Package 'psychotree'

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Title Recursive Partitioning Based on Psychometric Models

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Depends R (>= 2.10.0), stats, psychotools, party, strucchange,modeltools

Imports graphics, stats, psychotools, sandwich

Description Recursive partitioning based on psychometric models,employing the general MOB algorithm (from package party) to
obtain Bradley-Terry trees and Rasch trees.

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R topics documented:

btReg *Model-Generating Function for Bradley-Terry Models*

Description

btReg is a wrapper function that creates a "StatModel" object with certain fitting parameters passed on to btReg.fit for fitting simple Bradley-Terry models.

Usage

```
btReg(type = "loglin", ref = NULL, undecided = NULL, position = NULL)
```

Arguments

type	character. Should an auxiliary log-linear Poisson model or logistic binomial be employed for estimation? The latter is only available if not undecided effects are estimated.
ref	character or numeric. Which object parameter should be the reference category, i.e., constrained to zero?
undecided	logical. Should an undecided parameter be estimated?
position	logical. Should a position effect be estimated?

Details

btReg is the S4 interface for btReg.fit so that it can be used in mob. The user does not have to call this directly but can simply use the bttree interface.

Value

An object of class "StatModel" that fits Bradley-Terry models with the specified arguments.

See Also

bttree, btReg.fit

bttree *Bradley-Terry Tree Models*

Description

Recursive partitioning based on Bradley-Terry models.

Usage

```
bttree(formula, data, na.action = na.pass,
  type = "loglin", ref = NULL, undecided = NULL, position = NULL,
  minsplit = 10, ...)
```

Arguments

formula	A symbolic description of the model to be fit. This should be of type y ~ x1 + x2 where y should be an object of class paircomp and x1 and x2 are used as partitioning variables.
data	an optional data frame containing the variables in the model.
na.action	A function which indicates what should happen when the data contain NAs, defaulting to na.pass.
type, ref, undecided, position	arguments for the Bradley-Terry model passed on to btReg.
minsplit, ...	arguments passed to mob_control.

Details

Bradley-Terry tree models are an application of model-based recursive partitioning (implemented in mob) to Bradley-Terry models for paired comparison data (implemented in btReg). For all details about the underlying theory and further explanations of the illustrations from the example section can be found in Strobl, Wickelmaier, Zeileis (2011).

Various methods are provided for "bttree" objects, most of them inherit their behavior from "mob" objects (e.g., print, summary, etc.). worth behaves analogously to coef and extracts the worth parameters from the BT models in the nodes of the tree. The plot method employs the node_btplot panel-generating function.

Value

An object of S3 class "bttree" which is a list containing only a single element of S4 class "mob" (because this is currently not exported from the party package).

References

Carolin Strobl, Florian Wickelmaier, Achim Zeileis (2011). Accounting for Individual Differences in Bradley-Terry Models by Means of Recursive Partitioning. Journal of Educational and Behavioral Statistics, 36(2), 135-153. doi:10.3102/1076998609359791

See Also

mob, btReg

Examples

```
## package
library("psychotree")

## Germany's Next Topmodel 2007 data
data("Topmodel2007", package = "psychotree")
## BT tree
tm_tree <- bttree(preference ~ ., data = Topmodel2007, minsplit = 5, ref = "Barbara")
plot(tm_tree, abbreviate = 1, yscale = c(0, 0.5))
## parameter instability tests in root node
sctest(tm_tree, node = 1)
## worth parameters in terminal nodes
worth(tm_tree)

## CEMS university choice data
data("CEMSChoice", package = "psychotree")
summary(CEMSChoice$preference)
## BT tree
cems_tree <- bttree(preference ~ french + spanish + italian + study + work + gender + intdegree,
  data = CEMSChoice, minsplit = 5, ref = "London")
plot(cems_tree, abbreviate = 1, yscale = c(0, 0.5))
worth(cems_tree)
```

CEMSChoice *CEMS University Choice Data*

Description

Preferences of 303 students from WU Wien for different CEMS universities.

Usage

```
data("CEMSChoice")
```

Format

A data frame containing 303 observations on 10 variables.

preference Paired comparison of class `paircomp`. Preferences for all 15 paired comparisons from 6 objects: London, Paris, Milano, St. Gallen, Barcelona, Stockholm.

study Factor coding main discipline of study: commerce, or other (economics, business administration, business education).

english Factor coding knowledge of English (good, poor).

french Factor coding knowledge of French (good, poor).

spanish Factor coding knowledge of Spanish (good, poor).

italian Factor coding knowledge of Italian (good, poor).

work Factor. Was the student working full-time while studying?

gender Factor coding gender.

intdegree Factor. Does the student intend to take an international degree?

preference1998 Paired comparison of class `paircomp`. This is like `preference` but the comparisons between Barcelona an Stockholm are (erroneously) reversed, see below.

Details

Students at Wirtschaftsuniversität Wien (`http://www.wu.ac.at/`) can study abroad visiting one of currently 17 CEMS universities (Community of European Management Schools and International Companies). Dittrich et al. (1998) conduct and analyze a survey of 303 students to examine the student's preferences for 6 universities: London School of Economics, HEC Paris, Università Commerciale Luigi Bocconi (Milano), Universität St. Gallen, ESADE (Barcelona), Handelshögskolan i Stockholm. To identify reasons for the preferences, several subject covariates (including foreign language competence, gender, etc.) have been assessed. Furthermore, several object covariates are attached to `preference` (and `preference1998`): the universities' field of `specialization` (economics, management science, finance) and location (Latin country, or other).

The correct data are available in the online complements to Dittrich et al. (1998). However, the accompanying analysis was based on an erroneous version of the data in which the choices for the last comparison pair (Barcelona : Stockholm) were accidentally reversed. See the corrigendum in Dittrich et al. (2001) for further details. The variable `preference` provides the correct data and can thus be used to replicate the analysis from the corrigendum (Dittrich et al. 2001). For convenience, the erroneous version is provided in `preference1998` which can therefore be used to replicate the (incorrect) original analysis (Dittrich et al. 1998).

Source

The Royal Statistical Society Datasets Website.

`http://www.blackwellpublishing.com/rss/Readmefiles/dittrich.htm`

References

Dittrich R., Hatzinger R., Katzenbeisser W. (1998). Modelling the Effect of Subject-Specific Covariates in Paired Comparison Studies with an Application to University Rankings, *Journal of the Royal Statistical Society C*, **47**, 511–525.

Dittrich R., Hatzinger R., Katzenbeisser W. (2001). Corrigendum: Modelling the Effect of Subject-Specific Covariates in Paired Comparison Studies with an Application to University Rankings, *Journal of the Royal Statistical Society C*, **50**, 247–249.

See Also

`paircomp`

Examples

```
data("CEMSChoice", package = "psychotree")
summary(CEMSChoice$preference)
covariates(CEMSChoice$preference)
```

DIFSim *Artificial Data with Differential Item Functioning*

Description

Artificial data simulated from a Rasch model where the items exhibit differential item functioning (DIF).

Usage

```
data("DIFSim")
```

Format

A data frame containing 200 observations on 4 variables.

resp matrix with 0/1 results for 20 items.

age age in years.

gender factor indicating gender.

motivation ordered factor indicating motivation level.

Details

The data are employed for illustration in Strobl et al. (2010), whose results are replicated on the manual page for raschtree.

References

Strobl, C., Kopf, J., and Zeileis, A. (2010). A New Method for Detecting Differential Item Functioning in the Rasch Model. Technical Report 92. Department of Statistics, Ludwig-Maximilians-Universität München. http://epub.ub.uni-muenchen.de/11915/

See Also

raschtree

Examples

```
## data
data("DIFSim", package = "psychotree")

## summary of covariates
summary(DIFSim[,-1])

## histogram of raw scores
hist(rowSums(DIFSim$resp), breaks = 0:19 + 0.5)
```

EuropeanValuesStudy *European Values Study*

Description

A sample of the 1999 European Values Study (EVS) containing an assessment of materialism/postmaterialism in 3584 respondents from 32 countries.

Usage

```
data("EuropeanValuesStudy")
```

Format

A data frame containing 3584 observations on 10 variables.

country Factor coding the country of a respondent.

gender Factor coding gender.

birthyear Numeric. Year of birth.

eduage Numeric. Age when full time education was or will be completed.

marital Factor. Current legal marital status.

employment Ordered factor. Employment and number of working hours.

occupation Factor. What is/was your main job?

income Ordered factor. Income of household in ten categories from 10 percent lowest to 10 percent highest income category.

paircomp Paired comparison of class `paircomp`. Five pairwise choices among four important political goals derived from a double-choice task (see Details).

country2 Factor. Country group according to postmaterialism (see Details).

Details

The data are part of a larger survey conducted in 1999 in 32 countries in Europe (see http://www.europeanvaluesstudy.eu/). Vermunt (2003) obtained a sample from 10 percent of the available cases per country, yielding 3584 valid cases.

The item in the 1999 European Values Study questionnaire aiming at recording materialism/postmaterialism reads as follows:

There is a lot of talk these days about what the aims of this country should be for the next ten years. On this card are listed some of the goals which different people would give top priority. If you had to choose, which of the things on this card would you say is most important? And which would be the next most important?

A Maintaining order in the nation
B Giving people more say in important government decisions
C Fighting rising prices
D Protecting freedom of speech

The double-choice task implies a partial ranking of the alternatives and (assuming transitivity) an incomplete set of paired comparisons for each respondent.

The country group according to postmaterialism was derived by Vermunt (2003) using a latent class model, and applied by Lee and Lee (2010) in a tree model.

Source

Latent GOLD Sample Data Sets Website.

http://www.statisticalinnovations.com/products/choice_datasets.html

References

Lee, P.H., & Yu, P.L.H. (2010). Distance-Based Tree Models for Ranking Data. *Computational Statistics and Data Analysis*, **54**, 1672–1682.

Vermunt, J.K. (2003). Multilevel Latent Class Models. *Sociological Methodology*, **33**, 213–239.

See Also

paircomp

Examples

```
## data
data("EuropeanValuesStudy", package = "psychotree")
summary(EuropeanValuesStudy$paircomp)

## Bradley-Terry tree resulting in similar results compared to
## the (different) tree approach of Lee and Lee (2010)
evs <- na.omit(EuropeanValuesStudy)
bt <- bttree(paircomp ~ gender + eduage + birthyear + marital + employment + income + country2,
  data = evs, alpha = 0.01)
plot(bt, abbreviate = 2)
```

---

node_btplot *Panel-Generating Function for Visualizing Bradley-Terry Tree Models*

Description

Panel-generating function for visualizing the worth parameters from the nodes in Bradley-Terry tree models.

Usage

```
node_btplot(mobobj, id = TRUE,
  worth = TRUE, names = TRUE, abbreviate = TRUE, index = TRUE, ref = TRUE,
  col = "black", linecol = "lightgray", cex = 0.5, pch = 19,
  xscale = NULL, yscale = NULL, ylines = 1.5)
```

Arguments

mobobj	an object of class "mob" based on Bradley-Terry models fitted by btReg.
id	logical. Should the node ID be displayed?
worth	logical. Should worth parameters (or their logs) be visualized?
names	logical. Should the names for the objects be displayed?
abbreviate	logical or numeric. Should object names be abbreviated? If numeric this controls the length of the abbreviation.
index	logical. Should different indexes for different stimuli be used?
ref	logical. Should a horizontal line for the reference level be drawn?
col, cex, pch	graphical appearance of plotting symbols.
linecol	line color for reference line (if ref).
xscale, yscale	x and y axis limits.
ylines	numeric. Number of lines used for y-axis labels.

Details

The panel-generating function node_btplot is called by the plot method for "bttree" objects and does not have to be called by the user directly.

Value

A panel function which can be supplied to the plot method for "mob" objects.

See Also

bttree

---

node_raschplot *Panel-Generating Function for Visualizing Rasch Tree Models*

Description

Panel-generating function for visualizing the item parameters from the nodes in Rasch tree models.

Usage

```
node_raschplot(mobobj, id = TRUE, difficulty = TRUE,
  center = TRUE, index = TRUE, names = NULL, abbreviate = FALSE, ref = TRUE,
  col = cbind("lightgray", "black"), refcol = "lightgray", linecol = "black",
  lty = 2, cex = 0.5, pch = cbind(19, 1), xscale = NULL, yscale = NULL,
  xaxis = TRUE, yaxis = TRUE, ylines = 1.5)
```

Arguments

mobobj	an object of class "mob" based on Rasch models fitted by RaschModel.
id	logical. Should the node ID be displayed?
difficulty	logical. Should item difficulty (or alternatively: easiness) parameters be displayed?
center	logical. Should the item parameters be centered?
index	logical. Should different indexes for different items be used?
names	logical. Should the names for the objects be displayed?
abbreviate	logical or numeric. Should object names be abbreviated? If numeric this controls the length of the abbreviation.
ref	logical. Should a horizontal line for the reference level be drawn?
col, pch, cex	graphical appearance of plotting symbols. Can be of the same length as number of items. Additionally col and pch can be matrices with two columns resulting in two symbols being overplotted.
refcol	line color for reference line (if ref).
linecol	line color.
lty	line type.
xscale, yscale	x and y axis limits.
xaxis, yaxis	logical. Should a axes be plotted?
ylines	numeric. Number of lines used for y-axis labels.

Details

The panel-generating function node_raschplot is called by the plot method for "raschtree" objects and does not have to be called by the user directly.

Value

A panel function which can be supplied to the plot method for "mob" objects.

See Also

raschtree

RaschModel *Model-Generating Function for Rasch Models*

Description

RaschModel is a wrapper function that creates a "StatModel" object with certain fitting parameters passed on to RaschModel.fit for fitting simple Rasch models.

Usage

```
RaschModel(gradtol = 1e-6, deriv = c("sum", "diff", "numeric"), hessian = TRUE)
```

Arguments

deriv	character. Which type of derivatives should be used for computing gradient and Hessian matrix? Analytical with sum algorithm ("sum"), analytical with difference algorithm ("diff", faster but numerically unstable), or numerical.
hessian	logical. Should the Hessian of the final model be computed? If set to FALSE, the vcov method can only return NAs and consequently no standard errors or tests are available in the summary.
gradtol, ...	further arguments passed to nlm.

Details

RaschModel is the S4 interface for RaschModel.fit so that it can be used in mob. The user does not have to call this directly but can simply use the raschtree interface.

Value

RaschModel returns an S4 object of class "StatModel" that fits Rasch models with the specified arguments.

See Also

raschtree, RaschModel.fit

raschtree *Rasch Tree Models*

Description

Recursive partitioning based on Rasch models.

Usage

```
raschtree(formula, data, minsplit = 10, gradtol = 1e-6,
  deriv = c("sum", "diff", "numeric"), ...)
```

Arguments

formula	A symbolic description of the model to be fit. This should be of type `y ~ x1 + x2` where `y` should be a binary 0/1 matrix and `x1` and `x2` are used as partitioning variables.
data	a data frame containing the variables in the model.
deriv	character. Which type of derivatives should be used for computing gradient and Hessian matrix? Analytical with sum algorithm (`"sum"`), analytical with difference algorithm (`"diff"`, faster but numerically unstable), or numerical. Passed to `RaschModel`.
gradtol	numeric tolerance passed to `RaschModel` and on to `nlm`.
minsplit, ...	arguments passed to `mob_control`.

Details

Rasch tree models are an application of model-based recursive partitioning (implemented in `mob`) to Rasch models (implemented in `RaschModel`).

Various methods are provided for `"raschtree"` objects, most of them inherit their behavior from `"mob"` objects (e.g., `print`, `summary`, etc.). For the Rasch models in the nodes of a tree, `coef` extracts all item parameters except the first one which is always restricted to be zero. `worth` extracts all item parameters (including the first one) and restricts their sum to be zero. The `plot` method employs the `node_raschplot` panel-generating function.

Rasch tree models are introduced in Strobl et al. (2010), whose analysis for the `SPISA` data is replicated in `vignette("raschtree", package = "psychotree")`. Their illustration employing artificial data is replicated below.

Value

An object of S3 class `"raschtree"` which is a list containing only a single element of S4 class `"mob"` (because this is currently not exported from the party package).

References

Strobl, C., Kopf, J., and Zeileis, A. (2010). A New Method for Detecting Differential Item Functioning in the Rasch Model. Technical Report 92. Department of Statistics, Ludwig-Maximilians-Universität München. http://epub.ub.uni-muenchen.de/11915/

See Also

mob, RaschModel, bttree

Examples

```
## artificial data
data("DIFSim", package = "psychotree")

## fit Rasch tree model
rt <- raschtree(resp ~ age + gender + motivation, data = DIFSim)
plot(rt)

## extract item parameters
coef(rt)
worth(rt)

## inspect parameter stability tests in all splitting nodes
sctest(rt, node = 1)
sctest(rt, node = 2)

## highlight items 3 and 14 with DIF
ix <- rep(1, 20)
ix[c(3, 14)] <- 2
plot(rt, ylines = 2.5,  cex = c(0.4, 0.8)[ix],
  pch = c(19, 19)[ix], col = gray(c(0.5, 0))[ix])
```

SPISA *SPIEGEL Studentenpisa Data (Subsample)*

Description

A subsample from the general knowledge quiz "Studentenpisa" conducted online by the German weekly news magazine SPIEGEL. The data contain the quiz results from 45 questions as well as sociodemographic data for 1075 university students from Bavaria.

Usage

```
data("SPISA")
```

Format

A data frame containing 1075 observations on 6 variables.

spisa matrix with 0/1 results from 45 questions in the quiz (indicating wrong/correct answers).

gender factor indicating gender.

age age in years.

semester numeric indicating semester of university enrollment.

elite factor indicating whether the university the student is enrolled in has been granted "elite" status by the German "excellence initiative".

spon ordered factor indicating frequency of accessing the SPIEGEL online (SPON) magazine.

Details

An online quiz for testing one's general knowledge was conducted by the German weekly news magazine SPIEGEL in 2009. Overall, about 700,000 participants answered the quiz and a set of sociodemographic questions. The general knowledge quiz consisted of a total of 45 items from five different topics: politics, history, economy, culture and natural sciences. For each topic, four different sets of nine items were available, that were randomly assigned to the participants. A thorough analysis and discussion of the original data set is provided in Trepte and Verbeet (2010).

Here, we provide the subsample of university students enrolled in the federal state of Bavaria, who had been assigned questionnaire number 20 (so that all subjects have answered the same set of items). Excluding all incomplete records, this subsample contains 1075 observations.

The data are analyzed in Strobl et al. (2010), whose analysis is replicated in `vignette("raschtree", package = "psychotree")`.

The full list of items in questionnaire 20 is given below.

Politics:
Who determines the rules of action in German politics according to the constitution? – The Bundeskanzler (federal chancellor).
What is the function of the second vote in the elections to the German Bundestag (federal parliament)? – It determines the allocation of seats in the Bundestag.
How many people were killed by the RAF (Red Army Faction)? – 33.
Where is Hessen (i.e., the German federal country Hesse) located? – (Indicate location on a map.)
What is the capital of Rheinland-Pfalz (i.e., the German federal country Rhineland-Palatinate)? – Mainz.
Who is this? – (Picture of Horst Seehofer.)
Which EU institution is elected in 2009 by the citizens of EU member countries? – European Parliament.
How many votes does China have in the UNO general assembly? – 1.
Where is Somalia located? – (Indicate location on a map.)

History:
The Roman naval supremacy was established through... – ... the abolition of Carthage.
In which century did the Thirty Years' War take place? – The 17th century.
Which form of government is associated with the French King Louis XIV? – Absolutism.
What island did Napoleon die on in exile? – St. Helena.
How many percent of the votes did the NSDAP receive in the 1928 elections of the German Reichstag? – About 3 percent.

How many Jews were killed by the Nazis during the Holocaust? – About 6 Million.
Who is this? – (Picture of Johannes Rau, former German federal president.)
Which of the following countries is not a member of the EU? – Croatia.
How did Mao Zedong expand his power in China? – The Long March.

Economy:
Who is this? – (Picture of Dieter Zetsche, CEO of Mercedes-Benz.)
What is the current full Hartz IV standard rate (part of the social welfare) for adults? – 351 Euro.
What was the average per capita gross national product in Germany in 2007? – About 29,400 Euro.\
What is a CEO? – A Chief Executive Officer.
What is the meaning of the hexagonal "organic" logo? – Synthetic pesticides are prohibited.
Which company does this logo represent? – Deutsche Bank.
Which German company took over the British automobile manufacturers Rolls-Royce? – BMW.
Which internet company took over the media group Time Warner? – AOL.
What is the historic meaning of manufacturies? – Manufacturies were the precursors of industrial mass production.

Culture:
Which painter created this painting? – Andy Warhol.
What do these four buildings have in common? – All four were designed by the same architects.
Roman numbers: What is the meaning of CLVI? – 156.
What was the German movie with the most viewers since 1990? – Der Schuh des Manitu.
In which TV series was the US president portrayed by an African American actor for a long time? – 24.
What is the name of the bestselling novel by Daniel Kehlmann? – Die Vermessung der Welt (Measuring The World).
Which city is the setting for the novel 'Buddenbrooks'? – Lübeck.
In which city is this building located? – Paris.
Which one of the following operas is not by Mozart? – Aida.

Natural sciences:
Why does an ice floe not sink in the water? – Due to the lower density of ice.
What is ultrasound not used for? – Radio.
Which sensory cells in the human eye make color vision possible? – Cones.
What is also termed Trisomy 21? – Down syndrome.
Which element is the most common in the Earth's atmosphere? – Nitrogen.
Which kind of tree does this leaf belong to? – Maple.
Which kind of bird is this? – Blackbird.
Where is the stomach located? – (Indicate location on a map of the body.)
What is the sum of interior angles in a triangle? – 180 degrees.

References

Strobl, C., Kopf, J., and Zeileis, A. (2010). A New Method for Detecting Differential Item Functioning in the Rasch Model. Technical Report 92. Department of Statistics, Ludwig-Maximilians-Universität München. http://epub.ub.uni-muenchen.de/11915/

SPIEGEL Online (2009). Studentenpisa – Alle Fragen, alle Antworten. In German. Accessed 2010-10-26. http://www.spiegel.de/unispiegel/studium/0,1518,620101,00.html

Trepte, S., and Verbeet, M. (2010). Allgemeinbildung in Deutschland – Erkenntnisse aus dem SPIEGEL-Studentenpisa-Test. ISBN 978-3-531-17218-7. VS Verlag, Wiesbaden.

See Also

raschtree

Examples

```
## data
data("SPISA", package = "psychotree")

## summary of covariates
summary(SPISA[,-1])

## histogram of raw scores
hist(rowSums(SPISA$spisa), breaks = 0:45 + 0.5)

## Not run:
## See the following vignette for a tree-based DIF analysis
vignette("raschtree", package = "psychotree")

## End(Not run)
```

Topmodel2007 *Attractiveness of Germany's Next Topmodels 2007*

Description

Preferences of 192 respondents judging the attractiveness of the top six contestants of the TV show *Germany's Next Topmodel 2007* (second cycle).

Usage

```
data("Topmodel2007")
```

Format

A data frame containing 192 observations on 6 variables.

preference Paired comparison of class paircomp. Preferences for all 15 paired comparisons from 6 contestants: Barbara, Anni, Hana, Fiona, Mandy, and Anja.

gender Factor coding gender.

age Integer. Age of the respondents in years.

q1 Factor. Do you recognize the women on the pictures?/Do you know the TV show Germany's Next Topmodel?

q2 Factor. Did you watch Germany's Next Topmodel regularly?

q3 Factor. Did you watch the final show of Germany's Next Topmodel?/Do you know who won Germany's Next Topmodel?

Details

Germany's Next Topmodel is a German casting television show (based on a concept introduced in the United States) hosted by Heidi Klum (see Wikipedia 2009). The second season of the show aired March–May 2007.

A survey was conducted at the Department of Psychology, Universität Tübingen, in 2007 shortly after the final show. The sample was stratified by gender and age (younger versus older than 30 years) with 48 participants in each group.

Digital photographs (resolution 303 times 404 pixels) of the top six contestants were available from the ProSieben web page (http://www.prosieben.de/) at the time of the survey. The photos were selected to be comparable, showing the contestant's face and the upper part of the body, all women being casually dressed.

Participants were presented with all 15 pairs of photographs. On each trial, their task was to judge which of the two women on the photos was the more attractive. In order to assess the participants' expertise, additional questions regarding their familiarity with the show were asked after the pairwise comparisons were completed.

The actual ranking, as resulting from sequential elimination during the course of the show, was (from first to sixth place): Barbara, Anni, Hana, Fiona, Mandy, Anja.

References

Wikipedia (2009). Germany's Next Topmodel – Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Germany's_Next_Topmodel, accessed 2009-02-06.

See Also

paircomp

Examples

```
data("Topmodel2007", package = "psychotree")
summary(Topmodel2007$preference)
xtabs(~ gender + I(age < 30), data = Topmodel2007)
```

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