Package 'GofKmt'

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Type Package

Title Khmaladze Martingale Transformation Goodness-of-Fit Test

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Description Consider a goodness-of-fit (GOF) problem of testing whether a random sample comes from one sample location-scale model where location and scale parameters are unknown. It is well known that Khmaladze martingale transformation method - which was proposed by Khmaladze (1981) <DOI:10.1137/1126027> - provides asymptotic distribution free test for the GOF problem. This package contains one function: KhmaladzeTrans(). In this version, KhmaladzeTrans() provides test statistic and critical value of GOF test for normal, Cauchy, and logistic distributions. This package used the main algorithm proposed by Kim (2020) <DOI:10.1007/s00180-020-00971-7> and tests for other distributions will be available at the later version.

Depends R (>= 3.5.0)

License GPL-2

LazyData TRUE

Imports Rcpp (>= 1.0.3), ggplot2, stats, utils, Rsolnp

LinkingTo Rcpp, RcppArmadillo

RoxygenNote 7.1.1

NeedsCompilation yes

Repository CRAN

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Contents

GetCV *Obtain Critical Value Table*

Description

Obtain critical values of the Khmaladze martingale transformation test for various significane levels and sample sizes

Usage

```
GetCV(strDist, Modified)
```

Arguments

strDist	the name of the null distribution for the hypothesis test: Normal, Cauchy, or Logistic. Other distributions such as Gumbel, Weibull and Frechet will be available in later versions.
Modified	a logical value which specifies whether or not to use the modeifed version of the test: False calls the original version while True calls the modified version.

Value

A 10-by-6 table of critical values for various significance levles (0.1, 0.075, 0.05, 0.025, 0.01) and sample sizes (10,20,...,100).

See Also

KhmaladzeTrans()

Examples

```
### Critical values of the original test for a normal distribution


strDist = "Normal"
Modified=FALSE
CritValue = GetCV(strDist, Modified)



## Critical values of the modified test for the logistic distribution
strDist = "Logistic"
Modified=TRUE
CritValue = GetCV(strDist, Modified)
```

```
##Critical values of the modified test for the Cauchy distribution
strDist = "Cauchy"
Modified=TRUE
CritValue = GetCV(strDist, Modified)
```

KhmaladzeTrans *Implementing Khmaladze Martingale Transformation.*

Description

Performs goodness-of-fit test through Khmaladze matringale transformation

Usage

```
KhmaladzeTrans(X, Modified = FALSE, strDist, bGraph = FALSE, nNum = 10)
```

Arguments

X	a random sample of n observations
Modified	a logical value which specifies whether or not to use the modeifed version of the test: False calls the original version while True calls the modified version.
strDist	the name of the null distribution for the hypothesis test: Normal, Cauchy, or Logistic. Other distributions such as Gumbel, Weibull and Frechet will be available in later versions.
bGraph	a logical value which specifies whether or not to get the graph of the objective function of the martingale transformation.
nNum	the number of ticks on each segmented interval when drawing the graph of the objective function. The default is 10. Bigger value will result in a smoother graph.

Value

A list of the following values:

opt.x
- When Modified is False, opt.x is the value of x where the optimum of the objective function - which is also the test statistic - occurs.
- When Modified is True, opt.x is the vector of the value of x's where the infimum and supremum of U_n occur.

test.stat
- When Modified is False, test.stat is the test statistic obtained through Khmaladze martingale transformation.
- When Modified is True, test.stat is the vector of the supremum of U_n, the infimum of U_n, and the difference of them.

graph.data a data frame which includes the information of the objective function.

graph a ggplot object which includes the graph of the objective function.

intervals a list of segmented intervals over which the graph of the objective function is defined.

mu the point estimate for the location parameter mu

sigma the point estimate for the scale parameter sigma

References

[1] Khmaladze, E.V., Koul, H.L. (2004). Martingale transforms goodness-of-fit tests in regression models. Ann. Statist., 32. 995-1034

[2] E.V. Khmaladze, H.L. Koul (2009). Goodness-of-fit problem for errors in nonparametric regression: distribution free approach. Ann. Statist., 37(6A) 3165-3185.

[3] Kim, Jiwoong (2020). Implementation of a goodness-of-fit test through Khmaladze martingale transformation. Comp. Stat., 35(4): 1993-2017

Examples

```
####################
n = 10
X = rnorm(n, 1,3)    # Generate a random sample of n observations from N(1,3)
strDist = "Normal"
Modified=FALSE
lResult = KhmaladzeTrans(X, Modified, strDist, bGraph=TRUE, nNum=10)
KMT_OptimalX = lResult$opt.x
KMT_TestStat = lResult$test.stat
KMT_DM = lResult$graph.data
KMT_Graph = lResult$graph

#### Draw the graph of the objective function
KMT_Graph

KMT_Intervals = lResult$intervals
KMT_Muhat = lResult$mu
KMT_Sigmahat = lResult$sigma


#####################

####################
n = 10
X = rlogis(n, 1,2)  # Generate a random sample of n observations from the logistic distribution
strDist = "Logistic"
Modified=TRUE
lResult = KhmaladzeTrans(X, Modified, strDist, bGraph=TRUE, nNum=10)
KMT_Optimal_Positive_X = lResult$opt.x[1]
KMT_Optimal_Negative_X = lResult$opt.x[2]
KMT_Postive_TestStat = lResult$test.stat[1]
KMT_Negative_TestStat = lResult$test.stat[2]
KMT_TestStat = lResult$test.stat[3]
KMT_DM = lResult$graph.data
KMT_Graph = lResult$graph

#### Draw the graph of the objective function
KMT_Graph

KMT_Intervals = lResult$intervals
KMT_Muhat = lResult$mu
KMT_Sigmahat = lResult$sigma
```

```
#####################
```

```
#####################
n = 10
X = rcauchy(n, 0,1)  # Generate a random sample of n observations from Cauchy distribution
strDist = "Cauchy"
Modified=FALSE
lResult = KhmaladzeTrans(X, Modified, strDist, bGraph=TRUE, nNum=10)
KMT_OptimalX = lResult$opt.x
KMT_TestStat = lResult$test.stat
KMT_DM = lResult$graph.data
KMT_Graph = lResult$graph

#### Draw the graph of the objective function
KMT_Graph


KMT_Intervals = lResult$intervals
KMT_Muhat = lResult$mu
KMT_Sigmahat = lResult$sigma
#####################
```

`Tables` *Tables of integrations and critical values*

Description

A dataset containing integration values used for fast computation and critical values for hypothesis test

Usage

```
data(Tables)
```

Details

#'@format A list containing tables of integrations and critical values for normal, logistic and Cauchy distributions:

Integration.Table.Normal 2561-by-3 table for a normal distribution

Integration.Table.Logistic1 1281-by-3 table for the logistic distribution

Integration.Table.Logistic2 1281-by-1 table for the logistic distribution

Integration.Table.Cauchy 2561-by-3 table for the Cauchy distribution

Critical.Value.for.OriginalTest.Normal 100-by-6 table of critical values of the original test for a normal distribution

Critical.Value.for.ModifiedTest.Normal 100-by-6 table of critical values of the modified test for a normal distribution

Critical.Value.for.OriginalTest.Logistic 100-by-6 table of critical values of the original test for the logistic distribution

Critical.Value.for.ModifiedTest.Logistic 100-by-6 table of critical values of the modified test for the logistic distribution

Critical.Value.for.OriginalTest.Cauchy 100-by-6 table of critical values of the original test for the Cauchy distribution

Critical.Value.for.ModifiedTest.Cauchy 100-by-6 table of critical values of the modified test for the Cauchy distribution

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