

# Package ‘linkprediction’

October 19, 2018

**Title** Link Prediction Methods

**Version** 1.0-0

**Description** Implementations of most of the existing proximity-based methods of link prediction in graphs. Among the 20 implemented methods are e.g.: Adamic L. and Adar E. (2003) <doi:10.1016/S0378-8733(03)00009-1>, Leicht E., Holme P., Newman M. (2006) <doi:10.1103/PhysRevE.73.026120>, Zhou T. and Zhang Y (2009) <doi:10.1140/epjb/e2009-00335-8>, and Fouss F., Pirotte A., Renders J., and Saerens M. (2007) <doi:10.1109/TKDE.2007.46>.

**Depends** R (>= 3.1.1),

**License** MIT + file LICENSE

**LazyData** true

**Imports** igraph, intergraph

**Suggests** knitr, testthat

**RoxygenNote** 6.1.0

**VignetteBuilder** knitr

**BugReports** <https://github.com/recon-icm/linkprediction/issues>

**URL** <https://github.com/recon-icm/linkprediction>

**NeedsCompilation** no

**Author** Michal Bojanowski [aut, cre],  
Bartosz Chrol [aut],  
National Science Centre [fnd] (grant 2012/07/D/HS6/01971)

**Maintainer** Michal Bojanowski <michal2992@gmail.com>

**Repository** CRAN

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linkprediction	<i>Link Prediction Methods</i>
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**Description**

Implements most of existing methods proximity-based methods of link prediction in graphs. See [proxfun](#).

**Note**

Authors thank (Polish) National Science Centre for support through SONATA grant 2012/07/D/HS6/01971 for the project *Dynamics of Competition and Collaboration in Science: Individual Strategies, Collaboration Networks, and Organizational Hierarchies* ([recon.icm.edu.pl](http://recon.icm.edu.pl)).

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proxfun	<i>Vertex proximity indexes</i>
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**Description**

General function for calculating several types of vertex proximities in a graph.

**Usage**

```
proxfun(graph, ...)

## S3 method for class 'igraph'
proxfun(graph, method, v1 = NULL, v2 = v1,
        value = c("matrix", "edgelist", "graph"), ...)

## S3 method for class 'network'
proxfun(graph, method, v1 = NULL, v2 = v1,
        value = c("matrix", "edgelist", "graph"), ...)
```

**Arguments**

graph	an object of class <code>igraph</code> or <code>network</code>
...	additional arguments specific for a selected measure
method	single character, the method to be used, see <a href="#">Details</a>
v1, v2	vectors of vertices between which similarity will be calculated. Character vector is interpreted as vertex names. Numeric vector as vertex ids.
value	a character string giving a type of the object that should be returned. This must be one of "matrix", "graph" or "edgelist", with default "matrix".

## Details

This function calculates vertex proximities in graph `graph` with the selected method. The graph has to be undirected and connected. Some of the methods support computation only for selected vertices, which should be more efficient when needed. Supplying vertex IDs or names (if present in the graph) to `v1` and `v2` will calculate proximities of  $v_1xv_2$ .

The following methods are available (see `vignette("proxfun", package="linkprediction")` for more details and formal definitions):

`aa` Adamic-Adar index (Adamic and Adar 2001). Additional arguments are passed to [igraph::similarity](#).

`act` Average Commute Time (Fouss, Pirotte, Renders, and Saerens 2007)

`act_n` Normalized Average Commute Time (Fouss et al. 2007)

`cn` Common Neighbours

`cos` Cosine similarity (Salton and McGill 1986)

`cos_l` cosine similarity on L+ (Fouss et al. 2007)

`dist` graph distance

`hdi` Hub Depressed Index (Ravasz, Somera, Mongru, Oltvai, and Barabasi 2002)

`hpi` Hub Promoted Index (Ravasz et al. 2002)

`jaccard` Jaccard coefficient (Jaccard 1912)

`katz` Katz index (Katz 1953)

`l` L+ directly (Fouss et al. 2007)

`lhn_local` Leicht-Holme-Newman Index (Leicht, Holme, and Newman 2006)

`lhn_global` Leicht-Holme-Newman Index global version (Leicht et al. 2006)

`lp` Local Path Index (Zhou, Lu, and Zhang 2009)

`mf` Matrix Forest Index (Chebotarev P. Yu. 1997)

`pa` preferential attachment (Barabasi and Albert 1999)

`ra` resource allocation (Zhou et al. 2009)

`rwr` random walk with restart (Brin and Page 1998). Additional argument `alpha` (default value 0.3) is the probability that the walk will restart after a step.

`sor` sorensen index/dice coefficient (Sorensen 1948)

## Value

If `value = "matrix"` a matrix with `length(v1)` rows and `length(v2)` with rownames and colnames equal to `v1` and `v2` respectively. If `value = "edgelist"` a `data.frame` with three columns:

**from** ID of a start node of an edge

**to** ID of an end node of an edge

**value** similarity score for that edge

Edges with similarity score 0 are omitted. If `value = "graph"` an object of class `igraph` or `network`, depending on the class of input graph. Returned graph has the same structure (graph and node attributes, etc.) as the input graph, except for edges - original edges are skipped, and new edges with positive similarity score are added. Edged attribute `"weight"` indicates similarity score.

## References

- Adamic L and Adar E (2003). "Friends and Neighbors on the Web." *Social Networks*, 25, pp. 211-230 doi: [10.1016/S03788733\(03\)000091](https://doi.org/10.1016/S03788733(03)000091).
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## Examples

```
if(requireNamespace("igraph")) {
  g <- igraph::make_graph(~ A -- C:D:E -- B -- F -- G:H -- I)

  # Adamic-Adar
  proxfun(g, method="aa", value="edgelist")

  # Random Walk with Restart
  proxfun(g, method="rwr", value="edgelist")
}
```

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