

Package ‘mixRasch’

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Type Package

Title Mixture Rasch Models with JMLE

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Description Estimates Rasch models and mixture Rasch models, including the dichotomous Rasch model, the rating scale model, and the partial credit model.

License GPL (>= 2)

NeedsCompilation no

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mixRasch-package	<i>Contains a function for estimating and evaluating mixture Rasch models using JMLE</i>
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Description

The included function will estimate a mixture Rasch model using joint maximum likelihood estimation (JMLE). The estimation is based on a mixture partial credit model. Step parameters can be constrained to estimate a mixture rating scale model. Estimating a model with only one latent class accomplishes a standard Rasch analysis with JMLE.

Details

Package:	mixRasch
Type:	Package
Version:	1.1
Date:	2014-02-26
License:	GPL version 2 or newer

This is an early version of the package. It currently contains only the mixRasch function. Please contact the author if you encounter any bugs or if you have questions or suggestions.

Author(s)

John T. Willse <jtwillse@uncg.edu>

References

Willse, J. T. (2011). Mixture Rasch models with joint maximum likelihood estimation. *Educational and Psychological Measurement*, 71, 5-19.

exRasch	<i>Example 1-class data</i>
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Description

A small example data set for single-class (standard) Rasch model analysis.

Usage

```
data(exRasch)
```

Format

A data frame with 100 observations on the following 10 variables.

i1 a numeric vector
i2 a numeric vector
i3 a numeric vector
i4 a numeric vector
i5 a numeric vector
i6 a numeric vector
i7 a numeric vector
i8 a numeric vector
i9 a numeric vector
i10 a numeric vector

Source

Simulated to follow a 1-class (standard) Rasch model.

See Also

mixRasch

Examples

```
data(exRasch)
```

getEstDetails

Convenience function returning information about the estimation.

Description

This function extracts information about the estimation procedure conducted using the mixRasch procedure.

Usage

```
getEstDetails(raschResult, camelCase=TRUE)
```

Arguments

raschResult The result of a mixRasch analysis.
camelCase If TRUE, the variables returned are renamed to conform to camelCase style naming conventions.

Details

The function only requires a mixRasch result. The camelCase option is available so results can be exported to other software that might not support some types of R names (e.g., names with "."s in them).

Value

model	Reports which model was estimated.
n.c	Number of latent classes.
iter	The number of completed iterations.
max.change	The largest model parameter change in each class in the last iteration of the estimation.
converge.flag	Indicates if convergence was reached.
run.time	Reports time elapsed during estimation.

Author(s)

John T. Willse

Examples

```
# Example data included with mixRasch
data(SimMix)

test1 <- mixRasch(SimMix,1,50, conv.crit=.0001, n.c=1)
getEstDetails(test1)
```

getItemDetails *Convenience function returning information about an individual item.*

Description

This function extracts information about an individual item estimated using the mixRasch procedure.

Usage

```
getItemDetails(raschResult, item, class=1, camelCase=TRUE)
```

Arguments

raschResult	The result of a mixRasch analysis.
item	Either an integer representing the item position within the analysis or the item name (the column name from the dataframe used in the mixRasch analysis).
class	The class in a mixture Rasch analysis for which you want the item stats. In a standard Rasch analysis, class will always be 1.
camelCase	If TRUE, the variables returned are renamed to conform to camelCase style naming conventions.

Details

The function only requires a mixRasch result and an item number or name. If the analysis is a mixture analysis, the class from which the result is to be taken must be provided. The camelCase option is available so results can be exported to other software that might not support some types of R names (e.g., names with "."s in them).

Value

item.name	The name of the item.
n.cat	The number categories (e.g., 2 for dichotomous).
delta.i	Average step difficulty.
SE.delta.i	Standard error for delta.i.
tau	Step difficulty as a deviation from delta.i.
SE.tau	Standard error for tau.
infit	The infit statistic for the item
in.Z	The standardized infit statistic for the item
outfit	The outfit statistic for the item
out.Z	The standardized outfit statistic for the item
itemMean	The item mean, based on modal class.
pBis	The item-theta correlation, based on modal class.
bis	The item-theta polyserial correlation, based on modal class.

Author(s)

John T. Willse

Examples

```
# Example data included with mixRasch
data(SimMix)

test1 <- mixRasch(SimMix,1,50, conv.crit=.0001, n.c=1)
getItemDetails(test1,2)
```

 itemFitPlot

Function for producing item difficulty by fit statistic plots.

Description

This function produces item difficulty and fit statistic plots for Rasch calibrated items estimated using the mixRasch procedure.

Usage

```
itemFitPlot(raschResult, itemSet, useItemNames = TRUE,
            fitStat = "infit", plotTitle="Item Fit Plot",
            xlab, ylab, xlim, ylim, refLines,
            col = c("black", "white"), colTheme,
            gDevice, file)
```

Arguments

raschResult	A mixRasch object, where n.c = 1 (i.e., no mixture models).
itemSet	An optional vector of item names or item positions for plotting subsets of items.
useItemNames	If TRUE, then item names are used. If false item numbers are used.
fitStat	The item fit statistic ("infit", "outfit", "in.Z", "out.Z") used in the plot.
plotTitle	Controls the main plot title.
xlab	The label for the x axis.
ylab	The label for the y axis.
xlim	A vector overriding default limits for the x axis.
ylim	A vector overriding default limits for the y axis.
refLines	A vector overriding the default lower and upper reference lines that define the region of rejection.
col	A vector of the colors to be used in the plot. The first color will be used for item labels. The second color will be used for shading the area of rejection.
colTheme	Four color themes ("cavaliers", "dukes", "spartans", "greys") are provided. If you provide a color theme, it will override the col parameter.
gDevice	Controls graphics device. Options are "screen" (default), "jpg", or "png".
file	The name of the output file if a device other than "screen" is chosen.

Details

The function produces an item difficulty by item fit plot. Items are plotted using either their names or their test position (see useItemNames). Lower and upper reference line are drawn (see refLines) that help identify misfitting items. For infit and outfit, default reference lines are drawn at .7 and 1.3. For in.Z and out.Z, default reference lines are drawn at -2 and +2. Using col or colTheme, the region beyond the reference line may be shaded.

Author(s)

John T. Willse

Examples

```
# Example data included with mixRasch
data(exRasch)

rasch1 <- mixRasch(exRasch,1,50, conv.crit=.0001, n.c=1)

# Default Fit Plot
itemFitPlot(rasch1)

# Using Outfit and a color theme
itemFitPlot(rasch1, fitStat="outfit", colTheme="spartans")
```

mixRasch	<i>Function for estimating and evaluating mixture Rasch models using JMLE</i>
----------	---

Description

This function will estimate a mixture Rasch model using joint maximum likelihood estimation (JMLE). The estimation is based on a mixture partial credit model. Step parameters can be constrained to estimate a mixture rating scale model.

Usage

```
mixRasch(data, steps, max.iter = 50, conv.crit = 0.001, model = "RSM",
         n.c = 1, class, metric, info.fit = TRUE, treat.extreme = 0.3,
         maxchange = 1.5, maxrange = c(-4, 4), as.LCA = FALSE)
```

Arguments

data	A rectangular data set (matrix or data frame) to be analyzed.
steps	The maximum number of item thresholds to be estimated. Some items may have less than the maximum.
max.iter	Maximum number EM iterations
conv.crit	Estimation stops when the largest model parameter change is smaller than this criterion.
model	"RSM" (the default) constrains all step parameters to be equal (i.e., estimates a rating scale model). Assumes all items have the same number of steps. "PCM" allows step parameters to differ across items (i.e., estimates a partial credit model). The number of steps can differ across items.

n.c	Number of latent classes.
class	Optional matrix of starting values for latent class membership.
metric	Not implemented. Will be an optional argument for setting the final scale of the Rasch results.
info.fit	If "True" the information based criteria of fit (AIC, BIC) are estimated.
treat.extreme	Adjustment to perfect response vectors to allow estimation of person parameters. Perfect vectors are not used during item parameter estimation.
maxchange	Limits the change to model parameters in a single iteration. Helps keep estimates reasonable in the first few iterations.
maxrange	Admissible range of item difficulties.
as.LCA	If TRUE, all person parameters are constrained to equal zero. That analysis accomplishes a latent class analysis rather than a mixture Rasch model.

Details

The analyzed data should be a rectangular data file. Missing data are permitted and handled in the usual JMLE manner. Large amounts of missing data will slow down estimation. Basic results on item parameters are returned to the screen. When more than one class is specified (n.c greater than 1) Rasch model parameters and measures of fit are returned in a list, with each class's results returned in a separate element of that list. When n.c = 1 a standard Rasch model analysis is performed.

Value

LatentClass	One element for each latent class. Each LatentClass element is itself a list containing within class results: item statistics (i.stat), person parameters and measures of person fit (person.par), item parameters and measures of item fit (item.par).
max.change	The largest model parameter change in each class in the last iteration of the estimation.
class	A rectangular matrix of the order number of people by number of classes. Values represent the probability that a person (row) belongs to a particular class (column).
iter	The number of completed iterations.
converge.flag	Indicates if convergence was reached.
info.fit	Provides (if requested) AIC, BIC, CAIC, log likelihood, number of estimated parameters, and number of persons used in the estimation.
model	Reports which model was estimated.
removed.items	Provides a vector indicating which, if any, items had to be removed from estimation for having perfect vectors.
run.time	Reports time elapsed during estimation.

Note

Be aware that this function is an early implementation of the procedure. Please contact the author if you encounter any bugs or if you have questions or suggestions.

Author(s)

John T. Willse

References

Willse, J. T. (2009). Mixture Rasch models with joint maximum likelihood estimation. Presented at the National Council on Measurement in Education annual meeting. San Diego.

Examples

```
# Example data included with mixRasch
data(SimMix)

test1 <- mixRasch(SimMix,1,50, conv.crit=.0001, n.c=1)
test2 <- mixRasch(SimMix,1,500, conv.crit=.0001, n.c=2)

# Notice that the AIC and BIC are lowest for the 2 class solution
rbind(test1$info.fit,test2$info.fit)

# Notice that the two "difficulty" columns are ordered differently
# The results reflect that the two groups in the data set have a reversed
# scale from one another.
test2
```

personItemPlot	<i>Function for producing back-to-back histograms of item and person distributions.</i>
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Description

This function will enable you to make back-to-back histograms of the item and person distributions estimated using the mixRasch procedure.

Usage

```
personItemPlot(raschResult, nBreaks=15, plotTitle="Person Item Histogram",
  xlab = "Relative Frequency", ylab = "Ability",
  col = c("darkgrey","lightgrey"), colTheme, makeLegend=TRUE,
  legendLabels=c("items", "people"), legendLoc="bottomleft",
  gDevice, file)
```

Arguments

raschResult	A mixRasch object, where n.c = 1 (i.e., no mixture models).
nBreaks	The number of bins to be used in creating the histograms.
plotTitle	The title to be used on the plot.

xlab	The label for the x axis.
ylab	The label for the y axis.
col	A vector of the colors to be used in the plot. The first color will be used for items. The second color will be used for people.
colTheme	Four color themes ("cavaliers", "dukes", "spartans", "greys") are provided. If you provide a color theme, it will override the col parameter.
makeLegend	Controls whether a legend for the colors used in the plot.
legendLabels	A vector that allows for customized legend labels.
legendLoc	Allows placement of the legend in different location. Uses the same descriptions as the standard legend function.
gDevice	Controls graphics device. Options are "screen" (default), "jpg", or "png".
file	The name of the output file if a device other than "screen" is chosen.

Details

The function produces a standard person and item back-to-back histogram. These plots are only appropriate for standard Rasch models (i.e., not multiple-class mixture models). When used with polytomous model results, the item difficulty is based on the overall (average) step difficulty for each polytomous item.

Author(s)

John T. Willse

Examples

```
# Example data included with mixRasch
data(SimMix)

rasch1 <- mixRasch(SimMix,1,50, conv.crit=.0001, n.c=1)

personItemPlot(rasch1)
```

rICC

Function for producing theoretical and empirical item characteristic curves.

Description

This function produces item characteristic curves for the family of Rasch models.

Usage

```
rICC(delt, theta, itemVector, xlim, ylim, plotTitle, xlab, ylab,
     col = c("black", "white"), colTheme, expectedScore=FALSE,
     empICC=FALSE, empOnly=FALSE, gDevice, file, ...)
```

Arguments

delt	The threshold difficulties from a dichotomous or polytomous Rasch model.
theta	The estimated theta values associated with the analysis and paired with itemVector, only required when requesting an empirical ICC.
itemVector	The observed item responses, only required when requesting an empirical ICC.
xlim	A vector overriding default limits for the x axis.
ylim	A vector overriding default limits for the y axis.
plotTitle	Controls the main plot title.
xlab	The label for the x axis.
ylab	The label for the y axis.
col	A vector of the colors to be used in the plot. The first color will be used for item labels. The second color will be used for shading the area of rejection.
colTheme	Four color themes ("cavaliers", "dukes", "spartans", "greys") are provided. If you provide a color theme, it will override the col parameter.
expectedScore	Flag indicating whether polytomous items are presented as category probabilities (FALSE) or expected item scores (TRUE). Will be set to TRUE when requesting empirical ICC.
empICC	Flag indicating whether an empirical ICC should also be produced.
empOnly	A flag indicating if ONLY the empirical ICC should be produced.
gDevice	Controls graphics device. Options are "screen" (default), "jpg", or "png".
file	The name of the output file if a device other than "screen" is chosen.
...	Additional parameters passed to the plot command.

Details

The function produces an item characteristic curve plots. Both empirical and theoretical ICCs can be produced.

Author(s)

John T. Willse

Examples

```
library(mixRasch)
# Example data included with mixRasch
data(exRasch)
```

```
rasch1 <- mixRasch(exRasch,1,50, conv.crit=.0001, n.c=1)

# ICC for item 1
rICC(rasch1$item.par$delta[,1], rasch1$person.par$theta,
      exRasch[,1], empICC=TRUE, colTheme="cavaliers")
```

SimMix

Example 2-class data

Description

This simulated data contains two groups. The item difficulties for the two groups are reversed. The analysis should make a clear example for those people less familiar with mixture models.

Usage

```
data(SimMix)
```

Format

A data frame with 1000 observations on the following 10 variables.

i1 a numeric vector
i2 a numeric vector
i3 a numeric vector
i4 a numeric vector
i5 a numeric vector
i6 a numeric vector
i7 a numeric vector
i8 a numeric vector
i9 a numeric vector
i10 a numeric vector

Source

Simulated to follow a 2-class mixture Rasch model.

See Also

`mixRasch`

Examples

```
data(SimMix)
```

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