Package 'mRm'

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Type Package

Title An R Package for Conditional Maximum Likelihood Estimation in Mixed Rasch Models

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Description Conditional maximum likelihood estimation via the EM algorithm and information-criterion-based model selection in binary mixed Rasch models.

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R topics documented:

`mRm-package` *Parameter estimation and model selection in mixed Rasch models.*

Description

This package provides routines for cML estimation and model selection in binary mixed Rasch models (Rost 1990). For a detailed discussion of the accuracy of parameter estimates and reliability of AIC- and BIC- based model selection techniques see Preinerstorfer and Formann (2011).

The core part of the algorithm has been implemented in C++, using parts of the *Scythe Statistical Library* (2007) for matrix manipulations. Rows with missing values and constant rows are excluded.

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References

Pemstein, D., Quinn, K. M. and Martin, A. D. (2007). Scythe Statistical Library: Application programmer's interface. http://scythe.berkeley.edu/.

Preinerstorfer, D. and Formann, A. K. (2012) Parameter recovery and model selection in mixed Rasch models. *British Journal of Mathematical and Statistical Psychology, 65*, 251-262.

Rost (1990). Rasch models in latent classes: An integration of two approaches to item analysis. *Applied Psychological Measurement, 14*, 271-282.

`mrm` *cMLE and model selection in binary mixed Rasch models.*

Description

The function fits a binary mixed Rasch model via cML estimation (Rost 1990) and provides information criteria for model selection purposes. The core part of the routine has been written in C++, incorporating parts of the Scythe Statistical Library (2007) for matrix manipulations. Starting values for item parameters are uniformly drawn from the interval [-2, 2] and standardized appropriately (sum = 0). Starting values for latent score probabilities are uniformly drawn from the interval [0, 1] and standardized to sum up to one in each class. Rows with missing values, as well as constant rows and columns are excluded. The function returns an object of class 'mrm'.

Usage

```
mrm(data.matrix, cl, max.it = 1000, conv.crit = .0001)
```

Arguments

`data.matrix`	Input 0/1 data matrix or data frame, rows representing individuals and columns representing items. Rows with missing values as well as constant rows are excluded from the analysis.
`cl`	The number of classes to be fitted.

max.it	Maximum number of iterations.
conv.crit	If the absolute difference between two successive log-likelihoods falls below this value, the iteration procedure is terminated.

Value

beta	Item easiness parameters.
pi.r.c	Latent score probabilities.
class.size	Estimated class sizes.
logLik	Conditional log-likelihood.
AIC	AIC.
BIC	BIC.
number.of.iterations	Total number of iterations required.
number.of.parameters	Number of parameters.
conv.to.bound	Either 0 or 1, where 1 indicates termination due to divergence to the boundary of the parameter space, i.e. the modulus of an item parameter exceeds 20 (see Preinerstorfer and Formann 2011 for details).

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Examples

```
#Simulate data matrix conforming to a mixed Rasch model with two classes
data <- sim.mrm(1000, 20, c(.5, .5))

#Parameter estimation
fit <- mrm(data$data.matrix, 2)
```

plot.mrm *Plot method for Objects of Class mrm.*

Description

Figures of item parameters and conditional score probabilities are generated.

Usage

```
## S3 method for class 'mrm'
plot(x, ...)
```

Arguments

x	An object of class 'mrm'.
...	Additional parameters to plot.

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Examples

```
#Simulate data matrix conforming to a mixed Rasch model with two classes
data <- sim.mrm(1000, 20, c(.5, .5))

#Parameter estimation
fit <- mrm(data$data.matrix, 2)

plot(fit)
```

print.mrm *Print method for Objects of Class mrm.*

Description

Prints arguments of an object of class mrm.

Usage

```
## S3 method for class 'mrm'
print(x, ...)
```

Arguments

x	An object of class mrm.
...	Additional parameters to print.

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Examples

```
#Simulate data matrix conforming to a mixed Rasch model with two classes
data <- sim.mrm(1000, 20, c(.5, .5))

#Parameter estimation
fit <- mrm(data$data.matrix, 2)

print(fit)
```

---

sim.mrm *Generating data matrices conforming to a mixed Rasch model*

Description

This function generates data matrices conforming to a mixed Rasch model (Rost 1990). Both, person and item parameters may be provided by the user. Otherwise, person parameters are randomly drawn from a standard normal distribution; random equidistant partitions of the interval [-2, 2] are used as item parameters. Class membership of each object is based on a realization of a multinomial random variable with sample size and class proportions as parameters (see Preinerstorfer and Formann 2011 for details).

Usage

```
sim.mrm(N.sample, N.items, cl.prob, item.para = NULL,
pers.para = NULL, seed = NULL)
```

Arguments

N.sample	Sample size.
N.items	Number of items.
cl.prob	Vector of relative class sizes.
item.para	Matrix of item (easiness) parameters. Rows indicate items, columns indicate classes. If no parameters are provided by the user, random permutations of an equidistant partition of the interval [-2, 2] are used in each class.

pers.para	Vector of person parameters. If no parameters are provided by the user, person parameters are drawn from a standard normal distribution.
seed	Seed value.

Value

data.matrix	0/1 data matrix of item responses.
beta	Generated/Provided easiness parameters.
emp.probs	Observed class sizes
xi	Generated/Provided person parameters.

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References

Preinerstorfer, D. and Formann, A. K. (2012) Parameter recovery and model selection in mixed Rasch models. *British Journal of Mathematical and Statistical Psychology, 65*, 251-262.

Rost (1990). Rasch models in latent classes: An integration of two approaches to item analysis. *Applied Psychological Measurement, 14*, 271-282.

Examples

```
#Simulate a data matrix conforming to a 2-class
#mixed Rasch model with sample size 1000 and 20 items.

data <- sim.mrm(1000, 20, c(.5, .5))
```

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