodularity and graph structural properties to achieve near-optimal solutions with provable performance guarantees. The research further explores the application of these models to real-world networks, including social media platforms and epidemiological spread. Through extensive simulations on both synthetic and large-scale real datasets, we demonstrate that our proposed methods significantly outperform baseline approaches in terms of solution quality and computational efficiency. The findings provide a robust theoretical foundation and practical tools for optimizing information dissemination, with implications for viral marketing, public health interventions, and misinformation containment.

Keywords: Combinatorial optimization, Information propagation, Propagation model, Application