Package ‘airt’

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Type Package

Title Evaluation of Algorithm Collections Using Item Response Theory

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Maintainer Sevvandi Kandanaarachchi <sevvandik@gmail.com>

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)

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NeedsCompilation no

Author Sevvandi Kandanaarachchi [aut, cre]

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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 coordinates 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

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
effectiveness

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.

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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 coordinates for the actual effectiveness curves for each algorithm.
- prdcurves The x,y coordinates for the predicted effectiveness curves for each algorithm.

Examples
```r
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  
If 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

```r
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 continuous 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)
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.
**prepare_for_plots**

**Examples**

```r
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
```

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**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**

```r
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**

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