Package: Rwclust (via r-universe)

September 11, 2024

Title Random Walk Clustering on Weighted Graphs

Version 0.1.0

Author Carson Sprock [aut, cre]

Maintainer Carson Sprock <csprock@gmail.com>

Description Implements the random walk clustering algorithm for
weighted graphs as found in Harel and Koren (2001)
<https://link.springer.com/chapter/10.1007/3-540-45294-X_3>.

License MIT + file LICENSE

Encoding UTF-8

Roxygen list(markdown = TRUE)

RoxygenNote 7.1.2

Suggests igraph, knitr, rmarkdown, testthat (>= 3.0.0)

Config/testthat/edition 3

Imports checkmate, Matrix

Depends R (>= 3.5.0)

LazyData true

VignetteBuilder knitr

Repository https://csprock.r-universe.dev

RemoteUrl https://github.com/csprock/rwclust

RemoteRef HEAD

RemoteSha 013119c1ab77a4f2db4f71f1d1fd60b432569eaa

Contents

adjacency 2
apply_similarity 2
compute_similarities 3
compute_transition_matrix 4
create_weight_matrix 4
example1 5

example2 5
new_rwclust 6
plot.rwclust 6
run_main_loop 7
rwclust 7
update_weights 8

Index **10**

`adjacency` *Generic helper for extracting adjacency matrix from rwclust object.*

Description

Generic helper for extracting adjacency matrix from rwclust object.

Usage

```
adjacency(x)

## Default S3 method:
adjacency(x)

## S3 method for class 'rwclust'
adjacency(x)
```

Arguments

`x`	rwclust object

Value

Matrix object containing the adjacency matrix of the after the final iteration

---

`apply_similarity` *Apply similarity function to rows of a matrix*

Description

Apply similarity function to rows of a matrix

Usage

```
apply_similarity(idx, mat, similarity, ...)
```

Arguments

idx	vector of length two containing row indices
mat	a matrix
similarity	similarity function to apply
...	additional parameters to be passed to the similarity function

Value

a scalar

---

compute_similarities *Apply similarity function over edges of graph*

Description

Apply similarity function over edges of graph

Usage

```
compute_similarities(edgelist, mat, similarity, ...)
```

Arguments

edgelist	3-column dataframe
mat	a matrix
similarity	the similarity function to apply
...	other parameters to pass to the similarity function

Value

a vector containing updated weights

compute_transition_matrix *Compute transition matrix*

Description

Compute transition matrix

Usage

```
compute_transition_matrix(x)
```

Arguments

x	sparseMatrix or denseMatrix

Value

transition matrix

create_weight_matrix *Construct sparse matrix from weighted edgelist*

Description

Takes the weights from compute_kernel and creates weighted adjacency matrix

Usage

```
create_weight_matrix(edgelist, weights, ...)
```

Arguments

edgelist	a dataframe with two columns
weights	a vector of weights
...	other parameters to be passed to Matrix::sparseMatrix()

Value

sparseMatrix

example1 *Example Graph 1*

Description

First demonstration test graph used in the original.

Usage

```
example1
```

Format

A data frame with three columns representing a weighted graph. Each row represents an edge with a weight:

from An integer vertex id

to An integer vertex id

weight A double representing the edge weight

Examples

```
data(example1, package="Rwclust")
```

example2 *Example Graph 2*

Description

Second demonstration test graph used in the original paper.

Usage

```
example2
```

Format

A data frame with three columns representing a weighted graph. Each row represents an edge with a weight.

from An integer vertex id

to An integer vertex id

weight A double representing the edge weight

Examples

```
data(example2, package="Rwclust")
```

`new_rwclust` *rwclust class constructor*

Description

Returns a object of class "rwclust" for use with generic summary and plotting functions.

Usage

```
new_rwclust(x)
```

Arguments

`x`	output of `run_main_loop` function

See Also

`run_main_loop()`

`plot.rwclust` *Generic plotting for rwclust object*

Description

Generic function for plotting the distribution of weights. Calls `hist` under the hood.

Usage

```
## S3 method for class 'rwclust'
plot(x, cutoff = NULL, ...)
```

Arguments

`x`	rwclust object
`cutoff`	optional numeric, will plot the cutoff value as a vertical line
`...`	additional graphical parameters passed to the `hist` function

run_main_loop *Execute main algorithm loop*

Description

Execute main algorithm loop

Usage

```
run_main_loop(M, edgelist, similarity, k, iter)
```

Arguments

M	transition matrix
edgelist	dataframe edgelist
similarity	a similarity function
k	integer, length of longest walk
iter	number of iterations

Value

list

rwclust *Sharpen the edge weights of a weighted graph.*

Description

Sharpens the weights of a weighted graph for later pruning.

Usage

```
rwclust(x, iter = 5, k = 3, similarity = "hk")

## S3 method for class 'data.frame'
rwclust(x, iter = 5, k = 3, similarity = "hk")

## S3 method for class 'matrix'
rwclust(x, iter = 5, k = 3, similarity = "hk")
```

Arguments

x	matrix or dataframe with three columns 1. vertex label (integer) 2. vertex label (integer) 3. edge weights (float)
iter	integer, number of iterations
k	integer, maximum length of random walk
similarity	string, the name of the similarity metric used to update weights

Value

list

weights A vector of the updated edge weights

adj Updated adjacency matrix containing updated weights

Details

Internally, the edgelist passed to `rwclust` is converted into a transition matrix, whose powers are used to compute the probability of reaching a vertex u from vertex v in k steps for all v and u. New edge weights are computed using the similarity between these "walk probabilities" for each pair of vertices. The intuition is that vertices who have similar neighborhoods in terms of random walk reachability are similar to each other.

The returned weights can be used for clustering by deleting edges with weights below a certain threshold. The connected components of the resulting graph form the clusters.

References

Harel, David, and Yehuda Koren. "On clustering using random walks." International Conference on Foundations of Software Technology and Theoretical Computer Science. Springer, Berlin, Heidelberg, 2001.

`update_weights` *Update edge weights*

Description

Update edge weights

Usage

```
update_weights(M, edgelist, similarity, k)
```

Arguments

M	matrix
edgelist	dataframe representing weighted edgelist
similarity	a similarity function
k	integer, length of longest walk

Value

list

Index

∗ **datasets**
example1, 5
example2, 5

adjacency, 2
apply_similarity, 2

compute_similarities, 3
compute_transition_matrix, 4
create_weight_matrix, 4

example1, 5
example2, 5

new_rwclust, 6

plot.rwclust, 6

run_main_loop, 7
run_main_loop(), *6*
rwclust, 7

update_weights, 8