

Package ‘gfiExtremes’

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Type Package

Title Generalized Fiducial Inference for Extremes

Version 1.0.1

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Description Fiducial framework to perform inference on the quantiles for a generalized Pareto distribution model and on the parameters of the Pareto exceedance distribution, assuming the exceedance threshold is a known or unknown parameter. Reference: Damian V. Wandler & Jan Hannig (2012) <doi:10.1007/s10687-011-0127-9>.

License GPL (>= 2)

Depends coda

Imports Rcpp (>= 1.0.5), parallel, doParallel, foreach, stats

LinkingTo Rcpp, BH, RcppArmadillo

Encoding UTF-8

RoxygenNote 7.1.1

URL <https://github.com/stla/gfiExtremes>

BugReports <https://github.com/stla/gfiExtremes/issues>

Suggests knitr, rmarkdown

VignetteBuilder knitr

SystemRequirements C++ 17

NeedsCompilation yes

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Repository CRAN

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gfigpd1	<i>Fiducial inference for the generalized Pareto model with known threshold</i>
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Description

Runs the MCMC sampler of the fiducial distribution for the generalized Pareto model with known threshold.

Usage

```
gfigpd1(  
  X,  
  beta,  
  threshold,  
  gamma.init = NA,  
  sigma.init = NA,  
  sd.gamma = NA,  
  sd.sigma = NA,  
  Jnumb = 50L,  
  iter = 10000L,  
  burnin = 2000L,  
  thin = 6L,  
  nchains = 4L,  
  nthreads = parallel::detectCores(),  
  seeds = NULL  
)
```

Arguments

X	numeric vector of data
beta	vector of probabilities corresponding to the quantiles to be estimated
threshold	value of the known threshold, must be smaller than the maximum of X
gamma.init	starting value for gamma in the MCMC
sigma.init	starting value for sigma in the MCMC
sd.gamma	standard deviation for the proposed gamma in the MCMC
sd.sigma	standard deviation for the proposed sigma in the MCMC

Jnumb	number of subsamples that are taken from the Jacobian
iter	number of iterations per chain (burnin excluded)
burnin	number of the first MCMC iterations discarded
thin	thinning number for the MCMC chain. (e.g. if it is 1 no iteration is skipped)
nchains	number of MCMC chains to run
nthreads	number of threads to run the chains in parallel
seeds	the seeds used for the MCMC sampler; one seed per chain, or NULL to use random seeds

Value

An object of class `mcmc` if `nchains=1`, otherwise an object of class `mcmc.list`.

References

Damian V. Wandler & Jan Hannig. *Generalized fiducial confidence intervals for extremes*. *Extremes* (2012) 15:67–87. <doi:10.1007/s10687-011-0127-9>

Examples

```
set.seed(666L)
X <- rgpareto(200L, mu = 10, gamma = 0.5, sigma = 1)
gf <- gfigpd1(
  X, beta = c(0.98, 0.99), threshold = 10,
  iter = 2000L, nchains = 2L, nthreads = 2L
) # note: 2*2000 iterations is not enough, I'm using these settings because
  # of CRAN constraints (elapsed time must be < 5s)
summary(gf)
qgpareto(c(0.98, 0.99), mu = 10, gamma = 0.5, sigma = 1)
rejectionRate(gf)
HPDinterval(gf)
HPDinterval(joinMCMCchains(gf))
```

gfigpd2	<i>Fiducial inference for the generalized Pareto model with unknown threshold</i>
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Description

Runs the MCMC sampler of the fiducial distribution for the generalized Pareto model with unknown threshold.

Usage

```

gfigpd2(
  X,
  beta,
  threshold.init = NA,
  gamma.init = NA,
  sigma.init = NA,
  sd.gamma = NA,
  sd.sigma = NA,
  p1 = 0.9,
  p2 = 0.5,
  lambda1 = 2,
  lambda2 = 10,
  Jnumb = 50L,
  iter = 10000L,
  burnin = 2000L,
  thin = 6L,
  nchains = 4L,
  nthreads = parallel::detectCores(),
  seeds = NULL,
  allParameters = FALSE
)

```

Arguments

X	numeric vector of data
beta	vector of probabilities corresponding to the quantiles to be estimated
threshold.init	a guess of the unknown threshold, must be in the range of X
gamma.init	starting value for gamma in the MCMC
sigma.init	starting value for sigma in the MCMC
sd.gamma	standard deviation for the proposed gamma in the MCMC
sd.sigma	standard deviation for the proposed sigma in the MCMC
p1	probability that the MCMC will propose a new (gamma, sigma); (1-p1) would be the probability that the MCMC chain will propose a new index for a new threshold
p2	probability that the new index proposed will be larger than the current index
lambda1	the small jump the index variable will make
lambda2	the large jump the index variable will make; happens 1 of every 10 iterations
Jnumb	number of subsamples that are taken from the Jacobian
iter	number of iterations per chain (burnin excluded)
burnin	number of the first MCMC iterations discarded
thin	thinning number for the MCMC chain. (e.g. if it is 1 no iteration is skipped)
nchains	number of MCMC chains to run

nthreads	number of threads to run the chains in parallel
seeds	the seeds used for the MCMC sampler; one seed per chain, or NULL to use random seeds
allParameters	logical, whether to return the MCMC chains of all parameters (pretty useless) or only the ones of the quantiles

Value

An object of class `mcmc` if `nchains=1`, otherwise an object of class `mcmc.list`.

References

Damian V. Wandler & Jan Hannig. *Generalized fiducial confidence intervals for extremes*. *Extremes* (2012) 15:67–87. <doi:10.1007/s10687-011-0127-9>

Examples

```
set.seed(31415L)
X <- rgamma(350L, shape = 10, rate = 1)
gf <- gfigpd2(X, beta = c(0.98, 0.99), iter = 3000L, nthreads = 2L)
summary(gf)
qgamma(c(0.98, 0.99), shape = 10, rate = 1)
traceplot(gf[, "beta1"])
traceplot(gf[, "beta2"])
thresholdEstimate(gf)
rejectionRate(gf)
HPDinterval(gf)
HPDinterval(joinMCMCchains(gf))
```

GPareto

Generalized Pareto distribution

Description

Density, distribution function, quantile function, and random generation for the generalized Pareto distribution.

Usage

```
dgpareto(x, mu, gamma, sigma, log = FALSE)

pgpareto(q, mu, gamma, sigma)

rgpareto(n, mu, gamma, sigma)

qgpareto(p, mu, gamma, sigma)
```

Arguments

x	numeric vector
mu	location parameter
gamma	shape parameter
sigma	scale parameter, strictly positive
log	logical, whether to return the log-density
q	numeric vector of quantiles
n	positive integer, the desired number of simulations
p	numeric vector of probabilities

joinMCMCchains	<i>Join MCMC chains</i>
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Description

Joins multiple MCMC chains into a single chain.

Usage

```
joinMCMCchains(gfi)
```

Arguments

gfi	an output of gfigpd1 or gfigpd2 containing more than one chain
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Value

A mcmc object.

thresholdEstimate	<i>Threshold estimate</i>
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Description

Returns the estimate of the threshold.

Usage

```
thresholdEstimate(gfi)
```

Arguments

gfi	an output of gfigpd2
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Value

The estimated threshold.

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