Package ‘irtrees’

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irtrees-package ......................................................... 2
dendrify ........................................................................ 2
exogenize ................................................................. 3
graph2mx ................................................................. 4
linlat ...................................................................... 5
linresp ................................................................. 5
LtoL_multi.tree ....................................................... 6
LtoL_single.tree ..................................................... 7
LtoW_multi.tree ..................................................... 8
Description

Helper functions and example data sets to facilitate the estimation of tree-based item Response models of the GLMM family with function glmer from the lme4 package

Author(s)

Ivailo Partchev <partchev@gmail.com>

References


dendrify Measurement Mapping for an IRTree Model

Description

Expands a wide-form matrix of item responses to a long-form data frame of sub-item responses

Usage

dendrify(mat, cmx)

Arguments

mat An integer matrix of IRT responses (columns represent items, rows represent respondents)

cmx A mapping matrix with as many rows as there are response options for the items.
Value
A data frame with one row per sub-item response

Author(s)
Ivailo Partchev

References

See Also
exogenize

Examples
mapping <- cbind(c(0,1,1), c(NA,0,1))
str(linrespT <- dendrify(linresp, mapping))

Description
Expands a wide-form file of item responses to a long-form file supporting structural mappings among latent variables

Usage
exogenize(mat, cmx, items=seq_len(ncol(mat)), endnode, crossitem=NULL)

Arguments

mat An integer matrix of IRT responses (columns represent items, rows represent respondents)
cmpx The mapping matrix.
items A numeric vector with the column positions of all items (measurement variables) in mat. Defaults to all columns of mat.
endnode A factor with the same length as items indicating the latent variable to which the item is attached, and compatible with the mapping matrix.
crossitem A factor with the same length as items indicating the original items that have been crossed with endnode (e.g., given at various occasions over time), thus producing the actual items. This is not meaningful when the design is nested, and should better be omitted in such cases.
Value

A data frame with columns:

- **person**: a factor identifying the respondent;
- **item**: a factor identifying the items;
- **exo1 to exoS**: dummy variables identifying the internal nodes: these play the same role as **exofactor** but are necessary when the model must include independent random effects;
- **endnode**: a factor identifying the end nodes and thus the endogeneous latent variables;
- **crossitem**: a factor produced only for crossed designs, identifying the items that are crossed with **endnode**, for example, in the case when the same items are repeated over time in a longitudinal design;
- **value**: the binary item responses.

Author(s)

Ivailo Partchev

References


See Also

dendrify

Examples

```r
str(linlatT <- exogenize(linlat,
             cbind(c(1,0,0), c(1,1,0), c(0,1,0), c(0,1,1), c(0,0,1)),
             endnode = rep(1:3, each=10), cross = rep(1:10, 3))
```

---

**graph2mx**

Convert a tree to a mapping matrix

Description

Convert a tree description in mermaid format into a mapping matrix that can be used with the remaining functions in the package.

Usage

`graph2mx(td)`
Arguments

td tree description in mermaid format

Value

the mapping matrix

---

linlat  

Example Data: Sequential-Order Latent Variable Models

Description

Simulated example data set for a model with sequential-order latent variable models.

Format

An IRT response matrix with 300 persons and 30 binary items.

References


Examples

```r
str(linlat)
str(linlatT <- exogenize(linlat, 
cbind(c(1,0,0), c(1,1,0), c(0,1,0), c(0,1,1), c(0,0,1)), 
     endnode = rep(1:3, each=10), cross = rep(1:10, 3)))
```

---

linresp  

Example Data: Linear Hierarchical Categories

Description

Simulated example data set with linear hierarchical categories.

Format

An IRT response matrix with 300 persons and 10 three-category items.

References

LtoL_multi.tree

### Examples

```r
str(linresp)
mapping <- cbind(c(0,1,1), c(NA,0,1))
str(linrespT <- dendrify(linresp, mapping))
```

---

**LtoL_multi.tree**  
**Long-to-long, multiple trees**

### Description

Recode a long format data frame to a long format IRTRees data frame in the case when items may have different tree structures.

### Usage

```r
LtoL_multi.tree(
  data,
  cmx_list,
  item_list,
  id.col,
  item.col,
  resp.col,
  covar.col = NULL,
  time.col = NULL
)
```

### Arguments

- **data**: a long-format (person-item-response) data set
- **cmx_list**: a list including all tree structures
- **item_list**: a list of vectors, with a length matching the length of `cmx_list`; each element of such a vector points to an item ID in `item.col` using the corresponding mapping matrix
- **id.col**: the person ID column
- **item.col**: the item ID column
- **resp.col**: the response column
- **covar.col**: columns containing covariates
- **time.col**: the time column. If not NULL, `time.col` should be nested in `id.col`, since it indicates repeated measures within persons

### Details

Many examples of mapping matrices are given in the vignette. Columns may be specified by numeric index or by name. Response categories must be coded with consecutive integers starting from 1, not 0. Missing data should be properly represented as NA.
**LtoL_single.tree**  

**Description**  
Recode a long format data frame to a long format IRTrees data frame in the case when items have the same tree structure.

**Usage**

```
LtoL_single.tree(
  data,  
  cmx,  
  id.col,  
  item.col,  
  resp.col,  
  covar.col = NULL,  
  time.col = NULL
)
```

**Arguments**

- **data**: a long-format (person-item-response) data set  
- **cmx**: a category-by-node mapping matrix  
- **id.col**: the person ID column  
- **item.col**: the item ID column  
- **resp.col**: the response column  
- **covar.col**: columns containing covariates  
- **time.col**: the time column. If not NULL, `time.col` should be nested in `id.col`, since it indicates repeated measures within persons.

**Details**

Many examples of mapping matrices are given in the vignette. Columns may be specified by numeric index or by name. Response categories must be coded with consecutive integers starting from 1, not 0. Missing data should be properly represented as NA.
LtoW_multi.tree

Long-to-wide, multiple trees

Description

Recode a long format data frame to a wide format IRTrees data frame in the case when items may have different tree structures.

Usage

LtoW_multi.tree(
  data,
  cmx_list,
  item_list,
  id.col,
  item.col,
  resp.col,
  covar.col = NULL,
  time.col = NULL
)

Arguments

data a long-format (person-item-response) data set

  cmx_list a list including all tree structures

  item_list a list of vectors, with a length matching the length of cmx_list; each element of such a vector points to an item ID in item.col using the corresponding mapping matrix

  id.col the person ID column

  item.col the item ID column

  resp.col the response column

  covar.col columns containing covariates

  time.col the time column. If not NULL, time.col should be nested in id.col, since it indicates repeated measures within persons

Details

Many examples of mapping matrices are given in the vignette. Columns may be specified by numeric index or by name. Response categories must be coded with consecutive integers starting from 1, not 0. Missing data should be properly represented as NA.
Description

Recode a long format data frame to a wide format IRTrees data frame in the case when items have the same tree structure.

Usage

```r
LtoW_single.tree(
  data,
  cmx,
  id.col,
  item.col,
  resp.col,
  covar.col = NULL,
  time.col = NULL
)
```

Arguments

data a long-format (person-item-response) data set

`cmx` a category-by-node mapping matrix

`id.col` the person ID column

`item.col` the item ID column

`resp.col` the response column

`covar.col` columns containing covariates

`time.col` the time column. If not NULL, `time.col` should be nested in `id.col`, since it indicates repeated measures within persons.

Details

Many examples of mapping matrices are given in the vignette. Columns may be specified by numeric index or by name. Response categories must be coded with consecutive integers starting from 1, not 0. Missing data should be properly represented as NA.
neslat  

Example Data: Nested Hierarchical Categories

Description

Simulated example data set for a model with nested hierarchical latent variables.

Format

An IRT response matrix with 300 persons and 30 binary items.

References


Examples

```r
str(neslat)
str(neslatT <-
exogenize(neslat, cbind(c(1,1,1), c(1,0,0), c(0,1,0), c(0,0,1)),
endnode=rep(1:3, each = 10)))
```

nesresp  

Example Data: Nested Hierarchical Latent Variables

Description

Simulated example data set with nested hierarchical categories.

Usage

```r
data(nesresp)
```

Format

An IRT response matrix with 300 persons and 10 four-category items.

References

Examples

```r
str(nesresp)
head(nesresp)
str(nesrespt <-
    dendrify(nesresp, cbind(c(0,0,1,1), c(0,1,NA,NA), c(NA,NA,0,1))))
head(nesrespt, 20)
```

### tolong

*Convert a wide-format matrix to long format*

**Description**

Convert an IRT response matrix in the wide format to a data frame in the long format. In the wide format each row corresponds to a respondent and each column to an item.

**Usage**

```r
tolong(mat)
```

**Arguments**

- `mat`: an integer IRT response matrix (i.e. a wide format)

**Value**

a long-format data frame

---

### VerbAgg2

*Verbal Aggression Data, Dichotomized Items*

**Description**

Item responses to a questionnaire on verbal aggression. These data are used throughout De Boeck and Wilson, Explanatory Item Response Models (Springer, 2004) to illustrate various forms of item response models.

**Format**

A data matrix with 316 persons, 24 three-category items, and two person covariates (trait anger and gender).

**Source**

http://bear.soe.berkeley.edu/EIRM/
References


Examples

```r
str(VerbAgg2)
mapping <- cbind(c(1,1,1), diag(3))
str(VerbAgg2T <- exogenize(VerbAgg2[-c(1,2)], mapping,
  endnode=rep(1:3, 8)))
```

---

### VerbAgg3

*Verbal Aggression Data, Three-Category Items*

Description

Item responses to a questionnaire on verbal aggression. These data are used throughout De Boeck and Wilson, Explanatory Item Response Models (Springer, 2004) to illustrate various forms of item response models.

Format

A data matrix with 316 persons, 24 three-category items, and two person covariates (trait anger and gender).

Source

http://bear.soe.berkeley.edu/EIRM/

References


Examples

```r
str(VerbAgg3)
mapping <- cbind(c(0,1,1), c(NA,0,1))
str(VerbAgg3T <- dendrify(VerbAgg3[-c(1,2)], mapping))
```
Description

Recode a wide format data frame to a long format IRTRees data frame in the case when items may have different tree structures

Usage

WtoL_multi.tree(  
data,  
cmx_list,  
id.col,  
resp.col_list,  
covar.col = NULL,  
time.col = NULL  
)

Arguments

data a wide-format (person-by-item) data set

cmx_list a list including all tree structures

id.col the ID column

resp.col_list a list of vectors, with a length matching the length of cmx_list; each element of such a vector points to an item (response variable) using the corresponding mapping matrix

covar.col columns containing covariates

time.col the time column when there are repeated (longitudinal) data

Details

Many examples of mapping matrices are given in the vignette. Columns may be specified by numeric index or by name. Response categories must be coded with consecutive integers starting from 1, not 0. Missing data should be properly represented as NA.
WtoL_single.tree  Wide-to-long, one tree

Description
Recode a wide format data frame to a long format IRTrees data frame in the case when all items have the same tree structure

Usage
WtoL_single.tree(
  data,
  cmx,
  id.col,
  resp.col,
  covar.col = NULL,
  time.col = NULL
)

Arguments
  data         a wide-format (person-by-item) data set
  cmx         a category-by-node mapping matrix
  id.col      the ID column
  resp.col    the columns containing the item responses
  covar.col   columns containing covariates
  time.col    the time column when there are repeated (longitudinal) data

Details
Many examples of mapping matrices are given in the vignette. Columns may be specified by numeric index or by name. Response categories must be coded with consecutive integers starting from 1, not 0. Missing data should be properly represented as NA.

WtoW_multi.tree  Wide-to-wide, multiple trees

Description
Recode a wide format data frame to a wide format IRTRees data frame in the case when items may have different tree structures
Usage

\texttt{WtoW\_multi.tree(}
\begin{verbatim}
data, cmx\_list, id.col = NULL, resp.col\_list, covar.col = NULL, time.col = NULL
\end{verbatim}
\texttt{)}

Arguments

- **data**: a wide-format (person-by-item) data set
- **cmx\_list**: a list including all tree structures
- **id.col**: the ID column
- **resp.col\_list**: a list of vectors, with a length matching the length of \texttt{cmx\_list}; each element of such a vector points to an item (response variable) using the corresponding mapping matrix
- **covar.col**: columns containing covariates
- **time.col**: the time column when there are repeated (longitudinal) data

Details

Many examples of mapping matrices are given in the vignette. Columns may be specified by numeric index or by name. Response categories must be coded with consecutive integers starting from 1, not 0. Missing data should be properly represented as NA.

\textbf{Description}

Recode a wide format data frame to a wide format IRTrees data frame in the case when all items have the same tree structure

Usage

\texttt{WtoW\_single.tree(}
\begin{verbatim}
data, cmx, id.col = NULL, resp.col = NULL, covar.col = NULL, time.col = NULL
\end{verbatim}
\texttt{)}
Arguments

- **data**  
  a wide-format (person-by-item) data set

- **cmx**  
  a a category-by-node mapping matrix

- **id.col**  
  the ID column

- **resp.col**  
  the columns containing the item responses

- **covar.col**  
  columns containing covariates

- **time.col**  
  the time column when there are repeated (longitudinal) data

Details

Many examples of mapping matrices are given in the vignette. Columns may be specified by numeric index or by name. Response categories must be coded with consecutive integers starting from 1, not 0. Missing data should be properly represented as NA.
Index

* datasets
  - linlat, 5
  - linresp, 5
  - neslat, 10
  - nesresp, 10
  - VerbAgg2, 11
  - VerbAgg3, 12

* models
  - dendrify, 2
  - exogenize, 3
  - irtrees-package, 2

dendrify, 2, 4
exogenize, 3, 3

graph2mx, 4

irtrees (irtrees-package), 2
irtrees-package, 2

linlat, 5
linresp, 5
LtoL_multi.tree, 6
LtoL_single.tree, 7
LtoW_multi.tree, 8
LtoW_single.tree, 9

neslat, 10
nesresp, 10
tolong, 11

VerbAgg2, 11
VerbAgg3, 12

WtoL_multi.tree, 13
WtoL_single.tree, 14
WtoW_multi.tree, 14
WtoW_single.tree, 15