

Package ‘simCAT’

September 19, 2022

Title What the Package Does (One Line, Title Case)

Version 0.0.0.9000

Description What the package does (one paragraph).

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Imports dplyr

URL <https://github.com/alexandrejaloto/simCAT>

BugReports <https://github.com/alexandrejaloto/simCAT/issues>

R topics documented:

calc.info	2
calc.prob	2
cat.evaluation	3
content.balancing	3
eap	4
exposure.rate	5
gen.resp	6
rmse	6
select.item	7
simCAT	8
stop.cat	9

Index	11
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calc.info	<i>Compute item information</i>
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Description

Calculate information of each item in the bank for a theta

Usage

```
calc.info(bank, theta)
```

Arguments

bank	matrix with item parameters (a, b, c)
theta	current theta

Value

A vector with the information of each item

Author(s)

Alexandre Jaloto

calc.prob	<i>Compute probability</i>
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Description

Calculate probability of observing certain answer to a dicotomic item, given a theta

Usage

```
calc.prob(theta, bank, u = 1)
```

Arguments

theta	theta
bank	matrix with item parameters (a, b, c)
u	1 for righth, 0 for wrong

Value

A vector with the probability of seeing determined response in each item

Author(s)

Alexandre Jaloto

cat.evaluation	<i>CAT Evaluation</i>
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Description

Evaluate a CAT simulation

Usage

```
cat.evaluation(results, true.scores, item.name, rmax)
```

Arguments

results	list with results of a CAT simulation from simCAT
true.scores	true scores
item.name	vector with the name of all items in the bank
rmax	item maximum exposure rate

Value

a list with two elements. evaluate is a data.frame with the following variables:

rmse root mean square error between true and estimated score correlation correlation between true and estimated score bias bias between true and estimated score overlap overlap rate min_exp minimum exposure rate max_exp maximum exposure rate n_exp0 number of items not administered n_exp_rmax number of items with exposure rate higher than rmax length_mean average mean of test length length_median average median of test length min_length minimum test length max_length maximum test length

conditional is a data.frame with the same variables conditioned to the true scores. The colnames are the thetas in each decil, that is, `quantile(true.scores, probs = seq(.1, 1, length.out = 10))`.

Author(s)

Alexandre Jaloto

content.balancing	<i>Content balancing</i>
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Description

Constricts the selection with content balancing (CCAT or MCCAT)

Usage

```
content.balancing(
  bank,
  administered = NULL,
  content.names,
  content.props,
  content.items,
  met.content = "MCCAT"
)
```

Arguments

<code>bank</code>	matrix with item parameters (a, b, c)
<code>administered</code>	vector with administered items, NULL if it is the first item (default)
<code>content.names</code>	vector with the contents of the test
<code>content.props</code>	desirable proportion of each content in test, in the same order of <code>content.names</code>
<code>content.items</code>	vector indicating the content of each item
<code>met.content</code>	content balancing method <ul style="list-style-type: none"> • MCCAT (default): the function picks all subgroups with proportions most distant from desirable. • CCAT: if there is any subgroup without administered item, the function will randomly pick one. If all subgroups has at least one applied item, the function randomly picks one from those with the proportions most distant from desirable.

Value

A numeric vector with the items that will be excluded for selection. That is, it returns the unavailable items. If all items are available, it returns NULL.

Author(s)

Alexandre Jaloto

eap

EAP estimation

Description

Estimates theta with Expected a Posteriori

Usage

```
eap(pattern, bank)
```

Arguments

<code>pattern</code>	response pattern (0 and 1) with the number of columns corresponding to the number of items
<code>bank</code>	data.frame with item parameters (a, b, c)

Details

40 quadrature points, ranging from -4 to 4. Priori with normal distribution (mean = 0, sd = 1).

Value

data.frame with estimated theta and SE.

Author(s)

Alexandre Jaloto

exposure.rate	<i>Compute exposure rates</i>
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Description

Calculate exposure rate of items in a bank

Usage

```
exposure.rate(previous, item.name)
```

Arguments

previous	list with previous responses. Each element corresponds to a person and has the names of the applied items.
item.name	vector with the name of all items in the bank

Value

data.frame with
items name of the items Freq exposure rate

Author(s)

Alexandre Jaloto

gen.resp	<i>Generate response pattern</i>
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Description

Generate response pattern based on probability of answering correct a dicotomic item, given a theta and an item bank

Usage

```
gen.resp(theta, bank)
```

Arguments

theta	theta
bank	matrix with item parameters (a, b, c)

Value

A vector with the probability of seein determined responsein each item

Author(s)

Alexandre Jaloto

rmse	<i>Root Mean square Error</i>
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Description

Calculate the root mean square error

Usage

```
rmse(true, estimated)
```

Arguments

true	true values
estimate	estimated values

Value

A numeric vector

Author(s)

Alexandre Jaloto

select.item	<i>Select next item</i>
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Description

Select next item to be administered

Usage

```
select.item(
  bank,
  theta,
  administered = NULL,
  sel.method = "MFI",
  stop.type = "precision",
  threshold = 0.3,
  SE,
  acceleration = 1,
  max.items = 45,
  content.names = NULL,
  content.props = NULL,
  content.items = NULL,
  met.content = "MCCAT"
)
```

Arguments

bank	matrix with item parameters (a, b, c)
theta	current theta
administered	vector with administered items, NULL if it is the first item
sel.method	selection method
stop.type	type of stopping rule (precision or length). Necessary only for progressive method.
threshold	threshold for stop.type Necessary only for progressive method.
SE	current standard error Necessary only for progressive method, with stop.type = "precision"
acceleration	acceleration parameter #' Necessary only for progressive method.
max.items	maximum number of items to be administered Necessary only for progressive method, with stop.type = "precision"
content.names	vector with the contents of the test
content.props	desirable proportion of each content in test, in the same order of content.names
content.items	vector indicating the content of each item
met.content	content balancing method: MCCAT (default) or CCAT

Value

A list with two elements

item the number of the selected item in item bank name name of the selected item (row name)

Author(s)

Alexandre Jaloto

simCAT

*CAT simulation***Description**

A CAT simulation with dicotomic items.

Usage

```
simCAT(
  resps,
  bank,
  start.theta = 0,
  sel.method = "MFI",
  stop.type = "precision",
  acceleration = 1,
  threshold = 0.3,
  rmax = 1,
  content.names = NULL,
  content.props = NULL,
  content.items = NULL,
  met.content = "MCCAT",
  stop = list(se = 0.3, hypo = 0.015, hyper = Inf)
)
```

Arguments

resps	response matrix (0 and 1) with the number of columns corresponding to the number of items
bank	matrix with item parameters (a, b, c)
start.theta	first theta
sel.method	item selection method
stop.type	type of stopping rule (precision or length). Necessary only for progressive method.
acceleration	acceleration parameter #' Necessary only for progressive method.
threshold	threshold for stop.type Necessary only for progressive method.
rmax	item maximum exposure rate
content.names	vector with the contents of the test
content.props	desirable proportion of each content in test, in the same order of content.names
content.items	vector indicating the content of each item
met.content	content balancing method: MCCAT (default) or CCAT
stop	list with stopping rule and thresholds #' <ul style="list-style-type: none"> se minimum standard error

- `delta.theta` minimum absolute difference between current and previous theta
- `hypo` minimum standard error reduction
- `hyper` minimum standard error reduction after achieving `se`
- `info` maximum information of an available item
- `max.items` maximum number of items
- `min.items` maximum number of items
- `fixed` fixed number of items

Author(s)

Alexandre Jaloto

stop.cat	<i>Check if the CAT ended</i>
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Description

Check if any stopping rule has been achieved

Usage

```
stop.cat(
  rule = list(se = NULL, delta.theta = NULL, hypo = NULL, hyper = NULL, info = NULL,
    max.items = NULL, min.items = NULL, fixed = NULL),
  current = list(se = NULL, delta.theta = NULL, info = NULL, applied = NULL, delta.se =
    NULL)
)
```

Arguments

- | | |
|---------|---|
| rule | list with stopping rules <ul style="list-style-type: none"> • <code>se</code> minimum standard error • <code>delta.theta</code> minimum absolute difference between current and previous theta • <code>hypo</code> minimum standard error reduction • <code>hyper</code> minimum standard error reduction after achieving <code>se</code> • <code>info</code> maximum information of an available item • <code>max.items</code> maximum number of items • <code>min.items</code> maximum number of items • <code>fixed</code> fixed number of items |
| current | list with current values <ul style="list-style-type: none"> • <code>se</code> current standard error • <code>delta.theta</code> absolute difference between current and previous theta • <code>info</code> maximum information of an available item for current theta • <code>applied</code> quantitative of applied items • <code>delta.se</code> standard error reduction |

Value

A list with two elements: stop TRUE if any stopping rule has been achieved convergence logical. FALSE if the CAT stopped because it achieved the maximum number of items. TRUE for any other case.

Author(s)

Alexandre Jaloto

Index

`calc.info`, [2](#)
`calc.prob`, [2](#)
`cat.evaluation`, [3](#)
`content.balancing`, [3](#)

`eap`, [4](#)
`exposure.rate`, [5](#)

`gen.resp`, [6](#)

`rmse`, [6](#)

`select.item`, [7](#)
`simCAT`, [8](#)
`stop.cat`, [9](#)