

Some algorithms for community detection in social networks

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Abstract: This thesis investigates algorithms for community detection in social networks, a critical task for understanding network structure and function. Given the inherent complexity and scale of modern social graphs, the study focuses on developing and evaluating efficient computational methods. We propose and analyze several algorithms, including a novel approach based on modularity optimization enhanced by a heuristic for initial seed selection, and a spectral clustering method adapted for sparse, large-scale networks. The performance of these algorithms is rigorously tested against both synthetic benchmarks with known ground-truth communities and real-world datasets, such as citation networks and social media graphs. Experimental results demonstrate that the proposed methods achieve high accuracy in identifying cohesive communities while maintaining computational scalability. Specifically, the enhanced modularity optimization shows improved resilience to the resolution limit, and the spectral method effectively handles networks with millions of nodes. This work contributes practical, high-performance tools for network analysis and provides insights into the trade-offs between accuracy, speed, and memory usage in community detection.

Keywords: community detection, social networks, algorithms, graph mining