

# SLM Community Detection

## Description

The smart local moving (SLM) community detection algorithm (Waltman & Van Eck, 2013) is an algorithm for performing community detection (clustering) in networks by maximizing a modularity function. The SLM algorithm can be used to detect communities in very large networks within short computing times. The SLM algorithm builds on ideas from the Louvain community detection algorithm proposed by Blondel et al. (2008), but it includes a number of enhancements of this algorithm. Because of these enhancements, the SLM algorithm generally yields higher modularity values, but it also requires more computing time.

Adjust the following parameters to optimize the algorithm (See the paper for more detail):

|                     |  |
|---------------------|--|
| Weight              | An integer attribute of the edge that will be used as weight parameter   |
| Modularity Function | The <b>Standard</b> modularity function has been proposed by <a href="#">Newman and Girvan (2004)</a> and <a href="#">Newman (2004)</a> . The <b>Alternative</b> modularity function has been proposed by <a href="#">Traag, Van Dooren, and Nesterov (2011)</a> |
| Resolution          | The resolution parameter determines the granularity level at which communities are detected. Use a value above (below) 1.0 if you want to obtain a larger (smaller) number of communities.   |
| Random Start        | Number of random starts  |
| Iterations          | Number of iterations per random start  |
| Random Seed         | Seed of the random number generator  |

## Applications

The directionality of the input network does not matter, so both directed and undirected networks yield the same results.

If the input network has numeric edge attributes, one can be chosen as edge weight. If no edge weight (attribute) is specified, all edges default to having a weight of 1.

The output network will be structurally the same as the input network, but the nodes will be annotated with new attributes labeled "community\_level\_x", where x is a community level. The value of each of these attributes is the id of a community.

## Implementation Details

A single network is expected as the input, and a single network is produced as the output.

A modified version of the Java implementation of this algorithm is compiled and wrapped for integration into CShell (see [Link](#) and [References](#)). This version is modified to accept input from method call rather than console.

To integrate this algorithm in CShell, a custom (Java) converter is used to convert the input network file to an edge list file that is proprietary to the compiled algorithm. The compiled algorithm is then executed upon this proprietary edge list file. The output community file is merged with the input network to produce the output network with annotations.

## Usage Hints

The output of this algorithm can be visualized well with the Circular Hierarchy visualization or using Gephi.

## Links

- Source Code: [Link](#)
- Original Java implementation: [Link](#)
- Paper: [Link](#)

## References

1. Ludo Waltman, Nees Jan van Eck, 2013. "A smart local moving algorithm for large-scale modularity-based community detection". Eur. Phys. J. B (2013) 86: 471.

## See Also



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