

A Modularity Backbone Extraction Method for Weighted Complex Networks

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The exponential growth in the size of real-world complex networks is a major barrier to analyzing their structure and dynamics. Thus, it is of high significance to reduce the network's size while maintaining its topological features. Having said that, community structure is one of the fundamental fingerprints of real-world networks [1]. This work proposes a new node-filtering backbone extraction method aiming at preserving the network's community structure. The method is based on pruning the nodes according to their contribution to the network's overall modularity. Their contribution is quantified using the concept of vitality [2]. The proposed method named "modularity vitality backbone" is compared against the "overlapping nodes ego backbone" which showed its outperformance over the popular disparity filter [3, 4]. More specifically, results on seven real-world networks show how the proposed backbone outperforms the overlapping nodes ego backbone with respect to the network's weighted modularity, weighted average degree, and average link weight. Nonetheless, this comes at the expense of lower average betweenness. Figure 1 shows the backbones extracted by the two methods to obtain 30% of the Les Misérable's original size. These results permit researchers to conduct their studies on a realistic representation of real-world networks assuring the existence of their community structure yet with significantly smaller sizes.

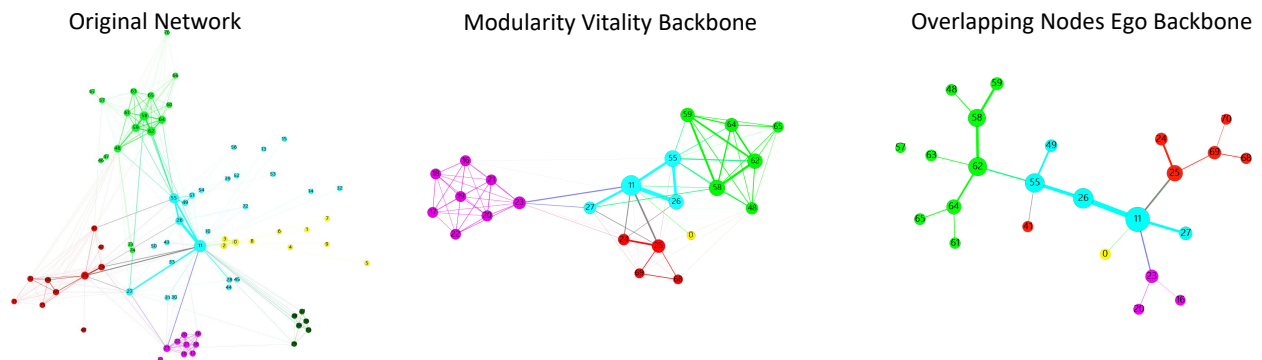


Figure 1: The backbone extraction of the Les Misérables network. The colors of the nodes correspond to the communities uncovered using the Louvain community detection algorithm.

References

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