Package ‘seqMC’

June 14, 2017

Title Sequential Monte Carlo

Version 0.0.1

Description Sequential Monte Carlo for nonlinear/non-Gaussian state-space models. Implementation is based on the Gordon, Salmond and Smith (1993) Novel approach to nonlinear or non-Gaussian Bayesian state estimation

Depends R (>= 3.4.0)

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Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

R topics documented:

batchSeqMC *Sequential Monte Carlo*

Description

Sequential Monte Carlo

Usage

```
batchSeqMC(f, prob_y_given_x, x0, y, sample_method = c("systematic",
  "residual", "bootstrap"))
```

Arguments

`f` function, when called with parameter t (time point) and x_t (state vector at time t), it would return x_(t+1)

`prob_y_given_x` function, when called with parameter t (time point), y_t (observation vector at time t) and x_t (state vector at time t), it would return the conditional probability: Prob(y_t | x_t)

`x0` matrix, sample of state vector at time 0, each col is a sample of state at time 0.

`y` matrix of T cols, observations, col 1 is observation at time 1, col 2 is observation at time 2, ... etc. T is the number of time points.

`sample_method` character, specify sample method in the resample stage. Default systematic, means "systematic resampling".

Value

sample from posterior distribution of state vectors, a 3D array, with dimension of d x N x T, where d is the length of a state vector, N is the number of samples, T is the number of time steps.

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seqMC *seqMC creates a seqMC object*

Description

seqMC creates a seqMC object

Usage

```
seqMC(f, prob_y_given_x, x0, y0, sample_method = c("systematic", "residual",
  "bootstrap"))
```

Arguments

`f` function, when called with parameter t (time point) and x_t (state vector at time t), it would return x_(t+1)

`prob_y_given_x` function, when called with parameter t (time point), y_t (observation vector at time t) and x_t (state vector at time t), it would return the conditional probability: Prob(y_t | x_t)

`x0` matrix, sample of state vector at time 0, each col is a sample of state at time 0.

`y0` observation at time 0 (can be missing).

`sample_method` character, specify sample method in the resample stage. Default systematic, means "systematic resampling".

Value

a seqMC object, which can be updated at each time point. e.g. `obj = update(ojb, y)`

Examples

```
f <- function(t, x) {
 0.5 * x + 25 * x / (1 + x * x) + 8.0 * cos(1.2 * (t-1)) + rnorm(length(x), sd=sqrt(10.0))
}

prob_y_given_x <- function(t, y, x) {
 as.numeric(dnorm(y - x * x / 20.0))
}

x0 = matrix(rnorm(4000, sd=2), nrow=1, ncol=4000)

mod = seqMC(f, prob_y_given_x, x0)

### simulate true path ###
x0 = 0.1
T = 50
x = rep(0.0, T)
x[1] = f(0, x0)
for (t in 1:(T-1)) {
 x[t+1] = f(t, x[t])
}
y = x * x / 20 + rnorm(length(x))

### estimate the posterior of state vector given y[t] ####
xhat = sapply(1:T, function(t) {
   mod <<- update(mod, y[t])
   c(mean(mod$x), quantile(mod$x, c(0.025, 0.975)))
})

plot(x, ylim=c(-40, 40), pch='*')
lines(xhat[1,])
lines(xhat[2,], lty='dotted')
lines(xhat[3,], lty='dotted')
```

update.seqMC *Update seqMC object after an observation (if y is not missing) or simply update the object to next time point (if y is missing).*

Description

Update seqMC object after an observation (if y is not missing) or simply update the object to next time point (if y is missing).

Usage

```
## S3 method for class 'seqMC'
update(obj, y)
```

Arguments

obj	seqMC object.

`y`	vector or matrix, if `y` is a vector, it represents an observation at a single time step, if `y` is a matrix, then each col is an observation at a time point, number of cols in `y` equal to number of time steps.

Value

seqMC object updated after given observation(s).

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