Package ‘MCMC4Extremes’

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Type Package

Title Posterior Distribution of Extreme Value Models in R

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Depends R (>= 3.1), evir

Description Provides some function to perform posterior estimation for some distribution, with emphasis to extreme value distributions. It contains some extreme datasets, and functions that perform the runs of posterior points of the GPD and GEV distribution. The package calculate some important extreme measures like return level for each t periods of time, and some plots as the predictive distribution, and return level plots.

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Description

These data are the 30-day maxima rainfall at Barcelos Station, in Portugal, from 1931 to 2008. The data are contained in a numeric vector.

Usage

data(barcelos)

Format

A numeric vector containing 918 observations.

Examples

  data(barcelos)
  hist(barcelos, main=NULL)

---

dggev

Dual Gamma Generalized Extreme Value Distribution

Description

Cumulative probability, quantiles, density and random generation from the dual gamma generalized extreme value distribution.

Usage

  pggev(q, xi, mu, sigma, delta)
  qggev(p, xi, mu, sigma, delta)
  dggev(x, xi, mu, sigma, delta)
  rggev(n, xi, mu, sigma, delta)
Arguments

- **q**: vector of quantiles
- **p**: vector of probabilities
- **x**: vector of values at which to evaluate density
- **n**: sample size
- **xi**: shape parameter
- **mu**: location parameter
- **sigma**: scale parameter
- **delta**: additional shape parameter of GGEV extension

Value

Probability (pggev), quantile (qggev), density (dggev) or random sample (rggev) for the GGEV distribution.

References


See Also

ggevp

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fajardo 15-day maxima river food at Fajardo River

Description

These data are the 15-day maxima river food at Fajardo River, in Porto Rico, from 1967 to 2008. The data are contained in a numeric vector.

Usage

data(fajardo)

Format

A numeric vector containing 864 observations.

Examples

data(fajardo)

hist(fajardo, main=NULL)
Description

MCMC runs of posterior distribution of data with Gamma(\(\alpha, \beta\)) density.

Usage

gammap(data, int=1000)

Arguments

data: data vector
int: number of iterations selected in MCMC. The program selects 1 in each 10 iterations, then thin=10. The first thin*int/3 iterations is used as burn-in. After that, is runned thin*int iteration, in which 1 of thin is selected for the final MCMC chain, resulting the number of int iterations.

Value

An object of class gammap that gives a list containing the points of posterior distributions of \(\alpha\) and \(\beta\) of the gamma distribution, the data, mean posterior, median posterior and the credibility interval of the parameters.

Note

The non-informative prior distribution of these parameters are both Gamma(0.0001, 0.0001). During the MCMC runs, screen shows the proportion of iterations made

Examples

# Vector of maxima return for each 10 days for ibovespa data
data(ibovespa)
ibmax=gev(ibovespa[,4],10)$data
# obtaining 500 points of posterior distribution
ibovpost=gammap(ibmax,300)
Description

MCMC runs of posterior distribution of data with parameters of Generalized Extreme Value (GEV) density, with parameters \( \mu \), \( \sigma \) and \( \xi \).

Usage

```r
gevp(data, block, int=1000)
```

Arguments

- `X`:
  - data vector
- `block`:
  - the block size. A numeric value is interpreted as the number of data values in each successive block. All the data is used, so the last block may not contain block observations
- `int`:
  - Number of iterations selected in MCMC. The program selects 1 in each 10 iteration, then thin=10. The first thin*int/3 iterations is used as burn-in. After that, is runned thin*int iteration, in which 1 of thin is selected for the final MCMC chain, resulting the number of int iterations.

Value

An object of class `gevp` that gives a list containing the points of posterior distributions of \( \mu \), \( \sigma \) and \( \xi \) of the gev distribution, the data, mean posterior, median posterior and the credibility interval of the parameters.

Note

The non-informative prior distribution of these parameters are Normal(0,1000) for the parameter \( \mu \), Gamma(0.001,0.001) for the parameter \( \sigma \) and Normal(0,100) for parameter \( \xi \). During the MCMC runs, screen shows the proportion of iterations made.

See Also

`plot.gevp`, `summary.gevp`

Examples

```r
# Obtaining posterior distribution of a vector of simulated points
x=rgev(300,xi=0.1, mu=10, sigma=5)

# Obtaining 600 points of posterior distribution
ajuste=gevp(x,1,200)
```
ggevp

Posterior Distribution with Parameters of Dual Gamma Generalized Extreme Value Distribution

Description

MCMC runs of posterior distribution of data with parameters of Dual Gamma Generalized Extreme Value Distribution density, with parameters mu, sigma and xi.

Usage

ggevp(data, block, int=1000, delta)

Arguments

data                data vector
block               the block size. A numeric value is interpreted as the number of data values in each successive block. All the data is used, so the last block may not contain block observations
int                 Number of interactions selected in MCMC. The program selects 1 in each 10 iteration, then thin=10. The first thin*int/3 iterations is used as burn-in. After that, is runned thin*int iteration, in which 1 of thin is selected for the final MCMC chain, resulting the number of int iterations.
delta               additional shape parameter of GGEV extension

Value

An object of class ggevp that gives a list containing the points of posterior distributions of mu, sigma and xi of the dual gamma generalized extreme value distribution, the data, mean posterior, median posterior and the credibility interval of the parameters.

References

Nascimento, F. F.; Bourguigon, M.; Leao, J. S. (2015). Extended generalized extreme value distribution with applications in environmental data. HACET J MATH STAT.
See Also

plot.ggevp, summary.ggevp

Examples

# Obtaining posterior distribution of a vector of simulated points
w = rggev(300, 0.1, 10, 5, 0.5)

# Obtaining 500 points of posterior distribution with delta=0.5
ajust = ggevp(w, 1, 200, 0.5)

Description

MCMC runs of posterior distribution of data with parameters of Generalized Pareto Distribution (GPD), with parameters sigma and xi.

Usage

gpdp(data, threshold, int=1000)

Arguments

data data vector
threshold a threshold value
int number of iterations selected in MCMC. The program selects 1 in each 10 iteration, then thin=10. The first thin*int/3 iterations is used as burn-in. After that, is runned thin*int iteration, in which 1 of thin is selected for the final MCMC chain, resulting the number of int iterations.

Value

An object of class gpdp that gives a list containing the points of posterior distributions of sigma and xi of the gpd distribution, the data, mean posterior, median posterior and the credibility interval of the parameters.

Note

The joint prior distribution for these parameters is the Jeffreys prior Given as Castellanos and Cabras (2007).

References

See Also

`plot.gpdb, summary.gpdb`

Examples

```r
# Obtaining posterior distribution of a vector of simulated points
x = rgpd(300, xi=0.1, mu=9, beta=2)  # in this case beta is the scale parameter sigma

# Obtaining 1000 points of posterior distribution
ajuste = gpdp(x, 9, 200)

# Histogram of posterior distribution of the parameters, with 95% credibility intervals
# Danish data for evir package, modelling losses over 10
# Not run data(danish)
# Not run out=gpdp(danish, 10, 300)
```

---

**gumbelp**

*Posterior Distribution with GEV, where \( \xi=0 \)*

Description

MCMC runs of posterior distribution of data with parameters of Generalized Extreme Value (GEV) density, in the particular case where \( \xi=0 \) with parameters \( \mu, \sigma \).

Usage

```r
gumbelp(data, block, int=1000)
```

Arguments

- **data**
  - data vector

- **block**
  - the block size. A numeric value is interpreted as the number of data values in each successive block. All the data is used, so the last block may not contain block observations.

- **int**
  - number of iterations selected in MCMC. The program selects 1 in each 10 iteration, then thin=10. The first thin*int/3 iterations is used as burn-in. After that, is runned thin*int iteration, in which 1 of thin is selected for the final MCMC chain, resulting the number of int iterations

Value

An object of class `gumbelp` that gives a list containing the points of posterior distributions of \( \mu \) and \( \sigma \) of the gev distribution, the data, mean posterior, median posterior and the credibility interval of the parameters.
Note

The non-informative prior distribution of these parameters are \( \text{Normal}(0, 1000) \) for the parameter \( \mu \) and \( \text{Gamma}(0.001, 0.001) \) for the parameter \( \sigma \). During the MCMC runs, screen shows the proportion of iterations made.

See Also

plot.gumbelp, summary.gumbelp

Examples

```r
# Obtaining posterior distribution of a vector of simulated points
x = rgev(200, xi=0.0001, mu=10, sigma=5)
# Obtaining 600 points of posterior distribution
ajuste = gumbelp(x, 1, 600)

# Maxima of each month in river nidd data
## Not run: data(nidd.annual)
## Not run: out = gumbelp(nidd.annual, 1, 500)

# Predictive distribution for 15 day maxima ibovespa returns
## Not run: data(ibovespa)
## Not run: postivb = gumbelp(ibovespa[,4], 15, 500)
```

gurgueia

Daily river quota of Gurgueia River.

Description

These data are the monthly maximum river quota of Gurgueia River, in Brazil, from 1975 to 2012.

Usage

data(gurgueia)

Format

A data frame with 415 observations on the following 2 variables.

date  month/year
maximum  a numeric vector with monthly maximum

Examples

data(gurgueia)
hist(gurgueia[,2], main=NULL)
Daily returns of ibovespa

Description
These data are the daily returns of ibovespa from 2000 to 2009.

Usage
data(iboewspa)

Format
A data frame with 2369 observations on the following 4 variables.

- month: a numeric vector with month
- day: a numeric vector with day
- year: a numeric vector with year
- returns: a numeric vector with returns

Examples

data(iboewspa)
hist(iboewspa[,4], main=NULL)

Posterior Distribution with Normal Density

Description
MCMC runs of posterior distribution of data with Normal(μ,1/τ) density, where τ is the inverse of variance.

Usage
normalp(data, int=1000)

Arguments

- data: data vector
- int: number of iterations selected in MCMC. The program selects 1 in each 10 iteration, then thin=10. The first thin*int/3 iterations is used as burn-in. After that, is runned thin*int iteration, in which 1 of thin is selected for the final MCMC chain, resulting the number of int iterations.
Value

An object of class gumbelp that gives a list containing the points of posterior distributions of \mu and \tau of the normal distribution, the data, mean posterior, median posterior and the credibility interval of the parameters.

Note

The non-informative prior distribution of these parameters are \textit{Normal}(0,10000000) for the parameter \mu and \textit{Gamma}(0.001,0.001) for the parameter \tau. During the MCMC runs, screen shows the proportion of iterations made.

See Also

plot.normalp

Examples

```r
# Obtaining posterior distribution of a vector of simulated points
x=rnorm(300,2,sqrt(10))

# Obtaining 1000 points of posterior distribution
ajuste=normalp(x, 200)

# Posterior distribution of river Nile dataset
## Not run: data(Nile)
## Not run: postnile=normalp(Nile,1000)
```

plot.gevp

\textit{Plot Fitted GEV Model}

Description

The plot method plot.gevp provides three different plots: a histogram of the gev parameters, a plot of predictive density resulting from posterior distribution of GEV parameters, and a return level plot of GEV distribution.

Usage

```r
## S3 method for class 'gevp'
plot(x, type = c("histogram", "predictive", "retlevel"), t=2, k=100, 
```n

Arguments

- \texttt{x} a gev object
- \texttt{type} which chosen plot
- \texttt{t} start return level
- \texttt{k} end return level
- \texttt{...} other graphics parameters
plot.ggevp

**See Also**

gevp

**Examples**

```r
# Return level of river nidd data
data(nidd.annual)
out=ggevp(nidd.annual, 1, 300)
## Not run: plot(out, "histogram")
plot(out, "predictive")
## Not run: plot(out, "retlevel", 10, 50)
```

---

**plot.ggevp**

*Plot Fitted for the Dual Gamma Generalized Extreme Value Distribution (GGEV) Model*

---

**Description**

The plot method plot.ggevp provides three different plots: a histogram of the GGEV parameters, a plot of predictive density resulting of posterior distribution of GGEV parameters, and a return level plot of GGEV distribution.

**Usage**

```r
## S3 method for class 'ggevp'
plot(x, type = c("histogram", "predictive", "retlevel"), t=2, k = 100, ...)
```

**Arguments**

- `x` a ggevp object
- `type` which chosen plot
- `t` start return level
- `k` end return level
- `...` other graphics parameters

**References**

Nascimento, F. F.; Bourguignon, M.; Leao, J. S. (2015). Extended generalized extreme value distribution with applications in environmental data. *HACET J MATH STAT.*

**See Also**

ggevp
plot.gpdp

Examples

# Obtaining posterior distribution of a vector of simulated points
w=ggev(300,0.4,10,5,0.5)

# Obtaining 300 points of posterior distribution with delta=0.5
fit=ggev(w,1,200,0.5)
## Not run: plot(fit,"histogram")
plot(fit,"predictive")
## Not run: plot(fit,"retlevel", 10, 50)

plot.gpdp  Plot Fitted GPD Model

Description

The plot method plot.gpdp provides three different plots: a histogram of the GPD parameters, a plot of predictive density resulting of posterior distribution of GPD parameters, and a return level plot of GPD distribution.

Usage

## S3 method for class 'gpdp'
plot(x, type = c("histogram", "predictive", "retlevel"), t=2, k=100, ...)

Arguments

x a gpdp object
type which chosen plot
t start return level
k end return level
... other graphics parameters

See Also

gpdp

Examples

data(danish)
out=gpdp(danish,10,300)
## Not run: plot(out,"histogram")
## Not run: plot(out,"predictive")
plot(out,"retlevel", 10, 50)
plot.gumbelp  
*Plot Fitted Gumbel Model*

**Description**

The plot method plot.gumbelp provides three different plots: a histogram of the gumbel parameters, a plot of predictive density resulting of posterior distribution of gumbel parameters, and a return level plot of gumbel distribution.

**Usage**

```r
## S3 method for class 'gumbelp'
plot(x, type = c("histogram", "predictive", "retlevel"), t=2, k=100, ...)
```

**Arguments**

- `x`: a gumbelp object
- `type`: which chosen plot
- `t`: start return level
- `k`: end return level
- `...`: other graphics parameters

**See Also**

- `gumbelp`

**Examples**

```r
data(nidd.annual)
out = gumbelp(nidd.annual, 1, 500)
## Not run: plot(out, "histogram")
## Not run: plot(out, "predictive")
plot(out, "retlevel", 10)
```

---

plot.normalp  
*Plot Fitted Normal Model*

**Description**

The plot method plot.normalp provides three different plots: a histogram of the normal parameters, a plot of predictive density resulting of posterior distribution of normal parameters, and a return level plot of normal distribution.
sum<em>mary.g<em>evp</em></em>

**Usage**

```r
## S3 method for class 'normalp'
plot(x, type = c("histogram"), ...)
```

**Arguments**

- `x` a `normalp` object
- `type` which chosen plot
- `...` other graphics parameters

**See Also**

`normalp`

**Examples**

```r
data(Nile)
p=normalp(Nile,600)
plot(p,"histogram")
```

---

**summary.g<em>evp**

*Summarizing Posterior Distribution with Parameters of GEV*

**Description**

Summary method for class "gevp"

**Usage**

```r
## S3 method for class 'gevp'
summary(object, ...)
```

**Arguments**

- `object` an object of class "gevp", usually, a result of a call to `gevp`.  
- `...` further arguments passed to or from other methods.

**Value**

The function `summary.gevp` computes and returns a list of summary statistics of the posterior distribution given in `object`.

- `postmean` mean posterior
- `postmedian` median posterior
- `postCI` credibility interval
- `fitm` fit measures for standard GEV model
See Also

gevp

Examples

# Return level of river nidd data
data(nidd.annual)
out=gevp(nidd.annual,1,300)
a=summary(out)
a

summary.ggevp  Summarizing Posterior Distribution with Parameters of GGEV

Description

summary method for class "ggevp"

Usage

## S3 method for class 'ggevp'
summary(object, ...)

Arguments

object  an object of class "ggevp", usually, a result of a call to ggevp.
...
  further arguments passed to or from other methods.

Value

The function summary.ggevp computes and returns a list of summary statistics of the posterior distribution given in object.

postmean  mean posterior
postmedian median posterior
postCI  credibility interval
fitm  fit measures for standard GGEV model

References

Nascimento, F. F.; Bourguigon, M.; Leao, J. S. (2015). Extended generalized extreme value distribution with applications in environmental data. HACET J MATH STAT.

See Also

ggevp
### Examples

```r
# Obtaining posterior distribution of a vector of simulated points
w=rgev(300,0.4,10,5,0.5)
# Obtaining 600 points of posterior distribution with delta=0.5
fit=ggevp(w,1,200,0.5)
a=summary(fit)

# Choice the best delta from a Grid of possible values as Nascimento et al. (2015)
## Not run: fitmeasures=summary(fit)$fitm
## Not run: delta=seq(0.1,2,0.2)
## Not run: results=array(0,c(length(delta),4))
## Not run: for (i in 1:length(delta))
## Not run: {ajust=ggevp(w,1,200,delta[i])
## Not run: results[i,]=summary(ajust)$fitm}

# As commented in Nascimento 2015 paper, a criteria to choice the best delta would be
# create a grid of values of theta and choose the best according the lowest fit measures
## Not run: resultsb=cbind(delta,results)
## Not run: colnames(resultsb)=c("delta","AIC","BIC","pD","DIC")
```

---

### Description

`summary.gpdp` method for class "gpdp"

### Usage

```r
## S3 method for class 'gpdp'
summary(object, ...)  
```

### Arguments

- `object` an object of class "gpdp", usually, a result of a call to `gpdp`.
- `...` further arguments passed to or from other methods.

### Value

The function `summary.ggevp` computes and returns a list of summary statistics of the posterior distribution given in `object`.

- `postmean` mean posterior
- `postmedian` median posterior
- `postCI` credibility interval
- `fitm` fit measures for standard GPD model
See Also
gpdb

Examples
data(danish)
out=gpdb(danish,10,300)
a=summary(out)
a

summary.gumbelp  Summarizing Posterior Distribution with Parameters of Gumbel

Description
summary method for class "gumbelp"

Usage
## S3 method for class 'gumbelp'
summary(object, ...)

Arguments
object an object of class "gumbelp", usually, a result of a call to gumbelp.
... further arguments passed to or from other methods.

Value
The function summary.gumbelp computes and returns a list of summary statistics of the posterior
distribution given in object.

postmean mean posterior
postmedian median posterior
postCI credibility interval
fitm fit measures for standard Gumbel model

See Also
gumbelp
Examples

# Example with simulated datapoints
x=rgev(300,0.01,10,5)
fit=gumbelp(x,1,300)
fitgum=summary(fit)

# Compare if the fit measures of gumbel is better than measures using GEV
## Not run: fit2=gevp(x,1,300)
## Not run: fitgev=summary(fit2)
# the best model is that with lowest fit measures
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