

Package ‘rgw’

May 9, 2026

Type Package

Title Goodman-Weare Affine-Invariant Sampling

Version 0.3.0

Date 2020-08-10

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Description Implementation of the affine-invariant method of Goodman & Weare (2010) <[DOI:10.2140/camcos.2010.5.65](https://doi.org/10.2140/camcos.2010.5.65)>, a method of producing Monte-Carlo samples from a target distribution.

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LazyLoad yes

Imports parallel

URL <https://github.com/abmantz/rgw>

NeedsCompilation no

Repository CRAN

Date/Publication 2020-08-11 04:20:02 UTC

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rgw-package

Goodman-Weare Affine-Invariant Sampling

Description

This package implements the affine-invariant method of Goodman & Weare (2010) <DOI:10.2140/camcos.2010.5.65>, a method of producing Monte-Carlo samples from a target distribution. The implementation is based on the description of the ‘emcee’ python package (implementing the same method) written by Foreman-Mackey et al. (2012) <DOI:10.1086/670067>. See ‘References’ in the documentation of the GoodmanWeare function for full citation details.

Details

Package: rgw
Type: Package
Version: 0.3.0
Date: 2017-08-11
License: MIT
LazyLoad: yes

Author(s)

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GoodmanWeare*Goodman-Weare Affine-Invariant Sampling*

Description

Produces a Monte-Carlo Markov ensemble using the affine-invariant method of Goodman & Weare.

Usage

```
GoodmanWeare(ensemble, Inpost, Nsteps, current.InP=NULL,  
             mc.cores=getOption("mc.cores", 1L), ...)
```

Arguments

ensemble	an Nparam*Nwalkers array holding the initial state of the sampler. Nparam is the dimensionality of the parameter space and Nwalkers is the number of positions in the parameter space comprising the ensemble. Nwalkers must be even, and in practice should be *at minimum* twice Nparam.
lnpost	function taking a vector of parameter values as input, and returning the log-posterior density.
Nsteps	number of iterations to run the sampler.
current.lnP	vector holding the log-posterior value corresponding to the initial position of each walker. If not provided, this will be calculated internally.
mc.cores	number of cores to use for parallelism.
...	additional arguments to pass to lnpost.

Value

A list containing \$ensemble: an array of the same dimensionality as ensemble, containing the position of the walkers after Nsteps iterations of the sampler; and \$current.lnP: the log-posterior density for each walker.

Note

By default, the code will attempt to run in parallel (see the 'parallel' package). To prevent this, pass mc.cores=1.

Author(s)

Adam Mantz

References

Goodman, J. & Weare, J. (2010, Comm. App. Math. Comp. Sci., 5:6) <DOI:10.2140/camcos.2010.5.65>. This implementation is based on the description given by Foreman-Mackey et al. (2012, arXiv:1202.3665) <DOI:10.1086/670067>.

Examples

```
# In this example, we'll sample from a simple 2D Gaussian

# Define the log-posterior function
lnP = function(x) sum( dnorm(x, c(0,1), c(pi, exp(0.5))), log=TRUE )

# Initialize an ensemble of 100 walkers
nwalk = 100
ensemble = array(dim=c(2, nwalk))
ensemble[1,] = rnorm(nwalk, 0, 0.1)
ensemble[2,] = rnorm(nwalk, 1, 0.1)

# Run for a bit
ens2 = GoodmanWeare(ensemble, lnP, 100, mc.cores=1)
```

```
# Plot the resulting ensemble
plot(t(ens2$ensemble))
# Compare to a direct draw from the posterior distribution
points(rnorm(nwalk, 0, pi), rnorm(nwalk, 1, exp(0.5)), col=2, pch=3)
```

GoodmanWeare.rem

Goodman-Weare Affine-Invariant Sampling

Description

Produces a Monte-Carlo Markov ensemble using the affine-invariant method of Goodman & Weare, saving progress periodically.

Usage

```
GoodmanWeare.rem(post, lnpost, thin=1, mention.every=NA,
  save.every=NA, save.file=NA, show.every=NA,
  show.params=1:dim(post)[1], show.walkers=min(dim(post)[2],8),
  show.pch1=1, show.pch2='.', show.pch.switch=500,
  return.lnpost=FALSE, ...)
```

Arguments

post	an Nparam*Nwalkers*Nsteps array. post[,1] should hold the initial state of the sampler (see help for GoodmanWeare). Checkpoints and the return value will have the same shape, with subsequent layers post[,i] holding the ensemble state at later iterations.
lnpost	function taking a vector of parameter values as input, and returning the log-posterior density.
thin	thinning factor for saving the results.
mention.every	print a message to the console every time this many iterations are completed.
save.every	save the accumulated Markov ensemble to disk every time this many iterations are completed.
save.file	filename for saving progress.
show.every	plot parameter traces so far to the active graphics device periodically.
show.params	(sub)set of parameter traces to plot (default is to show all).
show.walkers	which walkers to plot traces of (default is first 8).
show.pch1	plot symbol to use for short chains.
show.pch2	plot symbol to use for long chains.
show.pch.switch	chain length that distinguishes "short" and "long" chains for plotting purposes.
return.lnpost	whether to return log-posterior values for each sample; see Value.
...	additional named arguments to pass to GoodmanWeare or lnpost.

Value

If `return.Inpost==FALSE`, an array of the same dimensionality as `post`, storing the position of the walkers in `post[,i]` every thin iterations. Otherwise, a list containing that array as `$post`, as well as an `Nwalkers*Nsteps` array storing the corresponding log-posterior values as `$lnP`. The log-posterior values `$lnP[,1]`, corresponding with the starting ensemble positions `$post[,1]`, will always be NA.

Note

By default, the code will attempt to run in parallel (see the ‘parallel’ package). To prevent this, pass `mc.cores=1`.

If traces are being plotted (`show.every` not NA), `par(mfrow=c(length(show.params), 1))` is called on the current graphics device.

Author(s)

Adam Mantz

References

See also help for `rgw::GoodmanWeare`.

Examples

```
# In this example, we'll sample from a simple 2D Gaussian.
# (This is the same example as used in GoodmanWeare.)

# Define the log-posterior function
lnP = function(x) sum( dnorm(x, c(0,1), c(pi, exp(0.5))), log=TRUE) )

# Initialize an ensemble of 100 walkers. We'll take 100 steps, saving the
# ensemble after each.
nwalk = 100
post = array(NA, dim=c(2, nwalk, 101))
post[1,,1] = rnorm(nwalk, 0, 0.1)
post[2,,1] = rnorm(nwalk, 1, 0.1)

# Run
post = GoodmanWeare.rem(post, lnP, mc.cores=1)

# Plot the final ensemble
plot(post[1,,101], post[2,,101])
# Look at the trace of each parameter for one of the walkers.
plot(post[1,1,])
plot(post[2,1,])
```

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