Package ‘lsmnsd’

February 9, 2016

Title Classify movement strategies using a latent-state model and NSD

Version 0.0.0.9000

Description

This package provides a series of functions to analyse animal movement strategies using a latent-state model and net squared displacement.
References: Bastille-Rousseau, G., Potts, J., Yackulic, C., Frair, J., Ellington, E.H., Blake, S. (In review) Characterizing movement strategies of
Galapagos giant tortoises using a Bayesian mixture distribution model and net squared displacement. Movement Ecology

Depends R (>= 3.2.3)

License GPL (>=3)

LazyData true

RoxygenNote 5.0.1

Imports R2jags

R topics documented:

`bootNSD` *Iterative latent-state model of NSD*

Description

Bootstrap latent-state model by changing starting locations

Usage

```
bootNSD(x, y, day, interval = 30, by = 5, n.iter = 20000, ...)
```

Arguments

`x,` y, time, information on locations and time (continuous)

`interval` Amount of variation in time to be tested

`by` Time step between each iteration (number of iterations is a function of the interval and time step)

`n.iter` number of total iterations per chain (including burn in; default: 5000)

Value

A boot.clust object

Examples

```
data(Christian)
#May results in low convergence given low number of iterations
boot1<-bootNSD(Christian$x[1:300], Christian$y[1:300], Christian$Time[1:300], interval=20, by=5, n.iter=100
summary(boot1)
plot(boot1)
```

`breaks` *Calculating transitions among clusters*

Description

Calculating pattern of transitions among clusters

Usage

```
breaks(object)
```

Arguments

`object`	an object of class "mov.clust" or "rjags"

Examples

```
data(Zelfa_rjags)
breaks(Zelfa_rjags)
```

`Christian` *Christian - daily spatial locations*

Description

A dataset containing the x, y locations (UTM), and time of Christian, a male giant tortoise inhabiting Alcedo volcano on Isabela Island, Galapagos.

Usage

```
Christian
```

Format

A data frame with 1536 rows and 3 variables (x, y, time)

`Christian_rjags` *Latent-state model applied to Christian*

Description

The output of clustNSD function applied to Christian.

Usage

```
Christian_rjags
```

Format

A "rjags" object

classify *Classify movement strategies*

Description

Extract information to classify movement strategies

Usage

```
classify(object, grph = F, ...)
```

Arguments

object	an object of class "mov.clust" or "rjags"
grph	Produce a graph of classification (Default = F)

Value

A clust.classify object

Examples

```
data(Christian_rjags)
summary(classify(Christian_rjags))
data(Zelfa_rjags)
summary(classify(Zelfa_rjags))
```

clustNSD *Latent-state model of NSD*

Description

Perform latent-state model to characterize movement patterns based on NSD

Usage

```
clustNSD(data, WAIC = FALSE, n.iter = 5000, n.chains = 3,
  n.burnin = floor(n.iter/2), n.thin = max(1, floor((n.iter -
  n.burnin)/1000)), simplify = FALSE, sigma1.max = 0.1, sigma2.max = 0.1,
  sigma1.min = 0.001, sigma2.min = 0.001, mu1.max = 0.5, mu2.max = 1,
  mu1.min = 0, mu2.min = 0, ...)
```

Arguments

`data` a maxtrix with x,y, and time columns

`WAIC` save log-likelihood of every iteration to allow calculations of WAIC, default=FALSE

`n.iter` number of total iterations per chain (including burn in; default: 5000)

`n.chains` number of Markov chains (default: 3)

`n.burnin` length of burn in, i.e. number of iterations to discard at the beginning. Default is n.iter/2, that is, discarding the first half of the simulations. If n.burnin is 0, jags() will run 100 iterations for adaption.

`n.thin` thinning rate. Must be a positive integer. Set n.thin > 1 to save memory and computation time if n.iter is large. Default is max(1, floor(n.chains * (n.iter-n.burnin) / 1000)) which will only thin if there are at least 2000 simulations.

`simplify` Convert output to mov.clust object. Default=FALSE. See simple.clust for details

`sigma1.max` Upper limit of uniform prior for SD of first normal distribution (Default=0.1)

`sigma2.max` Upper limit of uniform prior for SD of second normal distribution (Default=0.1)

`sigma1.min` Lower limit of uniform prior for SD of first normal distribution (Default=0.001)

`sigma2.min` Lower limit of uniform prior for SD of second normal distribution (Default=0.001)

`mu1.max` Upper limit of uniform prior for mean of first normal distribution (Default=0.5)

`mu2.max` Upper limit of uniform prior for difference between mean of first and second normal distribution (Default=1)

`mu1.min` Lower limit of uniform prior for mean of first normal distribution (Default=0.001)

`mu2.min` Lower limit of uniform prior for difference between mean of first and second normal distribution (Default=0)

Value

A rjags or mov.clust object

Examples

```
data(Christian)
nsd1<-NSD_fct(Christian$x, Christian$y)
Christian_rjags<-clustNSD(cbind(range01(nsd1), Christian$Time), n.iter=10000, WAIC=T, simplify=F)
summary(simple.clust(Christian_rjags))
data(Zelfa)
nsd2<-NSD_fct(Zelfa$x, Zelfa$y)
Zelfa_rjags<-clustNSD(cbind(range01(nsd2), Zelfa$Time), n.iter=10000, WAIC=F, simplify=F)
summary(simple.clust(Zelfa_rjags))
```

colVars *Posterior variances*

Description

This function calculates posterior variances from simulation. Based on script initially written by Andrew Gelman

Usage

```
colVars(a)
```

Arguments

a	A matrix

Examples

```
mat<-matrix(rnorm(20), nrow=10, ncol=2)
```

Dist_fct *Calculate euclidean distance*

Description

This function calculates euclidean distance between spatial locations

Usage

```
Dist_fct(x, y)
```

Arguments

x, y	Spatial locations

Examples

```
data(Christian)
hist(Dist_fct(Christian$x, Christian$y))
```

lsmnsd *lsmnsd: A package for classifying animal movement strategies based on a latent-space model and net squared displacement.*

Description

The lsmnsd package provides four categories of important functions: clustNSD, simple.clust, classify, bootNSD.

Mode *Mode*

Description

This function finds the mode of a vector

Usage

```
Mode(x)
```

Arguments

x	A vector

Examples

```
v<-c(1,2,2,3,4,4,4,4,5,6)
Mode(v)
```

NSD_fct *Calculate NSD*

Description

This function calculates NSD from a time-series of spatial locations

Usage

```
NSD_fct(x, y)
```

Arguments

x, y	Spatial locations

Examples

```
data(Christian)
ts.plot(NSD_fct(Christian$x, Christian$y))
```

plot.boot.clust *Plotting boot.clust object*

Description

plot method for class "boot.clust"

Usage

```
## S3 method for class 'boot.clust'
plot(object)
```

Arguments

object	an object of class "boot.clust"

Examples

```
#plot(boot1)
```

plot.mov.clust *Plot mov.clust object*

Description

plotting method for class "mov.clust"

Usage

```
## S3 method for class 'mov.clust'
plot(object)
```

Arguments

object	an object of class "mov.clust"

Examples

```
data(Zelfa_rjags)
plot(simple.clust(Zelfa_rjags))
```

`print.mov.clust` *Print mov.clust object*

Description

printing method for class "mov.clust"

Usage

```
## S3 method for class 'mov.clust'
print(object)
```

Arguments

`object`	an object of class "mov.clust"

Examples

```
data(Zelfa_rjags)
simple.clust(Zelfa_rjags)
```

`range01` *Range standardisation (0,1)*

Description

This function standardises a vector between 0 and 1

Usage

```
range01(x)
```

Arguments

`x`	A vector

Examples

```
v<-c(1,2,2,3,4,4,5,6)
range01(v)
```

rerun *Rerun clustNSD*

Description

This function uses the autojags function to rerun the function clustNSD to facilitate convergence

Usage

```
rerun(rjags, n.update = 3, inc.fact = 1)
```

Arguments

`rjags`	Output from clustNSD
`n.update`	the max number of updates, default =3
`inc.fact`	Factor by which the number of iterations will be increased, default=1 (no increase)

Examples

```
# DO NOT RUN - TAKES A LONG TIME
#data(Christian_rjags)
#rerun(Christian_rjags, n.update=2, inc.fact=1)
```

simple.clust *Convert to mov.clust class*

Description

This function simplifies an rjags output from clustNSD to a mov.clust object

Usage

```
simple.clust(out)
```

Arguments

`out`	Output of clustNSD function

Value

A mov.clust object

Examples

```
data(Christian_rjags)
summary(simple.clust(Christian_rjags))
plot(simple.clust(Christian_rjags))
data(Zelfa_rjags)
summary(simple.clust(Zelfa_rjags))
plot(simple.clust(Zelfa_rjags))
```

summary.boot.clust *Summarizing boot.clust object*

Description

summary method for class "boot.clust"

Usage

```
## S3 method for class 'boot.clust'
summary(object)
```

Arguments

object	an object of class "boot.clust"

Examples

```
summary(boot1)
```

summary.clust.classify *Summarizing clust.classify object*

Description

summary method for class "clust.classify"

Usage

```
## S3 method for class 'clust.classify'
summary(object)
```

Arguments

object	an object of class "clust.classify"

Examples

```
data(Christian_rjags)
summary(classify(Christian_rjags))
```

summary.mov.clust *Summarizing mov.clust object*

Description

summary method for class "mov.clust"

Usage

```
## S3 method for class 'mov.clust'
summary(object)
```

Arguments

`object`	an object of class "mov.clust"

Examples

```
data(Christian_rjags)
summary(simple.clust(Christian_rjags))
```

switch.matrix *Switching probabilties matrix*

Description

Extract matrix of switching probabilities

Usage

```
switch.matrix(object)
```

Arguments

`object`	an object of class "mov.clust" or "rjags"

Examples

```
data(Zelfa_rjags)
switch.matrix(Zelfa_rjags)
```

t.plot *Diagnostics plots*

Description

This function uses the traceplot to display a plot of iterations vs. sampled values for each variable in the chain with a separate plot per variable.

Usage

```
## S3 method for class 'plot'
t(out)
```

Arguments

out	Output from clustNSD

Examples

```
data(Christian_rjags)
t.plot(Christian_rjags)
```

time.spent *Calculating time-spent in cluster*

Description

Calculating pattern of time spent in each cluster

Usage

```
## S3 method for class 'spent'
time(object)
```

Arguments

object	an object of class "mov.clust" or "rjags"

Examples

```
data(Zelfa_rjags)
time.spent(Zelfa_rjags)
```

`waic` *WAIC calculation*

Description

This function calculates WAIC from clustNSD output. Based on script initially written by Andrew Gelman

Usage

```
waic(jagsfit)
```

Arguments

`jagsfit`	Output of a clustNSD call

Examples

```
data(Christian_rjags)
waic(Christian_rjags)
```

`Zelfa` *Zelfa - daily spatial locations*

Description

A dataset containing the x, y locations (UTM), and time of Zelfa, a female giant tortoise inhabiting Espanola Island, Galapagos.

Usage

```
Zelfa
```

Format

A data frame with 1537 rows and 3 variables (x, y, time)

`Zelfa_rjags` *Latent-state model applied to Zelfa*

Description

The output of clustNSD function applied to Zelfa.

Usage

```
Zelfa_rjags
```

Format

A "rjags" object

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