Package ‘DirectedClustering’

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Type Package

Title Directed Weighted Clustering Coefficient

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Description Allows the computation of clustering coefficients for directed and weighted networks by using different approaches.

It allows to compute clustering coefficients that are not present in 'igraph' package.


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Depends R(>= 3.4.0)

Imports igraph

RoxygenNote 6.0.1

NeedsCompilation no

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R topics documented:

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Description

The `DirectedClustering` R package presented here includes an enhanced R implementation of Local and Global (average) Clustering Coefficients for Directed/Undirected and Unweighted/Weighted Networks.

Functions are based on Barrat et al. (2004) and Onnela et al. (2005) coefficients when the network is undirected, while it is based on Fagiolo (2007) and Clemente and Grassi (2018) proposals when the network is directed. In the directed case, different components of directed clustering coefficient are also considered.

Details of alternative coefficients computed by `DirectedClustering` R package can be found in Clemente, Grassi (2018).

Please report any issue arising or bug in the code to gianpaolo.clemente@unicatt.it.

Note

This package and the functions herein are provided as is, without any guarantee regarding the accuracy of calculations. The authors disclaim any liability arising by any losses due to direct and indirect use of this package.

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References


**ClustBCG**

*Clustering Coefficient for Directed/Undirected and Weighted Networks (Barrat et al. (2004) and Clemente, Grassi (2018) coefficients).*

Description

Compute Local and Global (average) Clustering Coefficients for Directed/Undirected and Unweighted/Weighted Networks.

Formulas are based on Barrat et al. (2004) coefficient when the network is undirected, while it is based on Clemente and Grassi (2018) proposal when the network is directed.

In the directed case, different components of directed clustering coefficient are also provided.
Usage

ClustBCG(mat, type = "undirected", isolates = "zero")

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mat</td>
<td>A Weighted Adjacency Matrix</td>
</tr>
<tr>
<td>type</td>
<td>The type of the clustering coefficient to calculate. Possible values are: &quot;undirected&quot; (default) or &quot;undirected&quot;.</td>
</tr>
<tr>
<td>isolates</td>
<td>Character scalar, defines how to treat vertices with degree zero and one. If it is 'NaN' then their local transitivity is reported as NaN and they are not included in the averaging. If it is 'zero', then we report 0 transitivity for them, and they are included in the averaging. Default value is 'zero'.</td>
</tr>
</tbody>
</table>

Details

The function ClustBCG computes Barrat et al. coefficient when a weighted and undirected network is considered. For directed network Clemente and Grassi formula is computed. In case of unweighted and undirected graphs, it provides classical local clustering coefficient (Watts and Strogatz).

In all cases, local clustering coefficients are obtained for each node, the global coefficient is the average of local coefficients.

These clustering coefficients do not work for graphs with multiple and/or loop edges. Hence, loops are removed.

In the directed case, different components of directed clustering coefficient are also considered.

Value

For 'undirected case':

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LocalCC</td>
<td>Local clustering coefficients</td>
</tr>
<tr>
<td>GlobalCC</td>
<td>Global clustering coefficient</td>
</tr>
</tbody>
</table>

For 'directed case':

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cycleCC</td>
<td>Local Cycle clustering coefficients</td>
</tr>
<tr>
<td>middlemanCC</td>
<td>Local Middleman clustering coefficients</td>
</tr>
<tr>
<td>inCC</td>
<td>Local In clustering coefficients</td>
</tr>
<tr>
<td>outCC</td>
<td>Local Out clustering coefficients</td>
</tr>
<tr>
<td>totalCC</td>
<td>Local Total clustering coefficients</td>
</tr>
<tr>
<td>GlobalcycleCC</td>
<td>Global Cycle clustering coefficient</td>
</tr>
<tr>
<td>GlobalmiddlemanCC</td>
<td>Global Middleman clustering coefficient</td>
</tr>
<tr>
<td>GlobalinCC</td>
<td>Global In clustering coefficient</td>
</tr>
<tr>
<td>GlobaloutCC</td>
<td>Global Out clustering coefficient</td>
</tr>
<tr>
<td>GlobaltotalCC</td>
<td>Global Total clustering coefficient</td>
</tr>
</tbody>
</table>
Author(s)
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References

Examples
library(igraph)
# Generate a Weighted and Undirected graph with Erdos Renyi Model
gsim<--erdos.renyi.game(50, 0.5, type="gnp", directed = FALSE, loops = FALSE)
PESI<--runif(length(E(gsim)), 0, 1)
E(gsim)$weight<--PESI

# Get Adjacency
A<--get.adjacency(gsim, sparse=FALSE, attr="weight")
# Compute Barrat et al. (2004) coefficient
BarratClust<--ClustBCG(A, "undirected")

# The same results can be obtained with igraph::transitivity
check<--sum(BarratClust$LocalCC-transitivity(gsim, "weighted"))

# Generate a Weighted and Directed Graph with Erdos Renyi Model
gsim<--erdos.renyi.game(50, 0.5, type="gnp", directed = TRUE, loops = FALSE)
PESI<--runif(length(E(gsim)), 0, 1)
E(gsim)$weight<--PESI

# Get Adjacency
A<--get.adjacency(gsim, sparse=FALSE, attr="weight")

# Compute Clemente, Grassi (2018) coefficient
CGClust<--ClustBCG(A, "directed")

ClustF

Clustering Coefficients for Directed/Undirected and Weighted Networks (Onnela et al. (2005) and Fagiolo (2007) coefficients)

Description
This function computes both Local and Global (average) Clustering Coefficients for either Directed/Undirected and Unweighted/Weighted Networks. Formulas are based on Onnela et al. (2005) coefficient when the network is undirected, while it is
based on Fagiolo (2007) coefficient when the network is directed.
In the directed case, different components of directed clustering coefficient are also considered.

Usage

```r
ClustF(mat, type = "undirected", isolates = "zero", norm=1)
```

Arguments

- `mat` A Weighted Adjacency Matrix. If weights are greater than one, a normalization is provided by dividing each weight by the maximum weight observed.
- `type` The type of the clustering coefficient to calculate. Possible values are: "undirected" (default) or "undirected".
- `isolates` Character scalar, defines how to treat vertices with degree zero and one. If it is 'NaN' then their local transitivity is reported as NaN and they are not included in the averaging. If it is 'zero', then we report 0 transitivity for them, and they are included in the averaging. Default value is 'zero'.
- `norm` If it is 1 (default), link's weights are normalized by dividing by the maximum observed weight (as proposed in Fagiolo). Otherwise, weights are not normalized. It is worth pointing out that weights are always normalized when the maximum weight is greater than zero. This normalization assures that clustering coefficient ranges between 0 and 1.

Details

The function `ClustF` computes Onnela et al. formula when weighted and undirected networks are considered.
For directed networks, Fagiolo formula is computed. In case of unweighted and undirected graphs, it provides classical local clustering coefficient (Watts and Strogatz).

Local coefficients are obtained for each node, the global coefficient is the average of local coefficients.
These clustering coefficients do not work for graphs with multiple and/or loop edges. Hence, loops are removed.
In the directed case, different components of directed clustering coefficient are also provided.

Value

For 'undirected case':

- `LocalCC` Local clustering coefficients
- `GlobalCC` Global clustering coefficient

For 'directed case':

- `cycleCC` Local Cycle clustering coefficients
- `middlemanCC` Local Middleman clustering coefficients
- `inCC` Local In clustering coefficients
- `outCC` Local Out clustering coefficients
totalCC          Local Total clustering coefficients
GlobalcycleCC   Global Cycle clustering coefficient
GlobalmiddlemanCC Global Middleman clustering coefficient
GlobalinCC       Global In clustering coefficient
GlobaloutCC      Global Out clustering coefficient
GlobaltotalCC    Global Total clustering coefficient

Author(s)
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References

Examples

```r
library(igraph)
# Generate a Weighted and Undirected graph with Erdos Renyi Model
gsim<-erdos.renyi.game(50, 0.5, type="gnp", directed = FALSE, loops = FALSE)
PESI<-runif(length(E(gsim)), 0, 1)
E(gsim)$weight<-PESI

# Get Adjacency
A<-get.adjacency(gsim, sparse=FALSE, attr="weight")

# Compute Onnela et al. (2005) coefficient
OnnelaClust<-ClustF(A, "undirected")

# Generate a Weighted and Directed Graph with Erdos Renyi Model
gsim<-erdos.renyi.game(50, 0.5, type="gnp", directed = TRUE, loops = FALSE)
PESI<-runif(length(E(gsim)), 0, 1)
E(gsim)$weight<-PESI

# Get Adjacency
A<-get.adjacency(gsim, sparse=FALSE, attr="weight")

# Compute Fagiolo (2007) coefficient
FagioloClust<-ClustF(A, "directed")
```
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