Article Brief: **Overlapping Community Structure in Co-authorship Networks: A Case Study**

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24/04/2023

Summary

This article serves as an excellent resource for writing an introduction, providing valuable references and introducing essential concepts and terminology for studying community structure analysis and overlap. It also offers useful ideas for a statistical approach to the study.

The article emphasizes the limited attention given to analyzing community structure in complex networks. It examines an overlapping community network derived from a large-scale co-authorship network, in which nodes symbolize functional communities and links represent shared nodes between communities. The analysis reveals that the two networks share similar topological properties, suggesting that the overlapping community network effectively represents the original co-authorship network, and its smaller size may be more practical for various analyses.

An interesting observation in the article is the significant similarities between the community network and the original network. This finding demonstrates the potential of such analysis to serve as a quality criterion for community detection algorithms.

The paper discusses real-world complex networks that share common topological properties. Community structures in these networks are crucial for understanding their structural and functional aspects. While numerous community detection algorithms exist, they generally assume nodes belong to either non-overlapping or overlapping communities. Overlapping community structures are especially relevant in social networks, where individuals belong to multiple communities.

Despite extensive work on community detection, few studies have focused on analyzing overlapping community structures. Palla et al.'s influential work introduced four basic quantities for characterizing networks with overlapping communities and used a clique percolation community detection algorithm to identify communities. However, these studies have limitations, such as dependency on community detection algorithms and relatively small network sizes.

The present work addresses these limitations by employing a large-scale network with ground truth community structure to analyze overlapping community networks. This approach allows the authors to investigate the relationship between the original co-authorship network and its

overlapping network of communities without the biases inherent to specific community detection algorithms. Furthermore, the use of a large-scale network enhances the generalizability and applicability of the study's findings.

The paper also explores the macroscopic level of structural analysis for complex networks, using statistical measures to summarize overall network features, such as degree distribution, degree correlation, and assortative and disassortative networks. This comprehensive approach enables a deeper understanding of the structural and functional properties of overlapping community networks.

The paper is organized into sections discussing the background, analysis results, and conclusions, offering a comprehensive overview of the topic.

Interesting References from the Bibliography

In this section, we highlight some interesting references from the article's bibliography that contribute to a deeper understanding of overlapping community structures and related concepts.

- **Reference 2:** J. Xie, S. Kelley, and B. Szymanski, "Overlapping community detection in networks: the state of the art and comparative study," arXiv preprint arXiv:1110.5813, vol. 45, no. 4, pp. 1–37, 2011. This paper provides a comprehensive review of overlapping community detection methods, comparing their performance and discussing their advantages and limitations.

- **Reference 3:** H. Cherifi, Complex Networks and their Applications. In Cambridge Scholars Publishing, 2014. This book discusses various aspects of complex networks, including community structures, their applications, and the different methods and techniques used to analyze them.

- **Reference 5:** A. Lancichinetti, M. Kivelä, J. Saramäki, and S. Fortunato, "Characterizing the community structure of complex networks." PloS one, vol. 5, no. 8, p. e11976, jan 2010. This study presents a characterization of community structures in complex networks, exploring their properties and providing insights into their significance in understanding network organization.

- **Reference 9:** L. d. F. Costa, O. N. Oliveira, G. Travieso, F. A. Rodrigues, P. R. Villas Boas, L. Antiqueira, M. P. Viana, and L. E. Correa Rocha, "Analyzing and modeling real-world phenomena with complex networks: a survey of applications," Advances in Physics, vol. 60, no. 3, pp. 329–412, jun 2011. This survey paper discusses various applications of complex network analysis to real-world phenomena, showcasing the versatility and importance of understanding and modeling complex networks.