

Package ‘LCTMtools’

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Type Package

Title Latent Class Trajectory Models: Tools for checking adequacy

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Description A selection of model adequacy tests for Latent Class Trajectory Models (LCTMs) which include the APPA (average posterior probability of assignment), the OCC (odds of correct classification), entropy, Relative entropy.

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actual_proportions	<i>The proportion within each class AFTER class assignment (using max posterior rule)</i>
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Description

The proportion within each class AFTER class assignment (using max posterior rule)

Usage

```
actual_proportions(p)
```

Arguments

p is the posterior probabilities of assignment of dimensions, K columns and N rows

Value

The proportion within each class AFTER class assignment (using max posterior rule)

Examples

```
## Not run: actual_proportions(p)
```

appa	<i>Computes the Average Posterior Probability Assignment (APPA) for a K latent class trajectory model.</i>
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Description

Computes the Average Posterior Probability Assignment (APPA) for a K latent class trajectory model.

Usage

```
appa(p)
```

Arguments

p is the posterior probabilities of assignment of dimensions, K columns and N rows

Value

The Average Posterior Probability Assignment (APPA) for each class

Examples

```
## Not run: appa(p)
```

bmi	<i>Body Mass Index (BMI) repeated measures of 10,000 individuals in wide format.</i>
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Description

A list containing a long and wide format dataset of BMI values of 10,000 individuals.

Usage

bmi

Format

A list of two formats data frame with 53940 rows and 10 variables:

ID Individual ID

BMI Body mass index of the individual at times T1,T2, T3 and T4, in kg/m²

T Time of BMI measure, in years

true_class Tag to identify the class the individual BMI data was simulated from

bmi_long	<i>Body Mass Index (BMI) repeated measures of 10,000 individuals in long format.</i>
----------	--

Description

A list containing a long and wide format dataset of BMI values of 10,000 individuals.

Usage

bmi_long

Format

A list of two formats data frame with 53940 rows and 10 variables:

ID Individual ID

Age Age of BMI measure, in years

BMI Body mass index of the individual at times T1,T2, T3 and T4, in kg/m²

true_class Tag to identify the class the individual BMI data was simulated from

class_assignment	<i>Maximum Class assignment</i>
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Description

Maximum Class assignment

Usage

```
class_assignment(p)
```

Arguments

p is the posterior probabilities of assignment of dimensions, K columns and N rows

Value

This function computes the Average Posterior Probability Assignment (APPA) for a K latent class trajectory model.

Examples

```
## Not run: class_assignment(p)
```

cohen.kappa	<i>Kappa matrix</i>
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Description

Kappa matrix of cohen's kappa values

Usage

```
cohen.kappa(x, w = NULL, n.obs = NULL, alpha = 0.05, levels = NULL)
```

Arguments

x Either a two by n data with categorical values from 1 to p or a p x p table. If a data array, a table will be found.

Value

Unweighted kappa

Examples

```
data(bmi_long, package="LCTMtools") # NO EXAMPLE SUPPLIED
```

confusion_matrix	<i>A confusion matrix</i>
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Description

A confusion matrix

Usage

```
confusion_matrix(model1, model2)
```

Arguments

model1	A fitted model from the lcmm R package (or from SAS passed through the SASmodelbuilder() function)
model2	is the posterior probabilities of assignment of dimensions, K columns and N rows
name1	optional paramter to pre-specify name of model
name2	optional paramter to pre-specify name of model

Value

A confusion matrix between two models with the same number of classes

Examples

```
## Not run:
data(bmi_long, package="LCTMtools")
require(lcmm)
model1 <- hlme(BMI ~Age, mixture= ~Age, random= ~Age, nwg=TRUE, ng=2, subject="ID", data=bmi_long[1:500, ])
model2 <- hlme(BMI ~Age, mixture= ~Age, random= ~1, nwg=FALSE, ng=2, subject="ID", data=bmi_long[1:500, ])
confusion_matrix(model1, model2)
## End(Not run)
```

entropy	<i>Entropy</i>
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Description

A global measure of uncertainty with values close to zero implying a good model. Entropy is a global measure of classification uncertainty, which takes into account all $N \times K$ posterior probabilities. The entropy of a model is defined as which takes values from $[0, \infty)$, with higher values indicating a larger amount of uncertainty. Entropy values closest to 0 correspond to models with least classification uncertainty.

Usage

```
entropy(p)
```

Arguments

p is the posterior probabilities of assignment of dimensions, K columns and N rows

Value

Entropy value between (0, infinity)

Examples

```
## Not run: entropy(p)
```

kappa_matrix	<i>Kappa matrix</i>
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Description

Kappa matrix of cohen’s kappa values

Usage

```
kappa_matrix(ConfMatrix, acc = 2)
```

Arguments

ConfMatrix A confusion matrix made using confusion_matrix(model1, model2)
acc The accuracy of the results, defaults to 2 decimal places

Value

Unweighted and weighted Kappa value computed using the cohen.kappa() function from the psych R package

Examples

```
data(bmi_long, package="LCTMtools")
require(lcmm)
require(psych)
model1 <- hlme(BMI ~Age, mixture= ~Age, random= ~Age, nwg=TRUE, ng=2, subject="ID", data=bmi_long[1:500, ])
model2 <- hlme(BMI ~Age, mixture= ~Age, random= ~1, nwg=FALSE, ng=2, subject="ID", data=bmi_long[1:500, ])
ConfMatrix <- confusion_matrix(model1, model2)
kappa_matrix(ConfMatrix)
```

LCTMcompare

A model comparison toolkit. LCTMcompare

Description

The function LCTMcompare gives a summary of comparison between fitted LCTM models.

Usage

```
LCTMcompare(modelA, modelB)
```

Arguments

`model` is the output from `hlme()` R model or `model` is the output of `SASmodelbuilder`(oe, os, op, of) passed through it

Value

A selection of model adequacy tests, including the APPA (average posterior probability of assignment), the OCC (odds of correct classification), entropy SE , Relative entropy (SE_k),

References

<https://bmjopen.bmj.com/content/8/7/e020683>

Examples

```
data(bmi_long, package="LCTMtools")
require(lcmm)
library(LCTMtools)
set.seed(002010800)
data(bmi_long, package = "LCTMtools" )
# Use the hlme function from the 'lcmm' R package to fit a 2 class latent class trajectory model
model2classes <- hlme(fixed = BMI ~ Age + I(Age^2),
                      mixture= ~ Age,
                      random = ~ Age,
                      ng = 2,
                      nwg = TRUE,
                      subject = "ID",
                      data = bmi_long[1:500, ] )

# Compute model adequacy measures
LCTMtoolkit(model2classes)
# Compare with a 3 class model
model3classes <- hlme(fixed = BMI ~ Age + I(Age^2),
                      mixture= ~ Age,
                      random = ~ Age,
                      ng = 3,
                      nwg = TRUE,
                      subject = "ID",
                      data = bmi_long[1:500, ] )

LCTMtoolkit(model3classes)
LCTMcompare(model2classes, model3classes)
```

LCTMtoolkit	<i>A toolkit which computes a selection of model adequacy tests</i>
	LCTMtoolkit

Description

The function LCTMtoolkit computes a selection of model adequacy tests, including the APPA (average posterior probability of assignment), the OCC (odds of correct classification), entropy E, Relative entropy (E_k), odds of correct classification is the ratio of the odds of classification based on the maximum posterior probability classification rule and the estimated class membership proportions (pi_k)

Usage

```
LCTMtoolkit(model)
```

Arguments

modelA	the models to be compared which is the output from hlme() R model or model is the output of SASmodelbuilder(oe, os, op, of) passed through it
modelB	the models to be compared which is the output from hlme() R model or model is the output of SASmodelbuilder(oe, os, op, of) passed through it

Value

A selection of model adequacy tests, including the APPA (average posterior probability of assignment), the OCC (odds of correct classification), entropy \$E\$, Relative entropy (\$E_k\$),

References

<https://bmjopen.bmj.com/content/8/7/e020683>

Examples

```
data(bmi_long, package="LCTMtools")
library(lcmm)
model2class <- hlme(BMI ~Age, mixture= ~Age, random= ~Age,
  nwg=TRUE, ng=2, subject="ID", data=bmi_long[1:500, ])
postprob(model2class)
LCTMtoolkit(model2class)
```

LCTMtools	<i>LCTMtools: A package for computing a number of Latent Class Trajectory Model tools for a given hlme() object or SAS model.</i>
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Description

The LCTMtools package provides two categories of important functions: LCTMtools (to test a models adequacy) and LCTMcompare (to aid model selection).

LCTMtools functions

The LCTMtools functions arw a selection of model adequacy tests for Latent Class Trajectory Models (LCTMs) which include the APPA (average posterior probability of assignment), the OCC (odds of correct classification), entropy, Relative entropy.

mismatch	<i>Computes the mismatch of the posterior probabilities (mismatch=actual-estimated)</i>
----------	---

Description

Computes the mismatch of the posterior probabilities (mismatch=actual-estimated)

Usage

```
mismatch(p, pi)
```

Arguments

p is the posterior probabilities of assignment of dimensions, K columns and N rows

pi is the estimated proportion of class membership of length K

Value

The mismatch of posterior probabilities

Examples

```
## Not run: mismatch(p, pi)
```

mm1cr_to_lctm	<i>Converts an R mm1cr model output to the format of R's hlme class</i>
---------------	---

Description

Converts an R mm1cr model output to the format of R's hlme class

Usage

```
mm1cr_to_lctm(model)
```

Arguments

model contains model parameter estimates and maximised likelihood, AIC, BIC values

Value

A format to feed into the LCTMtoolkit() R function

Examples

```
## Not run: mm1cr_to_lctm(model)
```

occ

The odds of correct classification is the ratio of the odds of classification based on the maximum posterior probability classification rule and the estimated class membership proportions (π_k).

Description

The odds of correct classification is the ratio of the odds of classification based on the maximum posterior probability classification rule and the estimated class membership proportions (π_k).

Usage

```
occ(p, pi)
```

Arguments

p is the posterior probabilities of assignment of dimensions, K columns and N rows

pi is the estimated proportion of class membership of length K

Value

The odds of correct classification

Examples

```
## Not run: occ(p, pi)
```

relative_entropy

The Relative Entropy

Description

The Relative Entropy

Usage

```
relative_entropy(p)
```

Arguments

p is the posterior probabilities of assignment of dimensions, K columns and N rows

Value

Relative Entropy - where values close to 1 indicate lowest classification uncertainty. In the special case when there is most uncertainty and each individual has equal probability of belonging to each class, $E_K=0$. Jedidi et al., describes relative entropy as a relative measure of ‘fuzziness’, and suggested cause concern when close to zero, as this implies that the latent class centroids are not sufficiently separated.

Examples

```
## Not run: relative_entropy(p)
```

sastraj_to_lctm	<i>Converts a SAS proc traj model to the format of R's hlme class</i>
-----------------	---

Description

Converts a SAS proc traj model to the format of R's hlme class

Usage

```
sastraj_to_lctm(oe, of, op, os)
```

Arguments

oe	contains model parameter estimates and maximised likelihood, AIC, BIC values
of	contains posterior probabilities
op	contains predictors
os	contains fixed effect and class membership parameter estimates

Value

A format to feed into the LCTMtoolkit() R function

Examples

```
## Not run: sastraj_to_lctm(oe, of, op, os)
```

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