Package ‘SimTools’

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Title Toolkit for Simulation Output Including Monte Carlo and MCMC

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Imports mcmcse, mvtnorm

Description
Toolkit for simulation output including Monte Carlo and Markov chain Monte Carlo. Tools for reliable visualisations are available, and support for multiple chain MCMC is integrated.

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Encoding UTF-8

RoxygenNote 7.1.1

NeedsCompilation no

R topics documented:

addCI *Add simultaneous confidence interval to existing plot.*

Description

Adds simultaneous confidence intervals for quantiles and means to an existing plot.

Usage

```
addCI(x, CIs, component = 1, bord = NA, mean = TRUE, mean.color = 'plum4',
                quan.color = 'lightsteelblue3', opaq = 0.7, ...)
```

Arguments

`x`	: a ‘Smcmc’ class object
`CIs`	: the output from the ‘getCI‘ function
`component`	: numeric indicating which component to draw the confidence intervals for
`bord`	: logical for whether a border is desired around the confidence intervals
`mean`	: logical argument whether the mean is to be plotted
`mean.color`	: color for the mean confidence interval
`quan.color`	: color for the quantile confidence intervals
`opaq`	: opacity of `mean.col` and `quan.col`. A value of 0 is transparent and 1 is completely opaque.
`...`	: arguments passed on to the boundaries of the confidence intervals in ‘segments‘

Value

adds segments for confidence intervals into an already existing plot environment

Examples

```
chain <- matrix(0, ncol = 1, nrow = 1e3)
chain[1,] <- 0
err <- rnorm(1e3)
for(i in 2:1e3)
{
  chain[i,] <- .3*chain[i-1,] + err[i]
}
chain <- Smcmc(list(chain))
plot(density(chain$stacked[,1]))
CIs <- getCI(chain)
addCI(chain, CIs, component = 1)
```

boxCI *Add simultaneous confidence interval to existing boxplot*

Description

Adds simultaneous confidence intervals for quantiles to an existing boxplot.

Usage

```
boxCI(x, CI, component = c(1), dimn = 1,
               quan.color = 'lightsteelblue3', horizontal = FALSE)
```

Arguments

`x` : a ‘Smcmc’ class object

`CI` : the output from the ‘getCI‘ function with ‘iid = TRUE‘

`component` : vector indicating which components to draw the confidence intervals for

`dimn` : numeric for how many components are being plotted

`quan.color` : color for the quantile confidence intervals

`horizontal` : logical for whether boxplots are horizontal

Value

adds segments for confidence intervals into an already existing plot environment

Examples

```
output <- matrix(rnorm(3*1e3), nrow = 1e3, ncol = 3)
```

boxplot.Siid *Boxplot for Siid*

Description

Boxplots with simultaenous error bars around all quantiles for iid data.

Usage

```
## S3 method for class 'Siid'
boxplot(x, ...,  alpha = 0.05, thresh = 0.001,
                     quan.col = 'lightsteelblue3', opaq = .6, range = 1.5,
                    width = NULL, varwidth = FALSE, outline = TRUE, plot = TRUE,
                     border = par(”fg”), col = 'white', ann = !add,
                     horizontal = FALSE, add = FALSE)
```

Arguments

`x` : a ‘Siid’ class object

`...` : arguments sent to boxplot

`alpha` : confidence level of simultaneous confidence intervals

`thresh` : numeric typically less than .005 for the accuracy of the simulteaneous procedure

`quan.col` : color for the quantile confidence intervals

`opaq` : opacity of `mean.col` and `quan.col`. A value of 0 is transparent and 1 is completely opaque.

`range` : as defined for base `boxplot`

`width` : as defined for base `boxplot`

`varwidth` : as defined for base `boxplot`

`outline` : as defined for base `boxplot`

`plot` : logical indicating whether the plot is to be constructed

`border` : as defined for base `boxplot`

`col` : as defined for base `boxplot`

`ann` : as defined for base `boxplot`

`horizontal` : as defined for base `boxplot`

`add` : as defined for base `boxplot`

Value

returns the base `boxplot` with simultaneous confidence intervals around all quantiles

References

Robertson, N., Flegal, J. M., Vats, D., and Jones, G. L., “Assessing and Visualizing Simultaneous Simulation Error”, Journal of Computational and Graphical Statistics, 2020.

Examples

```
# Generating iid data
chain <- matrix(rnorm(3*1e3), nrow = 1e3, ncol = 3)
siid.obj <- Siid(chain)
boxplot(siid.obj)
```

`getCI` *Calculates simultaneous confidence intervals.*

Description

Calculates simultaneous confidence intervals for means and quantiles as indicated for the desired MCMC output

Usage

```
getCI(x, Q = c(0.1, 0.9), alpha = 0.05, thresh = 0.001, iid = FALSE,
            mean = TRUE)
```

Arguments

`x` : a ‘Smcmc’ class object

`Q` : vector of quantiles

`alpha` : confidence levels of the simulatenous intervals

`thresh` : threshold for the optimization methodology that calculates the simultaneous CIs

`iid` : logical argument for constructing density plot for iid samples. Defaults to `FALSE`

`mean` : logical indicating whether mean is to be plotted

Value

adds segments for confidence intervals into an already existing plot environment

References

Robertson, N., Flegal, J. M., Vats, D., and Jones, G. L., “Assessing and Visualizing Simultaneous Simulation Error”, Journal of Computational and Graphical Statistics, 2020.

Examples

```
chain <- matrix(0, ncol = 1, nrow = 1e3)
chain[1,] <- 0
err <- rnorm(1e3)
for(i in 2:1e3)
{
  chain[i,] <- .3*chain[i-1,] + err[i]
}
chain <- Smcmc(list(chain))
plot(density(chain$stacked[,1]))
CIs <- getCI(chain)
addCI(chain, CIs, component = 1)
```

`plot.Siid` *Plot Siid*

Description

Density plots with simultaenous error bars around means and quantiles for iid data.

Usage

```
## S3 method for class 'Siid'
plot(x, Q = c(0.1, 0.9), alpha = 0.05, thresh = 0.001,
                            rug = TRUE, plot = TRUE, mean = TRUE, border = NA,
                            mean.col = 'plum4', quan.col = 'lightsteelblue3',
                            opaq = 0.7, auto.layout = TRUE,
                            ask = dev.interactive(), ...)
```

Arguments

`x` : a ‘Siid’ class object

`Q` : vector of quantiles

`alpha` : confidence level of simultaneous confidence intervals

`thresh` : numeric typically less than .005 for the accuracy of the simulteaneous procedure

`rug` : logical indicating whether a rug plot is desired

`plot` : logical argument for is plots are to be returned

`mean` : logical argument whether the mean is to be plotted

`border` : whether a border is required for the simultaneous confidence intervals

`mean.col` : color for the mean confidence interval

`quan.col` : color for the quantile confidence intervals

`opaq` : opacity of `mean.col` and `quan.col`. A value of 0 is transparent and 1 is completely opaque.

`auto.layout` : logical argument for an automatic layout of plots

`ask` : activating interactive plots

`...` : arguments passed on to the `density` plot in base R

Value

returns a plot of the univariate density estimates with simultaneous confidence intervals wherever asked. If `plot` == `FALSE` a list of estimates and simultaneous confidence intervals.

References

Robertson, N., Flegal, J. M., Vats, D., and Jones, G. L., “Assessing and Visualizing Simultaneous Simulation Error”, Journal of Computational and Graphical Statistics, 2020.

Examples

```
# Generating iid data
chain <- matrix(rnorm(3*1e3), nrow = 1e3, ncol = 3)
siid.obj <- Siid(chain)
plot(siid.obj)
```

plot.Smcmc *Plot Smcmc*

Description

Density plots with simultaenous error bars around means and quantiles for MCMC data. The error bars account for the correlated nature of the process.

Usage

```
## S3 method for class 'Smcmc'
plot(x, Q = c(0.1, 0.9), alpha = 0.05, thresh = 0.001, iid = FALSE,
                        plot = TRUE, mean = TRUE, border = NA, mean.col = 'plum4',
                            quan.col = 'lightsteelblue3',rug = TRUE, opaq = 0.7,
                             auto.layout = TRUE, ask = dev.interactive(),...)
```

Arguments

`x`	: a ‘Smcmc’ class object
`Q`	: vector of quantiles
`alpha`	: confidence level of simultaneous confidence intervals
`thresh`	: numeric typically less than .005 for the accuracy of the simulteaneous procedure
`iid`	: logical argument for constructing density plot for iid samples. Defaults to `FALSE`
`plot`	: logical argument for is plots are to be returned
`mean`	: logical argument whether the mean is to be plotted
`border`	: whether a border is required for the simultaneous confidence intervals
`mean.col`	: color for the mean confidence interval
`quan.col`	: color for the quantile confidence intervals
`rug`	: logical indicating whether a rug plot is desired
`opaq`	: opacity of `mean.col` and `quan.col`. A value of 0 is transparent and 1 is completely opaque.
`auto.layout`	: logical argument for an automatic layout of plots
`ask`	: activating interactive plots
`...`	: arguments passed on to the `density` plot in base R

Value

returns a plot of the univariate density estimates with simultaneous confidence intervals wherever asked. If `plot == FALSE` a list of estimates and simultaneous confidence intervals.

References

Robertson, N., Flegal, J. M., Vats, D., and Jones, G. L., “Assessing and Visualizing Simultaneous Simulation Error”, Journal of Computational and Graphical Statistics, 2020.

Examples

```
# Producing Markov chain
chain <- matrix(0, ncol = 1, nrow = 1e3)
chain[1,] <- 0
err <- rnorm(1e3)
for(i in 2:1e3)
{
  chain[i,] <- .3*chain[i-1,] + err[i]
}
chain <- Smcmc(list(chain))
plot(chain)
```

Siid *Siid class*

Description

Class for independent and identically distributed (iid) samples

Usage

```
Siid(data, varnames = colnames(data))
```

Arguments

`data`	: an iid output matrix with nsim rows and p columns
`varnames`	: a character string equal to the number of columns in `data`

Value

an Siid class object

Examples

```
# Generating iid data
chain <- matrix(rnorm(3*1e3), nrow = 1e3, ncol = 3)
siid.obj <- Siid(chain)
```

Smcmc *Smcmc class*

Description

Smcmc class for simulated data using Markov chain Monte Carlo

Usage

```
Smcmc(data, batch.size = TRUE, stacked = TRUE, varnames = colnames(data))
```

Arguments

- `data` : a list of MCMC output matrices each with ‘nsim‘ rows and ‘p‘ columns
- `batch.size` : logical argument, if true, calculates the batch size appropriate for this Markov chain. Setting to TRUE saves time in future steps.
- `stacked` : recommended to be ‘TRUE‘. logical argument, if true, stores a carefully stacked version of the MCMC output for use later.
- `varnames` : a character string equal to the number of columns in `data`

Value

an Smcmc class object

Examples

```
# Producing Markov chain
chain <- matrix(0, nrow = 1e3, ncol = 1)
chain[1,] <- 0
err <- rnorm(1e3)
for(i in 2:1e3)
{
  chain[i,] <- .3*chain[i-1,] + err[i]
}
smcmc.obj <- Smcmc(chain)
```

Index