Package ‘airt’

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Type Package

Title Evaluation of Algorithm Collections Using Item Response Theory

Version 0.1.0

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Description An evaluation framework for algorithm portfolios using Item Response Theory (IRT). We use polytomous IRT models to evaluate algorithms and introduce algorithm characteristics such as stability, effectiveness and anomalousness (Kandanaarachchi, Smith-Miles 2020) <doi:10.13140/RG.2.2.11363.09760>.

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Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Depends R (>= 3.4.0)

Imports pracma, mirt, tidyr

Suggests knitr, rmarkdown, ggplot2

VignetteBuilder knitr

NeedsCompilation no

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R topics documented:

`algo_effectiveness` *Computes the actual and predicted effectiveness of a given algorithm.*

Description

This function computes the actual and predicted effectiveness of a given algorithm for different tolerance values.

Usage

```
algo_effectiveness(mod, num = 1)
```

Arguments

`mod`	A fitted `mirt` model using the function `irtmodel` or `R` package `mirt`.
`num`	The algorithm number, for which the goodness of the IRT model is computed.

Value

A list with the following components:

`effective`	The `x,y` coodinates for the actual and predicted effectiveness curves for algorithm `num`.
`predictedEff`	The area under the predicted effectiveness curve.
`actualEff`	The area under the actual effectiveness curve.

#' @examples set.seed(1) x1 <- sample(1:5, 100, replace = TRUE) x2 <- sample(1:5, 100, replace = TRUE) x3 <- sample(1:5, 100, replace = TRUE) X <- cbind.data.frame(x1, x2, x3) mod <- irtmodel(X) out <- algo_effectiveness(mod$model, num=1) out

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`classification` *A dataset containing classification algorithm performance data.*

Description

This dataset contains the performance of 10 classification algorithms on 235 datasets discussed in the paper Instance Spaces for Machine Learning Classification by M. A. Munoz, L. Villanova, D. Baatar, and K. A. Smith-Miles .

Usage

```
classification
```

Format

A dataframe of 235 x 10 dimensions.

Dimension 1 Each row contains the algorithm performance of a dataset on 10 classification algorithms.

Dimensions 2 Each column contains the algorithm performance of a single algorithm.

Source

https://matilda.unimelb.edu.au/matilda/problems/learning/classification#classification

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`effectiveness` *Computes the actual and predicted effectiveness of the collection of algorithms.*

Description

This function computes the actual and predicted effectiveness of the collection of algorithms for different tolerance values.

Usage

```
effectiveness(mod)
```

Arguments

`mod`	A fitted `mirt` model using the function `irtmodel` or `R` package `mirt`.

Value

A list with the following components:

`effectivenessAUC`
The area under the actual and predicted effectiveness curves.

`actcurves` The `x,y` coodinates for the actual effectiveness curves for each algorithm.

#'

`prdcurves` The `x,y` coodinates for the predicted effectiveness curves for each algorithm.

Examples

```
set.seed(1)
x1 <- sample(1:5, 100, replace = TRUE)
x2 <- sample(1:5, 100, replace = TRUE)
x3 <- sample(1:5, 100, replace = TRUE)
X <- cbind.data.frame(x1, x2, x3)
mod <- irtmodel(X)
out <- effectiveness(mod$model)
out
```

irtmodel *Fits a polytomous IRT model.*

Description

This function fits a polytomous Item Response Theory (IRT) model to the algorithm performance data.

Usage

```
irtmodel(dat, ncycle = NULL, vpara = TRUE)
```

Arguments

dat	The performance data in a matrix or dataframe.
ncycle	The number of cycles for `mirt`. The default is 500.
vpara	It `TRUE` the `verbose` parameter for the `mirt` would be set to true.

Value

A list with the following components:

model	The IRT model using the R package `mirt`.
anomalous	A binary sequence corresponding to the algorithms. It is set to 1 if an algorithm is anomalous. Otherwise it is set to 0.
stability	A binary sequence corresponding to the algorithms. It is set to 1 if an algorithm is anomalous. Otherwise it is set to 0.

Examples

```
set.seed(1)
x1 <- sample(1:5, 100, replace = TRUE)
x2 <- sample(1:5, 100, replace = TRUE)
x3 <- sample(1:5, 100, replace = TRUE)
X <- cbind.data.frame(x1, x2, x3)
mod <- irtmodel(X)
```

`make_polyIRT_data` *Converts continuous performance data to polytomous data with 5 categories.*

Description

This function converts continous performance data to polytomous data with 5 categories

Usage

```
make_polyIRT_data(df, method = 1)
```

Arguments

`df`	The input data in a dataframe or a matrix
`method`	If `1`, then the data is an accuracy measure between 0 and 1. If `2`, then the performance data is possibly has a bigger range. So we divide it into 5 equal bins to make it polytomous.

Value

The polytomous data frame.

Examples

```
set.seed(1)
x1 <- runif(500)
x2 <- runif(500)
x3 <- runif(500)
x <- cbind(x1, x2, x3)
xout <- make_polyIRT_data(x)
```

`model_goodness` *Computes the goodness of IRT model for all algorithms.*

Description

This function computes the goodness of the IRT model for all algorithms for different goodness tolerances.

Usage

```
model_goodness(mod)
```

Arguments

mod A fitted mirt model using the function irtmodel or R package mirt.

Value

A list with the following components:

goodnessAUC The area under the model goodness curve for each algorithm.

curves The x,y coodinates for the model goodness curves for each algorithm.

Examples

```
set.seed(1)
x1 <- sample(1:5, 100, replace = TRUE)
x2 <- sample(1:5, 100, replace = TRUE)
x3 <- sample(1:5, 100, replace = TRUE)
X <- cbind.data.frame(x1, x2, x3)
mod <- irtmodel(X)
out <- model_goodness(mod$model)
out
```

---

model_goodness_for_algo

Computes the goodness of IRT model for a given algorithm.

Description

This function computes the goodness of the IRT model for a given algorithm for different goodness tolerances.

Usage

```
model_goodness_for_algo(mod, num = 1)
```

Arguments

mod A fitted mirt model using the function irtmodel or R package mirt.

num The algorithm number, for which the goodness of the IRT model is computed.

Value

A list with the following components:

xy The x values denote the goodness tolerances. The y values denote the model goodness.

auc The area under the model goodness curve.

Examples

```
set.seed(1)
x1 <- sample(1:5, 100, replace = TRUE)
x2 <- sample(1:5, 100, replace = TRUE)
x3 <- sample(1:5, 100, replace = TRUE)
X <- cbind.data.frame(x1, x2, x3)
mod <- irtmodel(X)
out <- model_goodness_for_algo(mod$model, num=1)
out
```

---

prepare_for_plots *Utility function to make a dataframe from the IRTmodel*

Description

This is a utility function to make a dataframe from the IRTmodel, which makes it easier to plot trace lines

Usage

```
prepare_for_plots(mod)
```

Arguments

mod	IRT model, either from function `irtmodel` or the `R` package `mirt`.

Value

Dataframe with output probabilities from the IRT model for all algorithms.

Examples

```
data(classification)
mod <- irtmodel(classification)
dat <- prepare_for_plots(mod$model)
head(dat)
```

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