Package 'netseer'

July 22, 2025

Type Package

Title Graph Prediction from a Graph Time Series

Version 0.1.1

Maintainer Sevvandi Kandanaarachchi <sevvandik@gmail.com>

Description Predicting the structure of a graph including new nodes and edges using a time series of graphs. Flux balance analysis, a linear and integer programming technique used in biochemistry is used with time series prediction methods to predict the graph structure at a future time point Kandanaarachchi (2024) <doi:10.48550/arXiv.2401.04280>.

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Encoding UTF-8

RoxygenNote 7.3.1

Imports dplyr, fable, fabletools, forecast, future, igraph, lpSolve, Matrix, rlang, stats, tibble, tsibble

Suggests feasts, nnet, urca

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

NeedsCompilation no

Author Sevvandi Kandanaarachchi [aut, cre] (ORCID: <https://orcid.org/0000-0002-0337-0395>)

Repository CRAN

Date/Publication 2024-11-12 07:00:02 UTC

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generate_graph_exp   *Generates a bigger graph using exponential growth.*

Description

Generates a bigger graph using parameters for node and edge growth. If a sequence of graphs are created, the number of nodes in this sequence would exponentially increase.

Usage

```
generate_graph_exp(
  gr = NULL,
  del_edge = 0.1,
  new_nodes = 0.1,
  edge_increase = 0.1
)
```

Arguments

gr	The input graph to generate the next graph. If set to `NULL` a graph using `igraph::sample_pa` is used as the input graph.
del_edge	The proportion of edges deleted from the input graph. Default set to `0.1`.
new_nodes	The proportion of nodes added to the input graph. Default set to `0.1`.
edge_increase	The proportion of edges added to the input graph. Default set to `0.1`.

Value

A graph.

Examples

```
set.seed(1)
gr <- generate_graph_exp()
gr
```

---

generate_graph_linear *Generates a bigger graph by linear growth.*

Description

Generates a bigger graph using parameters for node and edge growth. If a sequence of graphs are created, the number of nodes would linearly increase.

Usage

```
generate_graph_linear(
  gr = NULL,
  del_edge = 1,
  new_nodes = 1,
  edge_increase = 1,
  edges_per_new_node = 3
)
```

Arguments

gr	The input graph to generate the next graph. If set to NULL a graph using igraph::sample_pa is used as the input graph.
del_edge	The number of edges deleted from the input graph. Default set to 1.
new_nodes	The number of nodes added to the input graph. Default set to 1.
edge_increase	The number of edges added to the input graph. Default set to 1.
edges_per_new_node	
	The number of edges added to the new nodes. Default set to 3.

Value

A graph.

Examples

```
set.seed(1)
gr <- generate_graph_linear()
gr
```

---

predict_graph	*Predicts a graph from a time series of graphs.*

Description

This function predicts the graph at a future time step using a time series of graphs.

Usage

```
predict_graph(
  graphlist,
  formulation = 2,
  conf_level1 = NULL,
  conf_level2 = 90,
  dense_opt = 2,
  weights_opt = 6,
```

```
  weights_param = 0.001,
  h = 1
)
```

Arguments

graphlist   A list of graphs in igraph format.

formulation   Formulation 2 includes an additional condition constraining total edges by the
                 predicted value. Formulation 1 does not have that constraint. Formulation 2
                 gives more realistic graphs due to that constraint. Default is set to 2.

conf_level1   A value between 50 and 100 denoting the confidence interval for the number of
                 predicted nodes in the graph. If set to NULL the predicted graph has the mean
                 number of predicted nodes. If set to 80 for example, there would be 3 predicted
                 graphs. One with mean number of predicted nodes, and the other two with the
                 number of nodes corresponding to lower and upper confidence bounds.

conf_level2   The upper confidence bound for the degree distribution. Default set to 90.

dense_opt   If set to 2 the dense option in R package lpSolve will be used.

weights_opt   Weights option ranging from 1 to 6 used for different edge weight schemes.
                 Weights option 1 uses uniform weights for all edges. Option 2 uses binary
                 weights. If the edge existed in a past graph, then weight is set to 1. Else set
                 to 0. All possible new edges are assigned weight 1. Option 3 is a more selective
                 version. Option 4 uses proportional weights according to the history. Option 5
                 uses proportional weights, but as the network is more in the past, it gives less
                 weight. Option 5 uses linearly decaying proportional weights. Option 6 uses
                 harmonically decaying weights. That is the network at T is given weight 1, T-1
                 is given weight 1/2 and so on. Default is set to 6.

weights_param   The weight given for possible edges from new vertices. Default set to 0.001.

h   The prediction time step. Default is h = 1.

Value

A list of predicted graphs. If conf_level1 is not NULL, then 3 graphs are returned one with the
mean number of predicted nodes and the other 2 with the number of nodes equal to the lower and
upper bound values of prediction. If If conf_level1 is NULL, only the mean predicted graph is
returned.

Examples

```
set.seed(2024)
edge_increase_val <- new_nodes_val <- del_edge_val <- 0.1
graphlist <- list()
graphlist[[1]] <- gr <-  igraph::sample_pa(5, directed = FALSE)
for(i in 2:15){
  gr <-  generate_graph_exp(gr,
                     del_edge = del_edge_val,
                     new_nodes = new_nodes_val,
                     edge_increase = edge_increase_val )
  graphlist[[i]] <- gr
```

```
}
grpred <- predict_graph(graphlist[1:15], conf_level2 = 90, weights_opt = 6)
grpred
```

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