

SENAlyser – user manual

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See also at <http://www.stockholmresilience.su.se/senalyzer>

PLEASE OBSERVE! This application and manual is provided “as is”, and no support whatsoever can be provided. The user interface is not particular user friendly, but by spending some time experimenting, you’ll hopefully figure it out!

Introduction and input

SENAlyser (Social-Ecological Network Analyzer) is a simple java application that counts the frequencies of a set of different social-ecological configurations (motifs) in a social-ecological network. It can also generate random networks to use for comparison. These random networks are always created with the same number of nodes and links as in the empirical network. The application builds on the framework, and the terminology, as developed in Bodin & Tengö (2012).

The application reads the network data from files that needs to follow a certain format. There are two files, one for the network data, and another that stores information on the types (attribute) of nodes (nodes are either social or ecological). The formats are as follows:

Network file

```
Row 1: ;nodeId1; nodeId2; .... ;nodeIdN
Row 2: nodeId1;linkId1-Id1;linkId1-Id2; ....;linkId1-IdN
...
Row N+1: nodeIdN;linkIdN-Id1;linkIdN-Id2; ....;linkIdN-IdN
```

Link is either 1 or 0.

For example:

```
;N1;N2;N3
N1;0;0;1
N2;0;0;1
N3;1;1;0
```

Attribute file

```
Row1: NodeId, Soc
Row 1: NodeId1;isSoc
...
RowN: NodeIdN;isSoc
```

isSoc is either 1 or 0.

For example:

```
Node;Soc  
N1;0  
N2;1  
N3;1
```

Installation

Extract the zip file. Copy the “NetworkTools.jar” file to a separate directory. Copy the whole folder “figures” to the same directory. To save time, create a text file (run file), with the command line as described below.

Run the program

The application is started from the command prompt, and requires a recent version of Java SE runtime environment. There are some parameters that need to be specified.

```
java -cp NetworkTools.jar su.syseco.jnetworktools.motif.MotifComparator  
<Networkfile> <Attributefile> <3motif> <4motif> <5motif> <num of random  
networks>
```

<files> are the file names (full file path can be specified)

<Xmotif> is either 0 or 1, and determines if random networks are to be generated for these motifs.

<num of random networks> specifies the number of random networks to be created

For example:

```
.... Netw.txt Attr.txt 1 1 0 100
```

This translates to: run the analyses based on Netw.txt and Attr.txt, for 3 and 4 motifs, but not for 5 motifs. Generate 100 random networks.

Analyses

The application counts the number of times each node occupies a certain position, and how often a certain motif occurs (both in the empirical and the random networks). The position information is presented when the program is started (see below). The motif occurrence information is presented interactively.

Motif frequencies

The basic window (frame) presents the different motifs in different tabs. The naming convention is as follows.

3Motifs

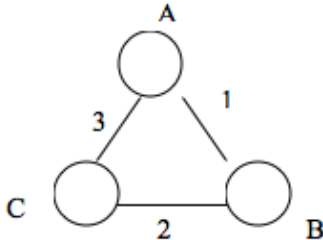


Fig. 1. Naming convention for 3Motifs. The type of node that is in minority is always put in the A position, and the first letter of the name is set accordingly. And the links are added after the letter "R". For example, a motif with one social node and two ecological nodes, with all links set to 1, would be "S1R111". A motif with two social nodes and no links would be "E1R000" (ecological node in minority, thus it starts with "E", and the ecological node is put in position "A"). Positions are labeled with a "X", followed by the number of nodes being in majority, the links, and the position (A, B, or C). For example, in a fully connected motif with one social node and two ecological nodes, the social node occupies position "X2R111A".

4Motifs

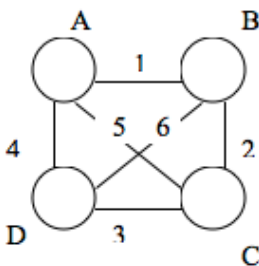


Fig. 2. Naming convention for 4Motifs. It follows the same principles as for 3Motifs. However, if there are 2 social nodes and 2 ecological nodes, the social nodes are placed first (position A and B). When determining positions, the same procedure as for 3Motifs is used, i.e. the least common comes first (position A). However, when there are two plus two nodes (2 soc, 2 eco), position labels will only be assigned to the node on position A and B. For the nodes on position C and D (which are ecological nodes, see ordering principle above), the motif is re-arranged so that these nodes instead occupy position A and B. After that rearrangement, they will be labeled with the positions for that (new) motif. Note that this new motif is a kind of mirror motif of the original motif (for example, S2R100110 will be converted to a S2R001101 – BUT with the ecological nodes on position A and B and not C and D). The reason for doing this is that we want to use the same labels on equivalent positions for a 2+2 motif, irrespectively of the nodes are social or ecological. This is needed if one wants to study the distribution of positions without taking into consideration of the nodes are ecological or social.

5Motifs

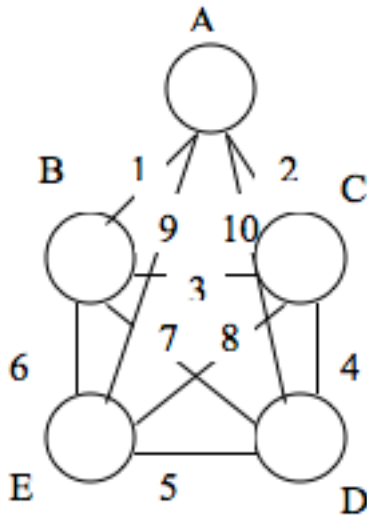


Fig. 3. Naming convention for 5Motifs. Same principles as for the other motifs, however, only a limited numbers of positions and types are supported.

Click on the motif of interest. Select “E” instead of “S” when investigating the configurations that start with “E”, but otherwise are equivalent to the “S” configurations. The frequency is presented at the command prompt (Fig. 4).

```
S2R001101
24.00-27.00 ***** (2)
27.00-30.00 ***** (1)
30.00-33.00 (0)
33.00-36.00 ***** (1)
36.00-39.00 ***** (1)
39.00-42.00 (0)
>42.00-45.00 ***** (1)
45.00-48.00 ***** (3)
48.00-51.00 (0)
51.00-54.00 ***** (1)
The num of motif in the other set: 44
```

Fig. 4. Motif S2R001101. The empirical network is presented with a “>” in the histogram capturing all random networks (it is also outlined on the last line “...other set:”).

Positional information

Is presented when the program starts (Fig. 5). The naming convention is presented in Fig. 1-3. The data is presented in such way to make it easy to copy and paste into a simple text file that can easily be imported into e.g. Excel.

```
;X0R000ABC;X0R001AC;X0R001B;X0R011AB;X0R011C;X0R111ABC;X2R000A;X2R000BC;)
Acanthurus_nigrofuscus;250;39;3;53;6;0;2;61;4;31;17;4;11;0;5;3;0;6;0;1
Acanthurus_triostegus;250;39;3;53;6;0;3;62;3;30;16;3;11;1;5;3;0;7;0;1
Carangoides_orthogrammus;291;0;60;0;0;0;5;73;1;35;19;1;0;3;0;0;0;8;0;0
Gnathanodon_speciosus;28;111;0;41;171;0;5;24;1;8;4;1;49;3;27;15;0;4;0;4
Sardinella_melanura;235;54;18;38;6;0;4;66;2;26;13;2;10;2;6;3;0;10;0;1
Carras ovata ;231;55;0;55;10;0;4;63;2;25;12;2;13;2;7;4;0;10;0;1
```

Fig. 5. Top row outlines the positions, and the remaining rows the positional information for each node.

References

Bodin, Ö., and M. Tengö. 2012. Disentangling intangible social–ecological systems. *Global Environmental Change* **22**:430–439.