Package ‘gPdtest’

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Type Package

Title Bootstrap goodness-of-fit test for the generalized Pareto distribution

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Description This package computes the bootstrap goodness-of-fit test for the generalized Pareto distribution by Villasenor-Alva and Gonzalez-Estrada (2009). The null hypothesis includes heavy and non-heavy tailed gPd's. A function for fitting the gPd to data using the parameter estimation methods proposed in the same article is also provided.

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gpd.fit

Fitting the generalized Pareto distribution to data

Description
This function fits a generalized Pareto distribution (gPd) to a data set using either the asymptotic maximum likelihood method (amle) or the combined method proposed by Villasenor-Alva and Gonzalez-Estrada (2009).

Usage
gpd.fit(x, method)

Arguments
- **x**: numeric data vector containing a random sample from a distribution function with support on the positive real numbers.
- **method**: a character string giving the name of the parameter estimation method to be used. There are two available methods: "combined" and "amle". Use "combined" for fitting a gPd with shape parameter <0. Use "amle" for fitting a gPd with shape parameter >= 0.

Details
The distribution function of the gPd is given in the details section of the function gpd.test.

Value
The parameter estimates.

Author(s)
Elizabeth Gonzalez Estrada, Jose A. Villasenor Alva

References

See Also
gpd.test for testing the gPd hypothesis, rgp for generating gPd random numbers.

Examples
```r
x <- rgp(20, shape = 1)  # Random sample of size 20
gpd.fit(x, "amle")        # Fitting a gPd to x using the "amle" method
```
**gpd.test**

*Bootstrap goodness-of-fit test for the generalized Pareto distribution*

**Description**

This function computes the bootstrap goodness-of-fit test by Villasenor-Alva and Gonzalez-Estrada (2009) for testing the null hypothesis \( H_0 \) : a random sample has a generalized Pareto distribution (gPd) with unknown shape parameter \( \gamma \), which is a real number.

**Usage**

\`gpd.test(x,J)\`

**Arguments**

- \( x \) numeric data vector containing a random sample from a distribution function with support on the positive real numbers.
- \( J \) number of bootstrap samples. This is an optional argument. Default \( J=999 \).

**Details**

The bootstrap goodness-of-fit test for the gPd is an intersection-union test for the hypotheses \( H_{0-} \) : a random sample has a gPd with \( \gamma < 0 \), and \( H_{0+} \) : a random sample has a gPd with \( \gamma \geq 0 \). Thus, heavy and non-heavy tailed gPd’s are included in the null hypothesis. The parametric bootstrap is performed on \( \gamma \) for each of the two hypotheses.

We consider the distribution function of the gPd with shape and scale parameters \( \gamma \) and \( \sigma \) given by

\[
F(x) = 1 - \left[ 1 + \frac{\gamma x}{\sigma} \right]^{-1/\gamma}
\]

where \( \gamma \) is a real number, \( \sigma > 0 \) and \( 1 + \gamma x/\sigma > 0 \). When \( \gamma = 0 \), we have the exponential distribution with scale parameter \( \sigma \):

\[
F(x) = 1 - exp\left(\frac{-x}{\sigma}\right)
\]

**Value**

A list with the following components.

- `boot.test` a list with class "htest" containing the p-value of the test, the name of the data set, and the character string "Bootstrap goodness-of-fit test for the generalized Pareto distribution".
- `p.values` the p-values of the tests of the hypotheses \( H_{0-} \) and \( H_{0+} \) described above.

**Author(s)**

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References


See Also

`gpd.fit` for fitting a gPd to data, `rgp` for generating gPd random numbers.

Examples

\[
x \leftarrow \text{rgp}(20, \text{shape }= 1) \quad \text{## Random sample of size 20}
\]
\[
\text{gpd.test}(x) \quad \text{## Testing the gPd hypothesis on } x
\]

rgp

*Generalized Pareto random numbers*

Description

This function generates pseudo random numbers from a generalized Pareto distribution (gPd).

Usage

\[
\text{rgp}(n, \text{shape}, \text{scale})
\]

Arguments

- `n`: sample size.
- `shape`: shape parameter.
- `scale`: scale parameter. Default `scale=1`.

Details

The distribution function of the gPd with shape and scale parameters $\gamma$ and $\sigma$ is

\[
F(x) = 1 - \left[1 + \frac{\gamma x}{\sigma}\right]^{-1/\gamma}
\]

where $\gamma$ is a real number, $\sigma > 0$ and $1 + \gamma x/\sigma > 0$. When $\gamma = 0$, we have the exponential distribution with scale parameter $\sigma$.

Value

A vector of length n.

Author(s)

Elizabeth Gonzalez Estrada, Jose A. Villasenor Alva
rgp

See Also

gpd.test for testing the gPd hypothesis

Examples

rgp(30,shape=1.5) ## Generates 30 random numbers from a gPd with shape parameter 1.5.
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