Scilight

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New classification method identifies communities faster in complex network structures

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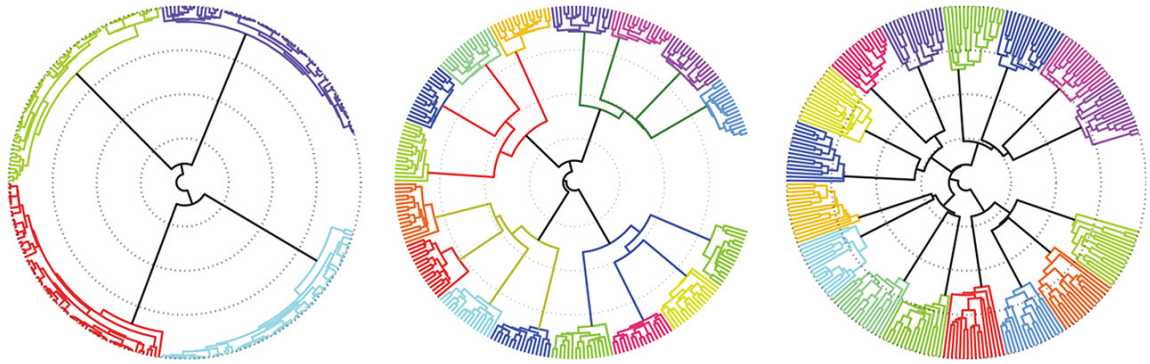
A novel approach rapidly and accurately identifies the historically difficult problem of community structuring in complex networks, offering a fuller understanding of previously obscured relationships.



Network theory, the study of relations within a system, provides deep insight into generally complex relationships between groups of discrete objects. Network theory has wide reaching implications in social interactions, biology, particle physics, climate and beyond. And the insight it provides can even guide researchers to better understand trends in impactful situations such as voting behavior and police investigations, or toward applications involving physical, interacting objects.

The presence of communities occurs naturally in networks and can often elucidate more complicated interactions and simplify the classification of a network. However, identification of communities in networks is often a computationally intensive problem.

New research reported in *Chaos* proposes a new, less burdensome method to identify and quantify communities within networks. As opposed to searching for communities by optimizing the underlying structure, this new approach allows the communities to emerge through the network's intrinsic, nonlinear dynamic behavior through linking the synchronization dynamics with the community structure. The key is to identify a coupling strength parameter that describes the dynamic evolution of the system and to allow its natural evolution to reveal the hierarchical community structure.

The results of this work enable more rapid and reliable identification of the hierarchical community structure in networks. It also provides a better understanding of nodal relationships with respect to the fixed coupling strength parameter that was selected for the optimization. Importantly, the proposed approach is applicable even when the network community structure is inherently weak, whereas other methods are less accurate or may completely fail in these situations.

Source: "Accurate detection of hierarchical communities in complex networks based on nonlinear dynamical evolution," by Zhao Zhuo, Shi-Min Cai, Ming Tang, and Ying-Cheng Lai, *Chaos* (2018). The article can be accessed at https://doi.org/10.1063/1.5025646.