Toy network data consists of a MAT file consisting a multilayer network with variables containing information about the network. The filename for the network is of the format, “Aij\_<subjectName>\_<taskName>\_t<windowSize>\_o<windowOverlap>.mat”, where subjectName refers to the subject or network name, taskName refers to the task or version information, windowSize refers to the number of samples per window, and windowOverlap refers to the number of overlapping samples between adjacent windows. The file also contains other variables not reflected in the file name, all network variables contained in the MAT file are listed below:

* Aij: multilayer network
* N: number of nodes in the network
* T/windowNum: number of windows in the network
* windowSize: number of samples in each window
* windowOverlap: number of overlapping samples between adjacent windows
* samplingRate: sampling rate of the data
* TR: repetition time (1/samplingRate)
* analysisType: analysis used to determine network edges (e.g., Pearson’s correlation, wavelet coherence, manually defined, etc.)
* subjectName: Name of subject or network
* taskName: Session or run information of network

To run multilayer network analysis on the toy data, there are four requirements: the latest version of the GenLouvain code (<http://netwiki.amath.unc.edu/GenLouvain/GenLouvain>), the function genlouvain\_multi, calc\_node\_cohesion\_multi, and calc\_node\_cohesion. To run the toy data, perform the following steps:

1. Load Aij multilayer network into MATLAB.
2. Run [S,Q] = genlouvain\_multi(Aij,repetitions,gamma,omega)

Aij is the multilayer network, repetitions is the number of times the GenLouvain code is run, gamma refers to the structural resolution parameter, and omega refers to the coupling parameter. The output consists of S, a cell array with the community structure for each repetition, and Q, a vector with the modularity value for each repetition.

1. Run [Cij,commFlexible,nodeInfo\_multi,commInfo\_multi,CijInfo] = calc\_node\_cohesion\_multi(S)

Cij is the cohesion matrix, commFlexible is an output of the mean number changes for each node over time, nodeInfo\_multi consists of various statistics of dynamic measures (including flexibility), comminfo\_multi consists of various outputs based on node changes over time, and CijInfo contains various statistics on the cohesion matrix.

Output: the variables of interests are contained in nodeInfo\_multi.global and nodeInfo\_multi.node, which refers to global measures across all nodes or individual nodes, respectively (please refer to code documentation for more detailed information). For the output plots used in this manuscript the variable, nodeInfo\_multi.global.mean.flexibility, was used for gamma-omega landscape plots.

Example:

>> load('Aij\_toy128\_v06\_t000\_o000.mat');

>> repetitions = 1000; gamma = 1; omega = 0.25;

>> [S,Q] = genlouvain\_multi(Aij,repetitions,gamma,omega);

>> mean(Q)

ans =

0.75

>> [~,~,nodeInfo\_multi,~,~] = calc\_node\_cohesion\_multi(S);

>> nodeInfo\_multi.global.mean.flexibility  
ans =

0.2292

>> nodeInfo\_multi.global.std.flexibility

ans =

0.1812

>> nodeInfo\_multi.global.var.flexibility

ans =

0.0328

>> nodeInfo\_multi.node.mean.flexibility(1:16:N) *(Note: Approximate values)*

ans =

0

0

0.1637

0.1697

0.2563

0.2437

0.4975

0.5025