Package ‘T2EQ’

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Type Package
Title Functions for Applying the T^2-Test for Equivalence
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Description Contains functions for applying the T^2-test for equivalence.
The T^2-test for equivalence is a multivariate two-sample equivalence test.
Distance measure of the test is the Mahalanobis distance.
For multivariate normally distributed data the T^2-test for equivalence
is exact and UMPI.
The function T2EQ() implements the T^2-test for equivalence
The function T2EQ.dissolution.profiles.hoffelder() implements a variant
of the T^2-test for equivalence according to Hoffelder (2016)
(http://www.ecv.de/suse_item.php?suseId=Zppl8430> for the
equivalence comparison of highly variable dissolution profiles.
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R topics documented:

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Description

Contains functions for applying the $T^2$-test for equivalence. The $T^2$-test for equivalence is a multivariate two-sample equivalence test. Distance measure of the test is the Mahalanobis distance. For multivariate normally distributed data the $T^2$-test for equivalence is exact and UMPI. The function T2EQ() implements the $T^2$-test for equivalence according to Wellek (2010). The function T2EQ.dissolution.profiles.hoffelder() implements a variant of the $T^2$-test for equivalence according to Hoffelder (2016) for the equivalence comparison of highly variable dissolution profiles.

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  Example dataset from Hoffelder et al. (2015)

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  Example dataset from Hoffelder (2016)

Author(s)

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References


Examples

## Not run: A recalculation of the example evaluation in Hoffelder et al. (2015)
can be done with the following code:
## End(Not run)

data(ex_data_JoBS)
REF_JoBS <- cbind(ex_data_JoBS[ which(ex_data_JoBS$Group=='REF'), ]
 [c("Diss_15_min","Diss_20_min","Diss_25_min")])
TEST_JoBS <- cbind(ex_data_JoBS[ which(ex_data_JoBS$Group=='TEST'), ]
 [c("Diss_15_min","Diss_20_min","Diss_25_min")])
equivalence_margin_JoBS <- 0.74*2

test_T2EQ_JoBS <- T2EQ(X=REF_JoBS,Y=TEST_JoBS,eq_margin = equivalence_margin_JoBS)

## Not run: A recalculation of the results underlying Figure 1 in Hoffelder (2016)
can be done with the following code:
## End(Not run)

data(ex_data_pharmind)
REF_pharmind <- cbind(ex_data_pharmind[ which(ex_data_pharmind$Group=='REF'), ]
 [c("Diss_10_min","Diss_20_min","Diss_30_min")])
TEST_pharmind <- cbind(ex_data_pharmind[ which(ex_data_pharmind$Group=='TEST'), ]
 [c("Diss_10_min","Diss_20_min","Diss_30_min")])
test_T2EQ.dissolution.profiles.hoffelder_pharmind <-
 T2EQ.dissolution.profiles.hoffelder(X=REF_pharmind,Y=TEST_pharmind)

---

ex_data_JoBS

Example dataset from Hoffelder et al. (2015)

Description
Multivariate example dataset of dissolution profiles. Dataset consists of two three-dimensional samples. The names of the three variables are "Diss_15_min","Diss_20_min" and "Diss_25_min". Variable "Group" discriminates between first sample (Group == "REF") and second sample (Group == "Test"). Sample size is 12 per group.

Usage

data("ex_data_JoBS")

Format
A data frame with 24 observations on the following 4 variables.

- Group  a factor with levels REF TEST
- Diss_15_min  a numeric vector
- Diss_20_min  a numeric vector
- Diss_25_min  a numeric vector
Details

Example dataset from Hoffelder et al. (2015).

Source


References

URL: http://dx.doi.org/10.1080/10543406.2014.920344

Examples

data(ex_data_JoBS)

---

`ex_data_pharmind` *Example dataset from Hoffelder (2016)*

Description

Multivariate example dataset of dissolution profiles. Dataset consists of two three-dimensional samples. The names of the three variables are "Diss_10_min","Diss_20_min" and "Diss_30_min". Variable "Group" discriminates between first sample (Group == "REF") and second sample (Group == "Test"). Sample size is 12 per group.

Usage

data("ex_data_pharmind")

Format

A data frame with 24 observations on the following 4 variables.

- `Diss_10_min` a numeric vector
- `Diss_20_min` a numeric vector
- `Diss_30_min` a numeric vector
- `Group` a character vector

Details

Example dataset underlying Figure 1 in Hoffelder (2016).

Source

T2EQ

**Description**

The function T2EQ() implements the $T^2$-test for equivalence (see Wellek, 2010 or Hoffelder et al., 2015). The $T^2$-test for equivalence is a multivariate two-sample equivalence test. Distance measure of the test is the Mahalanobis distance.

**Usage**

T2EQ(x, y, eq_margin, alpha = 0.05, print.results = TRUE)

**Arguments**

- **x**: numeric data matrix of the first sample. The rows of x contain the individual observations of the sample, the columns contain the variables/components of the multivariate sample.
- **y**: numeric data matrix of the second sample. The rows of x contain the individual observations of the sample, the columns contain the variables/components of the multivariate sample.
- **eq_margin**: numeric (>0). The equivalence margin of the test.
- **alpha**: numeric (0<alpha<1). The significance level of the $T^2$-test for equivalence. Usually set to 0.05 which is the default.
- **print.results**: logical; if TRUE (default) summary statistics and test results are printed in the output. If NO no output is created

**Details**

For multivariate normally distributed data the $T^2$-test for equivalence is exact and UMPI.

**Value**

- a data frame; three columns containing the results of the test
- **p.value**: numeric; the p-value of the $T^2$-test for equivalence
- **testresult.num**: numeric; 0 (null hypothesis of nonequivalence not rejected) or 1 (null hypothesis of nonequivalence rejected, decision in favor of equivalence)
- **testresult.text**: character; test result of the $T^2$-test for equivalence in text mode

**Examples**

```r
data(ex_data_pharmind)
```

**References**

URL: [http://www.ecv.de/suse_item.php?useId=Z|pi|8430](http://www.ecv.de/suse_item.php?useId=Z|pi|8430)
Author(s)

Thomas Hoffelder <thomas.hoffelder at boehringer-ingelheim.com>

References


Examples

```r
## Not run: A recalculation of the example evaluation in Hoffelder et al. (2015)
can be done with the following code:
## End(Not run)

data(ex_data_JoBS)
REF_JoBS <- cbind(ex_data_JoBS[ which(ex_data_JoBS$Group=='REF' ), ]
                    [c("Diss_15_min","Diss_20_min","Diss_25_min")])
TEST_JoBS <- cbind(ex_data_JoBS[ which(ex_data_JoBS$Group=='TEST' ), ]
                    [c("Diss_15_min","Diss_20_min","Diss_25_min")])
equivalence_margin_JoBS <- 0.74*2
test_T2EQ_JoBS <- T2EQ(X=REF_JoBS,Y=TEST_JoBS,eq_margin = equivalence_margin_JoBS)
```

The $T^2$-test for equivalence for dissolution data

Description

The function `T2EQ.dissolution.profiles.hoffelder()` implements a variant of the $T^2$-test for equivalence analyses of highly variable dissolution profiles (see Hoffelder,2016). It is a multivariate two-sample equivalence procedure. Distance measure of the test is the Mahalanobis distance.

Usage

```r
T2EQ.dissolution.profiles.hoffelder(X, Y, alpha = 0.05, print.results = TRUE)
```

Arguments

- `X`: numeric data matrix of the first sample (REF). The rows of `X` contain the individual observations of the REF sample, the columns contain the variables/components of the multivariate sample. More precisely, the variables are the measured dissolution time points and the rows contain the individual dissolution profiles.
Y numeric data matrix of the second sample (TEST). The rows of Y contain the individual observations of the TEST sample, the columns contain the variables/components of the multivariate sample. More precisely, the variables are the measured dissolution time points and the rows contain the individual dissolution profiles.

alpha numeric (0<alpha<1). The significance level of the test. Usually set to 0.05 which is the default.

print.results logical; if TRUE (default) summary statistics and test results are printed in the output. If NO no output is created

Details
This function implements a variant of the $T^2$-test for equivalence suggested in Hoffelder (2016): The equivalence margin of the test is a compromise between the suggestions of Tsong et al. (1996) and EMA (2010) requirements. See Hoffelder (2016) for a discussion on that equivalence margin.

Value
a data frame; three columns containing the results of the test

p.value numeric; the p-value of the equivalence test according to Hoffelder (2016)
testresult.num numeric; 0 (null hypothesis of nonequivalence not rejected) or 1 (null hypothesis of nonequivalence rejected, decision in favor of equivalence)
testresult.text character; test result of the test in text mode

Author(s)
Thomas Hoffelder <thomas.hoffelder at boehringer-ingelheim.com>

References

Examples
## Not run: A recalculation of the results underlying Figure 1 in Hoffelder (2016) can be done with the following code:
## End(Not run)
data(ex_data_pharmind)
REF_pharmind <- cbind(ex_data_pharmind[ which(ex_data_pharmind$Group=='REF'), ]
                      [c("Diss_10_min","Diss_20_min","Diss_30_min")])
TEST_pharmind <- cbind(ex_data_pharmind[ which(ex_data_pharmind$Group=='TEST'), ]
                        [c("Diss_10_min","Diss_20_min","Diss_30_min")])
test_T2EQ.dissolution.profiles.hoffelder_pharmind <-
  T2EQ.dissolution.profiles.hoffelder(X=REF_pharmind,Y=TEST_pharmind)
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