

Package ‘ROCFTP.MMS’

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Type Package

Title Perfect Sampling

Version 1.0.1

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Description The algorithm provided in this package generates perfect sample for unimodal or multimodal posteriors. Read Once Coupling From The Past, with Metropolis-Multishift is used to generate a perfect sample for a given posterior density based on the two extreme starting paths, minimum and maximum of the most interest range of the posterior. It uses the monotone random operation of multishift coupler which allows to sandwich all of the state space in one point. It means both Markov Chains starting from the maximum and minimum will be coalesced. The generated sample is independent from the starting points. It is useful for mixture distributions too. The output of this function is a real value as an exact draw from the posterior distribution.

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Encoding UTF-8

Language en-us

URL <https://github.com/nabipoor/ROCFTP.MMS>

Depends R (>= 4.0.0)

Imports stats (>= 4.0.0), vctrs (>= 0.3.8)

RoxygenNote 7.3.3

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

Collate 'LR.R' 'multishift.R' 'M.MSH.sampler.R' 'CFTP.R'
'ROCFTP.MMS.R'

NeedsCompilation no

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Repository CRAN

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Description

ROCFTP.MMS, Read Once Coupling From The Past, with Metropolis-Multishift is used to generate a perfect sample for a given posterior density based on the two extreme starting paths, minimum and maximum of the most interest range of the posterior. It uses the monotone random operation of multishift coupler which allows to sandwich all of the state space in one point. It means both Markov Chains starting from the maximum and minimum will be coalesced. The generated sample is independent from the starting points. It is useful for mixture distributions too. The output of this function is a real value as an exact draw from the posterior distribution.

Usage

```
ROCFTP.MMS(LB, start, post, sigma, log = FALSE)
```

Arguments

LB	defines the length of each block. The algorithm starts new blocks to find a coalescence of the two Markov chains started from extreme points of the most interest range. So, if it is too small the algorithm after 50 blocks repetition will give error message, and if it is too large then it will increase generation time.
start	is a vector of initial values or the two extreme points of the most interest range of posterior.
post	is the posterior which is defined in the form of an R function.
sigma	is a real value for standard deviation of multishift coupler. Multishift coupler is constructed based on normal density. If the posterior is a mixture distribution or a multi-modal distribution, then sigma should be chosen in such a way that Markov chains easily jumps between modes, and if the sigma is chosen small; the Markov chains may trap in one mode and don't coalesce.
log	has the default value of FALSE for density function of posteriors. If TRUE; then posterior should be defined in log form.

References

Nabipoor M, Murdoch D (2010). ROCFTP with Metropolis-Multishift Coupler. Summer Research, Department of Statistical and Actuarial Sciences, University of Western Ontario.

Nabipoor M (2025). On perfect sampling: ROCFTP with Metropolis-multishift coupler. arXiv:2504.12872.

Author(s)

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Examples

```
#Unimodal posterior
post<- function(x)
{
  dnorm(x, mean=30, sd=1)
}
start<- c(20,40)
LB=30
ROCFTP.MMS(LB,start, post,1)
#Generate n i.i.d. exact sample
RG <- function(i){ROCFTP.MMS(30, c(20,40), post, 1)}
n <- 5
mrtx <- matrix(1:n, ncol=1)
dat <- apply(mrtx,1,RG)
qqnorm(dat, pch = 16, frame = FALSE)
qqline(dat, col = "steelblue", lwd = 3)

# multimodal posterior
post <- function(x)
{
  0.2*dnorm(x, mean=-5, sd=1)+0.2*dnorm(x, mean=5, sd=1)+0.6*dnorm(x, mean=15, sd=1)
}
start <- c(-15,25)
LB <- 116
sigma <- 3.5
ROCFTP.MMS(LB,start, post,sigma) #generates one exact sample
#Generate n i.i.d. exact sample
RG <- function(i){ROCFTP.MMS(116, c(-15,25), post, 3.5)}
n <- 5
mrtx <- matrix(1:n, ncol=1)
apply(mrtx,1,RG)

#log form of posterior
post<- function(x) {dnorm(x, mean=30, sd=1, log=TRUE)}
start<- c(20,40)
LB=100
sigma=0.5
ROCFTP.MMS(LB,start, post, sigma, log=TRUE)
```

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