Package 'Transform'

June 8, 2023

Type Package

Title Statistical Transformations

Version 1.0

Date 2023-06-07

Depends R (>= 3.2.0)

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Description Performs various statistical transformations; Box-Cox and Log (Box and Cox, 1964) <doi:10.1111/j.2517-6161.1964.tb00553.x>, Glog (Durbin et al., 2002) <doi:10.1093/bioinformatics/18.suppl_1.S105>, Neglog (Whittaker et al., 2005) <doi:10.1111/j.1467-9876.2005.00520.x>, Reciprocal (Tukey, 1957), Log Shift (Feng et al., 2016) <doi:10.1002/sta4.104>, Bickel-Docksum (Bickel and Doksum, 1981) <doi:10.1080/01621459.1981.10477649>, Yeo-Johnson (Yeo and Johnson, 2000) <doi:10.1093/biomet/87.4.954>, Square Root (Medina et al., 2019), Manly (Manly, 1976) <doi:10.2307/2988129>, Modulus (John and Draper, 1980) <doi:10.2307/2986305>, Dual (Yang, 2006) <doi:10.1016/j.econlet.2006.01.011>, Gpower (Kelmansky et al., 2013) <doi:10.1515/sagmb-2012-0030>. It also performs graphical approaches, assesses the success of the transformation via tests and plots.

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NeedsCompilation no

Repository CRAN

Date/Publication 2023-06-08 17:42:53 UTC

R topics documented:

`bcTransform` *Box-Cox Transformation for Normality*

Description

`bcTransform` performs Box-Cox transformation for normality of a variable and provides graphical analysis.

Usage

```
bcTransform(data, lambda = seq(-3,3,0.01), lambda2 = NULL, plot = TRUE,
  alpha = 0.05, verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`lambda`	a vector which includes the sequence of candidate lambda values. Default is set to (-3,3) with increment 0.01.
`lambda2`	a numeric for an additional shifting parameter. Default is set to lambda2 = NULL.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Box-Cox power transformation is defined by:

$$y' = \begin{cases} \frac{y^{\lambda}-1}{\lambda} \text{ , if } \lambda \neq 0 \\ log(y) \text{ , if } \lambda = 0 \end{cases}$$

If the data include any non- positive observations, a shifting parameter λ_2 can be included in the transformation given by:

$$y' = \begin{cases} \frac{(y+\lambda_2)^{\lambda}-1}{\lambda} \text{ , if } \lambda \neq 0 \\ log(y+\lambda_2) \text{ , if } \lambda = 0 \end{cases}$$

Value

A list with class "bc" containing the following elements:

`method`	method to estimate Box-Cox transformation parameter
`lambda.hat`	estimate of Box-Cox Power transformation parameter
`lambda2`	additional shifting parameter
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Box, G.E., Cox, D.R. (1964). An Analysis of Transformations. *Journal of the Royal Statistical Society: Series B (Methodological)*, **26:2**, 211–43.

Examples

```
data <- cars$dist

library(Transform)
out <- bcTransform(data)
out$lambda.hat # the estimate of Box-Cox parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

bdTransform *Bickel-Docksum Transformation for Normality*

Description

bdTransform performs Bickel-Docksum transformation for normality of a variable and provides graphical analysis.

Usage

```
bdTransform(data, lambda = seq(0.01,6,0.01), plot = TRUE, alpha = 0.05,
  verbose = TRUE)
```

Arguments

data	a numeric vector of data values.
lambda	a vector which includes the sequence of candidate lambda values. Default is set to (0.01,6) with increment 0.01.
plot	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
alpha	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
verbose	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Bickel-Docksum power transformation is defined by:

$$y' = \frac{|y|^{\lambda} Sign(y) - 1}{\lambda} \text{, if } \lambda > 0$$

Value

A list with class "bd" containing the following elements:

method	method to estimate Bickel-Docksum transformation parameter
lambda.hat	estimate of Bickel-Docksum transformation parameter
statistic	Shapiro-Wilk test statistic for transformed data
p.value	Shapiro-Wilk test p.value for transformed data
alpha	level of significance to assess normality
tf.data	transformed data set
var.name	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Bickel, P.J., Doksum, K.A. (1981). An Analysis of Transformations Revisited. *Journal of the American Statistical Association*, **76:374**, 296–311.

Examples

```
data <- cars$dist

library(Transform)
out <- bdTransform(data)
out$lambda.hat # the estimate of Bickel-Docksum parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

---

dlTransform *Dual Transformation for Normality*

Description

`dlTransform` performs Dual transformation for normality of a variable and provides graphical analysis.

Usage

```
dlTransform(data, lambda = seq(0,6,0.01), plot = TRUE, alpha = 0.05,
  verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`lambda`	a vector which includes the sequence of candidate lambda values. Default is set to (0,6) with increment 0.01.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Dual power transformation is defined by:

$$y' = \begin{cases} \frac{y^{\lambda} - y^{-\lambda}}{2\lambda} \text{ , if } \lambda > 0 \\ \log(y) \text{ , if } \lambda = 0 \end{cases}$$

Value

A list with class "dl" containing the following elements:

`method`	method to estimate Dual transformation parameter
`lambda.hat`	estimate of Dual transformation parameter
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Yang, Z. (2006). A Modified Family of Power Transformations. *Economics Letters*. **92:1**, 14–9.

Examples

```
data <- cars$dist

library(Transform)
out <- dlTransform(data)
out$lambda.hat # the estimate of Dual parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

`glTransform` *Glog Transformation for Normality*

Description

`glTransform` performs Glog transformation for normality of a variable and provides graphical analysis.

Usage

```
glTransform(data, plot = TRUE, alpha = 0.05, verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Glog power transformation is defined by:

$$y' = \log(y + \sqrt{y^2 + 1})$$

Value

A list with class "gl" containing the following elements:

`method`	method name
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Durbin, B.P., Hardin, J.S., Hawkins, D.M., Rocke, D.M. (2002). A Variance-Stabilizing Transformation for Gene-expression Microarray Data. *Bioinformatics*, **18(suppl_1)**, 105–110.

Examples

```
data <- cars$dist

library(Transform)
out <- glTransform(data)
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

`gpTransform` *Gpower Transformation for Normality*

Description

`gpTransform` performs Gpower transformation for normality of a variable and provides graphical analysis.

Usage

```
gpTransform(data, lambda = seq(-3,3,0.01), plot = TRUE, alpha = 0.05,
  verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`lambda`	a vector which includes the sequence of candidate lambda values. Default is set to (-3,3) with increment 0.01.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Gpower power transformation is defined by:

$$y' = \begin{cases} \frac{(y+\sqrt{y^2+1})^{\lambda}-1}{\lambda} \text{ , if } \lambda \neq 0 \\ \log(y+\sqrt{y^2+1}) \text{ , if } \lambda = 0 \end{cases}$$

Value

A list with class "gp" containing the following elements:

`method`	method to estimate Gpower transformation parameter
`lambda.hat`	estimate of Gpower transformation parameter
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Kelmansky, D.M., Martinez, E.J., Leiva, V. (2013). A New Variance Stabilizing Transformation for Gene Expression Data Analysis. *Statistical Applications in Genetics and Molecular Biology*, **12:6**, 653–66.

Examples

```
data <- cars$dist

library(Transform)
out <- gpTransform(data)
out$lambda.hat # the estimate of Gpower parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

`lgTransform` *Log Transformation for Normality*

Description

`lgTransform` performs Log transformation for normality of a variable and provides graphical analysis.

Usage

```
lgTransform(data, lambda2 = NULL, plot = TRUE, alpha = 0.05, verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`lambda2`	a numeric for an additional shifting parameter. Default is set to lambda2 = NULL.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Log power transformation is defined by:

$$y' = \log(y)$$

If the data include any nonpositive observations, a shifting parameter λ_2 can be included in the transformation given by:

$$y' = \log(y + \lambda_2)$$

Value

A list with class "lg" containing the following elements:

`method`	method name
`lambda2`	additional shifting parameter
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Box, G.E., Cox, D.R. (1964). An Analysis of Transformations. *Journal of the Royal Statistical Society: Series B (Methodological)*, **26:2**, 211–43.

Examples

```
data <- cars$dist

library(Transform)
out <- lgTransform(data)
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

---

lsTransform *Log-shift Transformation for Normality*

Description

`lsTransform` performs Log-shift transformation for normality of a variable and provides graphical analysis.

Usage

```
lsTransform(data, lambda = seq(-3,3,0.01), plot = TRUE, alpha = 0.05,
  verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`lambda`	a vector which includes the sequence of candidate lambda values. Default is set to (-3,3) with increment 0.01.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Log-shift power transformation is defined by:

$$y' = \log(y + \lambda)$$

Value

A list with class "ls" containing the following elements:

`method`	method to estimate Log-shift transformation parameter
`lambda.hat`	estimate of Log-shift transformation parameter
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Feng, Q., Hannig, J., Marron, J. (2015). A Note on Automatic Data Transformation. *Stat*, **5:1**, 82–7.

Examples

```
data <- cars$dist

library(Transform)
out <- lsTransform(data)
out$lambda.hat # the estimate of Log-shift parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

`mdTransform` *Modulus Transformation for Normality*

Description

`mdTransform` performs Modulus transformation for normality of a variable and provides graphical analysis.

Usage

```
mdTransform(data, lambda = seq(-3,3,0.01), plot = TRUE, alpha = 0.05,
  verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`lambda`	a vector which includes the sequence of candidate lambda values. Default is set to (-3,3) with increment 0.01.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Modulus power transformation is defined by:

$$y' = \begin{cases} Sign(y)\frac{(|y|+1)^{\lambda}-1}{\lambda}\text{ , if } \lambda \neq 0 \\ Sign(y)\log\left(|y|+1\right)\text{ , if } \lambda = 0 \end{cases}$$

Value

A list with class "md" containing the following elements:

`method`	method to estimate Modulus transformation parameter
`lambda.hat`	estimate of Modulus transformation parameter
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

John, J., Draper, N.R. (1980). An Alternative Family of Transformations. *Journal of the Royal Statistical Society Series C: Applied Statistics*, **29:2**, 190–7.

Examples

```
data <- cars$dist

library(Transform)
out <- mdTransform(data)
out$lambda.hat # the estimate of Modulus parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

`mnTransform` *Manly Transformation for Normality*

Description

`mnTransform` performs Manly transformation for normality of a variable and provides graphical analysis.

Usage

```
mnTransform(data, lambda = seq(-3,3,0.01), plot = TRUE, alpha = 0.05,
  verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`lambda`	a vector which includes the sequence of candidate lambda values. Default is set to (-3,3) with increment 0.01.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Manly power transformation is defined by:

$$y' = \begin{cases} \frac{e^{\lambda y}-1}{\lambda} \text{ , if } \lambda \neq 0 \\ y \text{ , if } \lambda = 0 \end{cases}$$

Value

A list with class "mn" containing the following elements:

`method`	method to estimate Manly transformation parameter
`lambda.hat`	estimate of Manly transformation parameter
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Manly, B.F. (1976). Exponential Data Transformations. *Journal of the Royal Statistical Society: Series D (The Statistician)*, **25:1**, 37–42.

Examples

```
data <- cars$dist

library(Transform)
out <- mnTransform(data)
out$lambda.hat # the estimate of Manly parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

`nlTransform` *Neglog Transformation for Normality*

Description

`nlTransform` performs Neglog transformation for normality of a variable and provides graphical analysis.

Usage

```
nlTransform(data, plot = TRUE, alpha = 0.05, verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Neglog power transformation is defined by:

$$y' = Sign(y)\log(|y| + 1)$$

Value

A list with class "nl" containing the following elements:

`method`	method name
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Whittaker, J., Whitehead, C., Somers, M. (2005). The Neglog Transformation and Quantile Regression for the Analysis of a Large Credit Scoring Database. *Journal of the Royal Statistical Society: Series C (Applied Statistics)*, **54:5**, 863–78.

Examples

```
data <- cars$dist

library(Transform)
out <- nlTransform(data)
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

`rpTransform` *Reciprocal Transformation for Normality*

Description

`rpTransform` performs Reciprocal transformation for normality of a variable and provides graphical analysis.

Usage

```
rpTransform(data, plot = TRUE, alpha = 0.05, verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Dual power transformation is defined by:

$$y' = \frac{1}{y}$$

Value

A list with class "rp" containing the following elements:

method	method name
statistic	Shapiro-Wilk test statistic for transformed data
p.value	Shapiro-Wilk test p.value for transformed data
alpha	level of significance to assess normality
tf.data	transformed data set
var.name	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Tukey, J.W. (1957). On the Comparative Anatomy of Transformations. *The Annals of Mathematical Statistics*, 602–32.

Examples

```
data <- cars$dist

library(Transform)
out <- rpTransform(data)
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

---

ssTransform *Square Root Transformation for Normality*

Description

ssTransform performs Square Root transformation for normality of a variable and provides graphical analysis.

Usage

```
ssTransform(data, lambda = seq(-3,3,0.01), plot = TRUE, alpha = 0.05,
  verbose = TRUE)
```

Arguments

data	a numeric vector of data values.
lambda	a vector which includes the sequence of candidate lambda values. Default is set to (-3,3) with increment 0.01.
plot	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
alpha	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
verbose	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Square Root power transformation is defined by:

$$y' = \sqrt{y + \lambda}$$

Value

A list with class "ss" containing the following elements:

method	method to estimate Square Root transformation parameter
lambda.hat	estimate of Square Root transformation parameter
statistic	Shapiro-Wilk test statistic for transformed data
p.value	Shapiro-Wilk test p.value for transformed data
alpha	level of significance to assess normality
tf.data	transformed data set
var.name	variable name

Author(s)

Muge Coskun Yildirim, Osman Dag

References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Medina, L., Castro, P., Kreutzmann, A. (2018). Rojas-Perilla N. trafo: Estimation, Comparison and Selection of Transformations. *R package version*. **1.0.1**.

Examples

```
data <- cars$speed

library(Transform)
out <- ssTransform(data)
out$lambda.hat # the estimate of Square Root parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

Transform *Statistical Transformations for Normality*

Description

Transform performs transformations for normality of a variable and provides graphical analysis.

Usage

```
Transform(data, method = "dl", lambda = seq(0,6,0.01), lambda2 = NULL, plot = TRUE,
  alpha = 0.05, verbose = TRUE)
```

Arguments

data	a numeric vector of data values.
method	a character string. Different transformation methods can be used for the estimation of the optimal transformation parameter: Box-Cox ("bc"), Log-shift ("ls"), Bickel-Doksum ("bd"), Yeo-Johnson ("yj"), Square Root ("ss"), Manly ("mn"), Modulus ("md"), Dual ("dl"), Gpower ("gp"), Log ("lg"), Glog ("gl"), Neglog ("nl"), Reciprocal ("rp"). Default is set to method = "dl".
lambda	a vector which includes the sequence of candidate lambda values. Please see the corresponding method to learn the lambda range. Default is set to (0,6) with increment 0.01.
lambda2	a numeric for an additional shifting parameter. Please see the corresponding method to learn the lambda2. Default is set to lambda2 = NULL.
plot	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
alpha	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
verbose	a logical for printing output to R console.

Value

See the corresponding transformation method.

Author(s)

Muge Coskun Yildirim, Osman Dag

Examples

```
data <- cars$dist

library(Transform)
out <- Transform(data, method = "bc")
out$lambda.hat # the estimate of Box-Cox parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

---

yjTransform *Yeo- Johnson Transformation for Normality*

Description

`yjTransform` performs Yeo- Johnson transformation for normality of a variable and provides graphical analysis.

Usage

```
yjTransform(data, lambda = seq(-3,3,0.01), plot = TRUE, alpha = 0.05,
  verbose = TRUE)
```

Arguments

`data`	a numeric vector of data values.
`lambda`	a vector which includes the sequence of candidate lambda values. Default is set to (-3,3) with increment 0.01.
`plot`	a logical to plot histogram with its density line and qqplot of raw and transformed data. Defaults plot = TRUE.
`alpha`	the level of significance to check the normality after transformation. Default is set to alpha = 0.05.
`verbose`	a logical for printing output to R console.

Details

Denote y the variable at the original scale and y' the transformed variable. The Yeo-Johnson power transformation is defined by:

$$y' = \begin{cases} \frac{(y+1)^{\lambda}-1}{\lambda} \text{ , if } \lambda \neq 0, y \geq 0 \\ \log(y+1) \text{ , if } \lambda = 0, y \geq 0 \\ \frac{(1-y)^{2-\lambda}-1}{\lambda-2} \text{ , if } \lambda \neq 2, y < 0 \\ -\log(1-y) \text{ , if } \lambda = 2, y < 0 \end{cases}$$

Value

A list with class "yj" containing the following elements:

`method`	method to estimate Yeo-Johnson transformation parameter
`lambda.hat`	estimate of Yeo-Johnson transformation parameter
`statistic`	Shapiro-Wilk test statistic for transformed data
`p.value`	Shapiro-Wilk test p.value for transformed data
`alpha`	level of significance to assess normality
`tf.data`	transformed data set
`var.name`	variable name

Author(s)

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References

Asar, O., Ilk, O., Dag, O. (2017). Estimating Box-Cox Power Transformation Parameter via Goodness of Fit Tests. *Communications in Statistics - Simulation and Computation*, **46:1**, 91–105.

Yeo, I.K., Johnson, R.A. (2000). A New Family of Power Transformations to Improve Normality or Symmetry. *Biometrika*, **87:4**, 954–9.

Examples

```
data <- cars$dist

library(Transform)
out <- yjTransform(data)
out$lambda.hat # the estimate of Yeo- Johnson parameter based on Shapiro-Wilk test statistic
out$p.value # p.value of Shapiro-Wilk test for transformed data
out$tf.data # transformed data set
```

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