Community Detection based on An Improved Modularity

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1. Problem

Modularity-based approaches obtain more attention in community detection because it is a main criterion to evaluate community partitions. However, current modularity only measures the intra-links within communities and rarely considers the inter-links between them.

2. An Improve Modularity

We encode both the intra-links and inter-links in an optimization framework to improve the modularity. The improved form is as follow:

$$Q = \frac{1}{2m} \sum_{i,j}^{n} \left[\left(A_{ij} - \frac{k_i k_j}{2m} \right) \delta(C_i, C_j) \right]$$
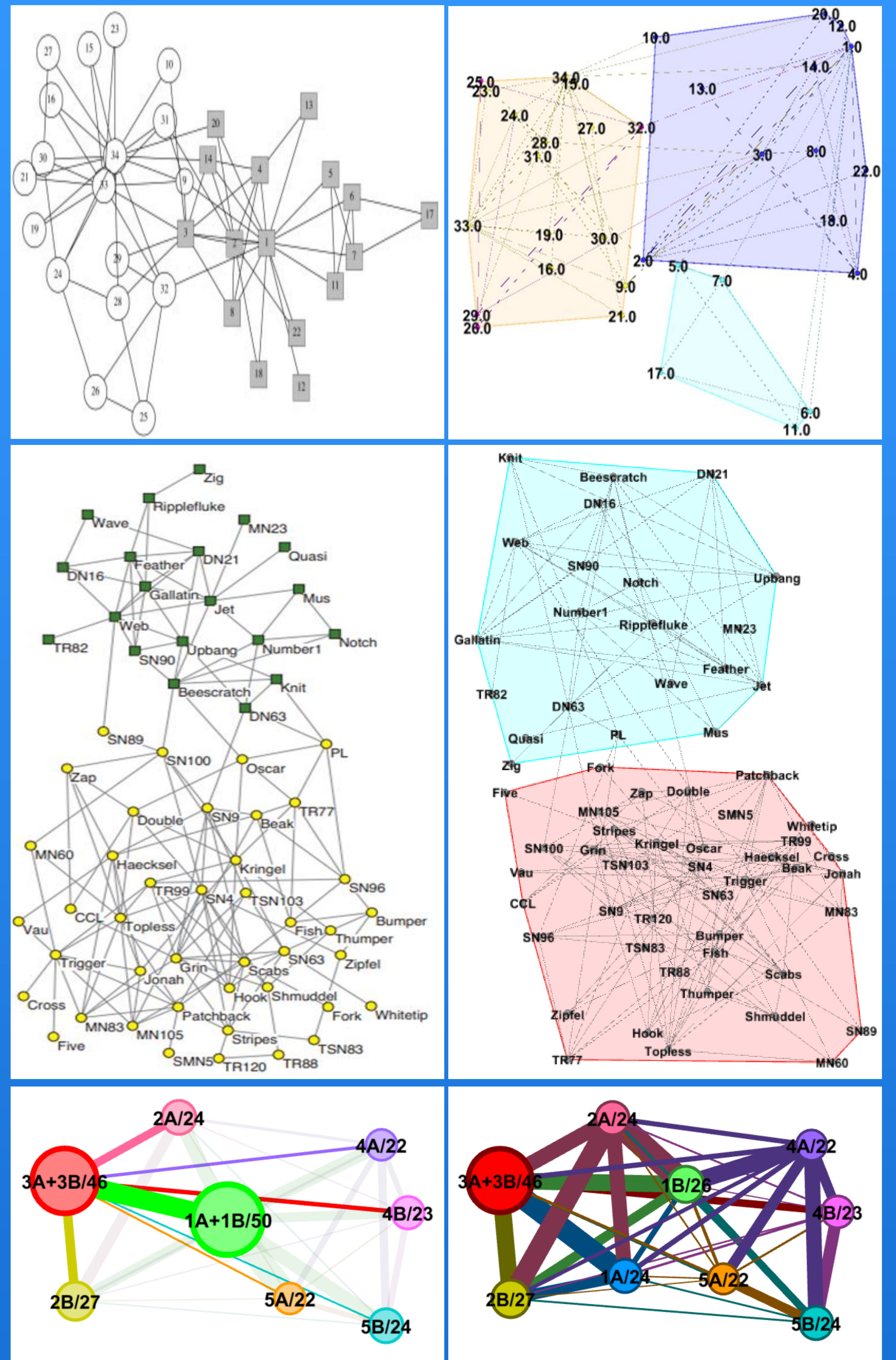
3. Optimization Strategy
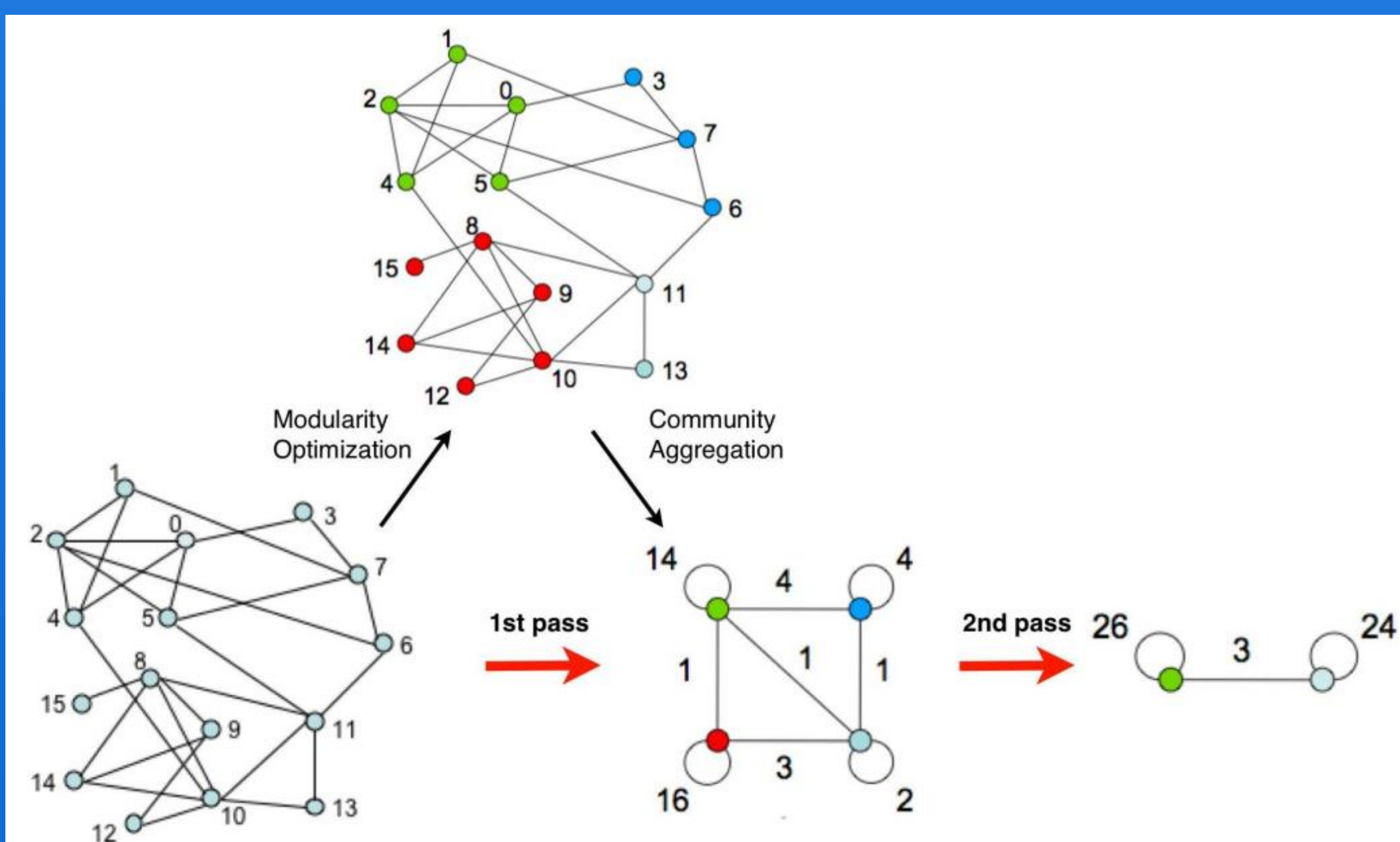
Vincent D. Blondel, Jean-Loup Guillaume, Renaud Lambiotte and Etienne Lefebvre. Fast unfolding of communities in large networks. Journal of Statistical Mechanics: Theory and Experiment, 2008, 2008:P10008.

4. Experimental results

Visualizing part of the results

Details

dataset	Nodes	Edges	Purity	Normalized mutual information	β
Karate club	34	78	0.82/0.82	0.70/0.80	0.37
Dolphin	62	159	0.16/0.98	0.46/0.89	0.45
Football	115	613	0.88/0.91	0.89/0.92	0.45
School	238	5539	0.66/0.76	0.87/0.91	0.20

For the future work, we aim to investigate a uniform definition of community and a benchmark with the natural partition of a network.