A generalized Louvain method for community detection implemented in MATLAB

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The "GenLouvain" generalized Louvain MATLAB code for community detection allows the user to define a quality function in terms of a generalized-modularity null model framework and then follows a two-phase iterative procedure similar to the "Louvain" method [1], with the important distinction that the Louvain passes in the codes here work directly with the modularity matrix (or its matrix-free function), not the adjacency matrix. That is, the code can be used with any quality function specified in terms of a modularity matrix; but as such it does not take advantage of any particular structure to those matrices (cf. the original Louvain method described in [1]).

By requiring a modularity matrix, GenLouvain is flexible enough to handle a wide variety of multilayer modularity formulations, including those of the type appearing in the paper that derives multilayer modularity [2] (though we did not have the "multilayer" terminology itself in that paper), and its many generalizations to a variety of multilayer configurations and different null models within layers. Indeed, the earliest versions of this code were developed for the examples in the multilayer modularity paper [2].

The code and information about its use is available at both

> http://netwiki.amath.unc.edu/GenLouvain and
> http://github.com/GenLouvain .

Because different students have been involved with the development at different times, the preferred citation has changed over time. If you use this code in your own work, we currently ask that you please cite it as

> Lucas G. S. Jeub, Marya Bazzi, Inderjit S. Jutla and Peter J. Mucha, "A generalized Louvain method for community detection implemented in MATLAB," http://netwiki.amath.unc.edu/GenLouvain (2011–2017).

The earliest public release of this code was in 2011. As of the date of this writing, the most recent code is Version 2.1.1, released in February 2017. Again, at the risk of possible confusion, the author list and order has deliberately changed as the code has been updated over the years, to acknowledge the contributions made by different people. The original release was authored by Jutla,

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Jeub and Mucha. To respect the continuing contributions by Lucas, he was later promoted to first author. More recently, because of Marya Bazzi's contributions, she was added as an author on the package.

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References

[1] V. D. Blondel, J.-L. Guillaume, R. Lambiotte, and E. Lefebvre, *Fast unfolding of communities in large networks*, Journal of Statistical Mechanics: Theory and Experiment, 2008 (2008), p. P10008.

[2] P. J. Mucha, T. Richardson, K. Macon, M. A. Porter, and J.-P. Onnela, *Community structure in time-dependent, multiscale, and multiplex networks*, Science, 328 (2010), pp. 876–878.