Package: graphonmix (via r-universe)

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Type Package

Title Generates Mixture Graphs from Dense and Sparse Graphons

Version 0.0.1.0

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Description Generates (U,W) mixture graphs where U is a line graph graphon and W is a dense graphon. Graphons are graph limits and graphon U can be written as sequence of positive numbers adding to 1. Graphs are sampled from U and W and joined randomly to obtain the mixture graph. Given a mixture graph, U can be inferred. Kandanaarachchi and Ong (2025) <doi:10.48550/arXiv.2505.13864>.

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Encoding UTF-8

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Imports ggplot2, igraph, imager, stats

Suggests gridExtra, knitr, rmarkdown

VignetteBuilder knitr

URL https://sevvandi.github.io/graphonmix/

Config/pak/sysreqs
libfftw3-dev libglpk-dev libicu-dev libjpeg-dev libpng-dev libtiff-dev libxml2-dev libx11-dev

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

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Contents

`autoplot.extract_sparse` *Plots the output of extract_sparse function.*

Description

Plots the two lines fitted to the unique, sorted log degrees of the graph.

Usage

```
## S3 method for class 'extract_sparse'
autoplot(object, ...)
```

Arguments

`object`	The output of the function 'extract_sparse'
`...`	Other arguments currently ignored

Value

A ggplot object.

Examples

```
library(igraph)
gr <- sample_pa(10000, power = 1.2, directed = FALSE)
sparse <- extract_sparse(gr)
autoplot(sparse)
```

create_exp_matrix *Creates an nxn exponential matrix*

Description

Creates an nxn matrix where the (i,j)th entry is exp(-(i+j)/scalar)

Usage

```
create_exp_matrix(nrow, scalar)
```

Arguments

nrow	The dimension of the matrix
scalar	The scalar in exp(-(i+j)/scalar)

Value

An nxn matrix

Examples

```
W <- create_exp_matrix(100, 100)
```

empirical_graphon *Computes empirical graphon from graph*

Description

Computes empirical graphon given a graph

Usage

```
empirical_graphon(gr, n = NULL)
```

Arguments

gr	A graph
n	Dimension of the graphon matrix

Value

The empirical graphon

Examples

```
library(igraph)
gr <- sample_gnp(1000, p=0.2)
emp <-  empirical_graphon(gr, n = 100)
```

`extract_sparse` *Extracts the sparse part from a (U,W) graphon mixture*

Description

This function extracts the sparse component from a (U,W) mixture graph by fitting two lines to the unique sorted log degree values. The first line gives the number of hubs in the sparse part and the remaining line fits the degrees of the dense part.

Usage

```
extract_sparse(gr)
```

Arguments

`gr`	The input graph

Value

a list with the following components:

`num_hubs`	The number of hubs in the sparse component.
`phat`	The probability vector of the sparse component. This is also known as the mass partition.
`segment_sizes`	The sizes of the two line segments.
`line_equations`	The two equations of the lines.
`cutoff`	The best cut off for the two lines.
`models`	The models of the fitted lines.
`mse`	The mean squared error
`data`	The degree data.

Examples

```
library(igraph)
gr <- sample_pa(10000, power = 1.2, directed = FALSE)
sparse <- extract_sparse(gr)
sparse$phat
```

generate_star_union *Generates a sparse graph of star graphs*

Description

Generates a union of star graphs given the weights

Usage

```
generate_star_union(wts, n)
```

Arguments

wts	The proportion of the hub degrees
n	The number of nodes in the new graph

Value

A disjoint union of star graphs

Examples

```
library(igraph)
wts <- c(0.5, 0.3, 0.2)
gr <- generate_star_union(wts, n = 100)
gr
```

graph_join *Joins two graphs*

Description

Joins two graphs randomly connecting vertices

Usage

```
graph_join(gr1, gr2, p = 0.5, option = 2)
```

Arguments

gr1	The first graph to join
gr2	The second graph to join
p	The proportion of edges in gr1 to be added as part of the joining
option	Two options. 1 does the disjoint union, 2 does the random edges union.

Value

The joined graph

Examples

```
W <- create_exp_matrix(100, 100)
# create the sparse part - a disjoint set of stars
wts <- c(0.5, 0.3, 0.2)
grdense <- sample_graphon(W, 100)
grsparse <- generate_star_union(wts, 200)
gr <- graph_join(grdense, grsparse, opt = 2)
```

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line_graphon *Creates a line graphon from a sequence of probabilities*

Description

Creates a line graphon, which is a disjoint clique graphon from a sequence of probability values

Usage

```
line_graphon(probs)
```

Arguments

probs	The list of probabilities starting from the largest.

Value

The line graphon

Examples

```
library(ggplot2)
wts <- c(0.5, 0.3, 0.2)
U <- line_graphon(wts)
plot_graphon(U)
```

plot_graphon *Plots graphon*

Description

Plots graphon

Usage

```
plot_graphon(W, cols = c("white", "black"))
```

Arguments

W	A graphon given by an nxn matrix
cols	Colors, by default white and black

Value

A ggplot object.

Examples

```
W <- create_exp_matrix(100, 100)
plot_graphon(W)
```

predict_hubs *Predicts the degree of hubs of an new graph*

Description

Predicts the degree of hubs of an unseen graph given a graph generated from the same process.

Usage

```
predict_hubs(gr, n, k = NULL)
```

Arguments

gr	The input graph
n	The number of nodes in the new graph
k	The number of hubs. Default is NULL

Value

A vector of hub degrees

Examples

```
library(igraph)
gr <- sample_pa(10000, power = 1.2, directed = FALSE)
predict_hubs(gr, n = 11000)
```

`sample_graphon` *Generates a graph given a graphon*

Description

Generates a graph given a dense graphon W.

Usage

```
sample_graphon(W, n)
```

Arguments

`W`	A graphon given by a matrix
`n`	The number of nodes of the sampled graph

Value

A graph sampled from the graphon W with n nodes

Examples

```
library(igraph)
W <- matrix(0.2, nrow = 100, ncol = 100)
gr <- sample_graphon(W, n= 100)
```

`sample_mixed_graph` *Generate a (U,W) mixture graph*

Description

Generate a (U,W) mixture graph from a dense graphon W and a mass partition corresponding to a line graph graphon U.

Usage

```
sample_mixed_graph(W, wts, nd, ns, p = 0.5, option = 2)
```

Arguments

W	The dense graphon. This is a symmetric matrix with values in [0,1]
wts	The degree proportions of the hub degrees. Need to add up to 1. This is the mass partition corresponding to the line graph graphon U.
nd	The number of nodes in the dense part of the graph
ns	The number of nodes in the sparse part of the graph
p	The nodes to be added as a proportion of the edges in the dense part
option	Graph joining option. If option == 1 then a disjoit union is considered. If option == 2 the two graphs are joined randomly with the number of edges specified by p.

Value

A graph sampled from the (U,W) mixture.

Examples

```
library(igraph)
W <- matrix(0.1, nrow = 100, ncol = 100)
wts <- c(0.5, 0.3, 0.2)
ns <- 200
nd <- 100
p <- 0.5
gr <- sample_mixed_graph(W, wts, nd, ns, p, option = 2)
gr
```

---

scale_graphon *Scales a graphon to an nxn matrix*

Description

Scales a graphon to an nxn matrix suitable for large adjacency matrices

Usage

```
scale_graphon(W, n)
```

Arguments

W	A graphon given as a symmetric square matrix
n	The dimension of the output matrix

Value

Scaled nxn graphon

Examples

```
library(igraph)
gr <- sample_gnp(1000, p=0.2)
adj <- as_adjacency_matrix(gr)
W <- scale_graphon(adj, 100)
```

`separate_dense_and_sparse` *Separates the dense and sparse part from a (U,W) graphon mixture*

Description

This function breaks a (U,W) mixture graph into a dense and sparse component.

Usage

```
separate_dense_and_sparse(grmix)
```

Arguments

`grmix`	The input graph

Value

a list with the following components:

`gr_dense`	The dense component.
`gr_sparse`	The sparse component.
`data`	The original graph.

Examples

```
library(igraph)
W <- matrix(0.1, nrow = 100, ncol = 100)
wts <- c(0.5, 0.3, 0.2)
ns <- 200
nd <- 100
p <- 0.5
gr <- sample_mixed_graph(W, wts, nd, ns, p = 0.1, option = 2)
out <- separate_dense_and_sparse(gr)
out
```

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