Package 'hab'

January 23, 2015

Version 1.20.3

Date 2015-01-23

Title Habitat and movement functions

Description A set of functions related to habitat selection and movement analyses. Also includes a few patches for functions from the adehabitatXY package family.

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Depends adehabitatMA, adehabitatLT, adehabitatHR

Suggests survival, tkrplot

License GPL (>= 3)

URL http://ase-research.org/basille/hab

R topics documented:

`acf.test` *Test of autocorrelation in SSFs*

Description

Test of autocorrelation and partial autocorrelation in SSF models, based on the estimation of autocorrelation functions (ACF).

Usage

```
acf.test(residuals, id, type = c("correlation", "covariance", "partial"),
  ci = 0.95)
```

Arguments

`residuals`	A vector of residuals on which to compute the ACF. The residuals must be sorted chronologically.
`id`	A vector of corresponding animal IDs.
`type`	A character string giving the type of ACF to be computed. Allowed values are `correlation` (default), `covariance` or `partial`.
`ci`	A numeric giving the confidence interval to be used to test the ACF.

Value

A list, with the following parameters:

- `acfk`: a list with the individual autocorrelation functions
- `threshold`: a vector with individual thresholds
- `lag`: a vector with the resulting individual lags

Author(s)

Mathieu Basille <basille@ase-research.org>

See Also

See acf for further details on the ACF.

`as.ltraj` *Working with Trajectories in 2D Space: the Class ltraj*

Description

Faster version of as.ltraj, which can be up to 5-10 times faster.

Usage

```
as.ltraj(xy, date = NULL, id, burst = id, typeII = TRUE,
  slsp = c("remove", "missing"), infolocs = data.frame(pkey = paste(id,
  date, sep = ".")))
```

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See ld for further details on the function and all available arguments.

Examples

```
data(puechabonsp)
locs <- puechabonsp$relocs
xy <- coordinates(locs)
df <- as.data.frame(locs)
id <- df[,1]
da <- as.POSIXct(strptime(as.character(df$Date), "%y%m%d"))
ltr1 <- adehabitatLT:::as.ltraj(xy, da, id = id)
ltr2 <- as.ltraj(xy, da, id = id)
all.equal(ltr1, ltr2)
```

`closest` *Closest relocation*

Description

Find closest relocation from ltraj objects.

Usage

```
closest(from, to = NULL, dt = c(-3600, 0), units = c("sec", "min", "hour",
  "day"), ref = c("start", "end"), prefix = "to.", by = c("id", "burst"),
  range = c("[]", "[)", "(]", "()"), protect = NULL)
```

Arguments

from	A ltraj object.
to	A ltraj object, supposed to be different from from.
dt	A numeric of length 2, giving the boundaries of the temporal window. See Details.
units	A character string indicating the time units for dt.
ref	
prefix	A character string attached to the names of the variables returned.
by	Character. Only if to == NULL, either "id" to exclude the relocations from the same individual in the computation of distances, or "burst" to exclude relocations from the same burst.
range	A character string indicating the range type, using a representation with square and round brackets: a square bracket means "inclusive" and a round bracket means "exclusive". For example, "[)" includes the beginning, but not the end of the interval.
protect	A character string indicating other variables to keep from to in infolocs.
ref	A character string indicating whether the distance should be computed from the start (ref = start), or the end (ref = "end") of the step.

Details

Distances are computed between the relocations of two ltraj objects within a temporal window. If only one ltraj is provided, distances are computed for relocations of other individuals or bursts (see parameter by).

dt allows to define the time window using Inf (e.g. dt = c(-Inf, 0) corresponds to all previous locations), as well as positive values (e.g. dt = c(-3600,3600) corresponds to all locations from one hour before to one hour after).

Value

The same ltraj as from, with additional variables giving x and y coordinates, the date, id and burst of the closest relocation, together with the distance to this relocation.

Note

The function assumes that both ltraj are projected, and in the same projection.

Author(s)

Mathieu Basille <basille@ase-research.org>

Examples

```
data(puechcirc)

toto <- closest(puechcirc)
tail(infolocs(toto)[[3]])

toto2 <- closest(puechcirc, ref = "end")
tail(infolocs(toto2)[[3]])

tata <- closest(puechcirc, dt = c(-3, 2), units = "hour", by = "burst")
tail(infolocs(tata)[[3]])

titi <- closest(puechcirc, dt = c(-5, -2), units = "hour", protect = "abs.angle")
tail(infolocs(titi)[[3]])
```

---

dl *Quick Conversion of Objects of Class ltraj from and to Dataframes*

Description

Faster versions of `ld` and `dl`.

Usage

```
dl(x, strict = TRUE)

ld(ltraj, strict = TRUE)
```

Arguments

`strict`	Logical. Whether to use the regular `ld` or `dl` functions, which enforce more verifications.

Details

In `ld`, `strict = FALSE` can be up to 10 times faster, but assumes that the `ltraj` is well structured (i.e. not modified by the user). In `dl`, `strict = FALSE` can be up to 20 times faster, but assumes that the trajectory parameters in the data frame (x/y increments, angles, etc.) are still valid (e.g. no locations have been removed).

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See `ld` for further details on the function and all available arguments.

Examples

```
data(puechcirc)
puechcirc ## class ltraj

## ld
df1 <- adehabitatLT:::ld(puechcirc)
df2 <- ld(puechcirc, strict = FALSE)
all.equal(df1, df2)
## Note a difference in row names:
attr(df1, "row.names")
attr(df2, "row.names")

## dl
all.equal(dl(df2), adehabitatLT:::dl(df2))
dl(df2, strict = FALSE)
## Comparison regarding 'strict'
all.equal(dl(df2), dl(df2, strict = FALSE))
## Differences in row.names (numeric in regular 'dl', characters using
## 'strict = FALSE') + NAs in R2n (for a reason, 'puechcirc[[2]]'
## starts by a sequence of missing values, but has several 'R2n'
## values. As a result, 'strict = FALSE' keeps the 'R2n' values)
```

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hab *Habitat selection and movement analyses*

Description

A set of functions related to habitat selection and movement analyses. Also includes a few patches for functions from the adehabitatXY package family. For a list of documented functions, use `library(help = "hab")`

Author(s)

Mathieu Basille <basille@ase-research.org>

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infolocs *Infolocs of an Object of Class ltraj*

Description

Modified version of infolocs that returns NULL if infolocs exists, but which is not a colum of it (note that adehabitatLT::infolocs already returns NULL if there is no infolocs).

Usage

```
infolocs(ltraj, which, by = c("burst", "id", "none"), simplify = FALSE)
```

Arguments

by	Character, replaces perani. Either "burst" (identical to perani = FALSE), "id" (identical to perani = TRUE), or "none" to return only one element for all bursts together.
simplify	Logical. If a single variable is requested, should the function return 1-column data frames (FALSE, default) or vector (TRUE).

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See infolocs for further details on the function and all available arguments.

Examples

```
## Load puechcirc data, and add some random infolocs:
data(puechcirc)
infolocs(puechcirc)
info <- list(data.frame(A = rnorm(80), B = runif(80), C = rpois(80,
    1)), data.frame(A = rnorm(69, 10), B = runif(69, 10, 11),
    C = rpois(69, 10)), data.frame(A = rnorm(66, -10), B = runif(66,
    -10, -9), C = rpois(66, 100)))
## Watch the row names:
info <- mapply(function(x, y) {
    row.names(x) <- row.names(y)
    return(x)
}, info, puechcirc, SIMPLIFY = FALSE)
infolocs(puechcirc) <- info
puechcirc

## Parameters "by" and "simplify"
infolocs(puechcirc, "A", simplify = TRUE)
infolocs(puechcirc, "A", by = "id", simplify = TRUE)
infolocs(puechcirc, "A", by = "none", simplify = TRUE)

## Try to retrieve the column `toto`:
infolocs(puechcirc, "toto")
```

---

kerneloverlap *Spatial Interaction between Animals Monitored Using Radio-Tracking*

Description

Modified version of kerneloverlap, which now allows to select several methods at once, and works on SpatialPointsDataFrame or estUDm in the same function.

Usage

```
kerneloverlap(x, method = c("HR", "PHR", "VI", "BA", "UDOI", "HD"),
  percent = 95, conditional = FALSE, ...)

## S3 method for class 'kerneloverlap'
summary(object, ...)
```

Arguments

x	an object of class SpatialPointsDataFrame containing only one column (which is a factor indicating the identity associated to the relocations) or an object of class estUDm containing several home-ranges for which the overlap is to be calculated
method	the desired method(s)for the estimation of overlap (several methods can be chosen, defaults to all at once)
object	An array or matrix of class kerneloverlap

Value

An array of class kerneloverlap with as many matrices as chosen methods (if only one method is chosen, a matrix of class kerneloverlap); each matrix gives the value of indices of overlap for all pairs of animals.

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See kerneloverlap for further details on the function and all available arguments.

Examples

```
## Prepare the data:
data(puechabonsp)
loc <- puechabonsp$relocs
elev <- puechabonsp$map

## Kernel overlap using various approaches:
kerneloverlap(puechabonsp$relocs[,1], grid = 200, meth = "HR", conditional = TRUE)
kerneloverlap(puechabonsp$relocs[,1], grid = elev, meth = c("HR", "VI"), conditional = TRUE)
kerneloverlap(puechabonsp$relocs[,1], grid = 200, conditional = TRUE)

## Summarizing the results:
summary(kerneloverlap(puechabonsp$relocs[,1], grid = 200))
summary(kerneloverlap(puechabonsp$relocs[,1], grid = 200, percent = 50))
```

kernelUD *Estimation of Kernel Home-Range*

Description

Modified version of kernelUD, which silences the use of same4all when working on a SpatialPixels as a grid.

Usage

```
kernelUD(xy, h = "href", grid = 60, same4all = FALSE, hlim = c(0.1,
  1.5), kern = c("bivnorm", "epa"), extent = 0.5, boundary = NULL)
```

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See kernelUD for further details on the function and all available arguments.

Examples

```
## Prepare the data:
data(puechabonsp)
loc <- puechabonsp$relocs
elev <- puechabonsp$map

## Compute the kernel estimation
ker1 <- kernelUD(puechabonsp$relocs[,1], grid = elev, same4all = TRUE)

## Summarizing the overlaps
summary(kerneloverlap(ker1, conditional = TRUE))
```

kfold *kfold*

Description

Cross-validation for regression models.

Usage

```
kfold(mod, k = 5, nrepet = 100, jitter = FALSE, reproducible = TRUE,
  details = FALSE)

## S3 method for class 'coxph'
kfold(mod, k = 5, nrepet = 100, jitter = FALSE,
  reproducible = TRUE, details = FALSE)
```

Arguments

mod	A fitted model for which there exists a kfold method (currently coxph and clogit models).
k	The number of equal size subsamples of the partition.
nrepet	The number of repetitions.
jitter	Logical, whether to add some random noise to the predictions (useful when the model is fitted on categorical variables, which can produces error in the ranking process).
reproducible	Logical, whether to use a fixed seed for each repetition.
details	Logical, whether to return details of each repetition (useful for debugging).

Details

Note: needs complete names in the coxph/clogit call, and not 'cos(var)' or 'I(var*10)', except for 'strata()' and 'cluster()'.

Also needs complete case in the model (e.g. it fails if there is at least one NA in the observed steps for any variable of the model). Returns an error if some stratas have no case.

Value

A data frame with the correlations (cor) and the type of value (type).

Author(s)

Mathieu Basille <basille@ase-research.org>, with the help of Terry Therneau and Guillaume Bastille-Rousseau

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lincircor *Linear-circular correlation*

Description

Compute Linear-circular correlation, and test it.

Usage

```
lincircor(xl, theta)

lincircor.test(xl, theta)
```

Arguments

xl	A numeric, providing the linear variable.
theta	A numeric, providing the circular variable, in radians (rad = deg * pi / 180).

Value

lincircor returns a numeric providing the linear-circular correlation. lincircor.test returns a list with class "htest" containing the following components:

- statistic: the value of the test statistic
- parameter: the degrees of freedom of the test statistic, which follows a F distribution if x, and theta are independent and x is normally distributed
- p.value: the p-value of the test
- estimate: the estimated measure of linear-circular correlation
- null.value: the value of the correlation measure under the null hypothesis, always 0
- alternative: a character string describing the alternative hypothesis
- method: a character string indicating how the correlation was measured
- data.name: a character string giving the names of the data

Author(s)

Mathieu Basille <basille@ase-research.org>

References

Mardia, K. V. & Jupp, P. E. (2000) Directional statistics. Wiley, 429 pp.

Examples

```
## From Mardia & Jupp (2000), p.246
xl <- c(28, 85.2, 80.5, 4.7, 45.9, 12.7, 72.5, 56.6, 31.5, 112,
    20, 72.5, 16, 45.9, 32.6, 56.6, 52.6, 91.8, 55.2)
theta <- c(327, 91, 88, 305, 344, 270, 67, 21, 281, 8, 204, 86,
    333, 18, 57, 6, 11, 27, 84)
## 'xl' is not in radians (but the test is computed anyway)
lincircor(xl, theta)
## Conversion to radians
lincircor(xl, theta*pi/180)
## Test
lincircor.test(xl, theta*pi/180)
```

---

ltraj2sldf *Conversion of the class* ltraj *to the package* sp

---

Description

ltraj2spdf: Add a proj4string parameter, and keeps id and burst. ltraj2sldf: Add a proj4string parameter, and by is now a character, which accepts "id", "burst" (default) and "step". Warning: the conversion to SLDF using by = "step" is significantly longer, of a factor of ~50, than the other two (it takes about 10 sec for each 10,000 steps on a relatively recent computer).

Usage

```
ltraj2sldf(ltr, by = c("burst", "id", "step"), strict = TRUE,
  proj4string = CRS(as.character(NA)))

ltraj2spdf(ltr, strict = TRUE, proj4string = CRS(as.character(NA)))
```

Arguments

by	Sets the level of aggregation: if id, one object of class Lines corresponds to one animal; if burst (default), it corresponds to one burst; if step, it corresponds to one step.
strict	Logical (TRUE by default). See ld. For ltraj2sldf, only applies to by = "step".
proj4string	A valid proj4 string (see proj4string for more details).

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See ltraj2spdf for further details on the function and all available arguments.

Examples

```
## Load puechcirc data, and add some random infolocs:
data(puechcirc)
info <- list(data.frame(A = rnorm(80), B = runif(80), C = rpois(80,
    1)), data.frame(A = rnorm(69, 10), B = runif(69, 10, 11),
    C = rpois(69, 10)), data.frame(A = rnorm(66, -10), B = runif(66,
    -10, -9), C = rpois(66, 100)))
## Watch the row names:
info <- mapply(function(x, y) {
    row.names(x) <- row.names(y)
    return(x)
}, info, puechcirc, SIMPLIFY = FALSE)
infolocs(puechcirc) <- info

## Conversion to SPDF:
summary(adehabitatLT:::ltraj2spdf(puechcirc))
summary(ltraj2spdf(puechcirc, strict = FALSE))
summary(ltraj2spdf(puechcirc, strict = FALSE, proj4string = CRS("+init=epsg:27572")))

## Conversion to SLDF:
summary(adehabitatLT:::ltraj2sldf(puechcirc, byid = TRUE))
summary(ltraj2sldf(puechcirc, by = "id"))
summary(ltraj2sldf(puechcirc, proj4string = CRS("+init=epsg:27572")))
summary(ltraj2sldf(puechcirc, strict = FALSE, by = "step",
    proj4string = CRS("+init=epsg:27572")))
```

makeCluster *Create independent clusters*

Description

Create independant clusters from a sequence of (observed + random) steps.

Usage

```
makeCluster(seq, strata, case, ndrop, nclust = NULL, nstep = NULL)
```

Arguments

seq	A numeric, indicating the continuous sequences of steps. See Details.
strata	A numeric, indicating the strata of each observed and random steps.
case	A numeric, with 1 for observed steps and 0 for random steps.
ndrop	The number of steps to drop between each cluster. They will be NAs in the resulting vector.
nclust	The ideal number of clusters to obtain. See Details.
nstep	The number of steps consisting in a single cluster. See Details.

Details

There must be one and only one case per strata. In addition, the sequences must be orderd in ascending order (there is no check on this), and the case and strata should correspond to that order.

It is only necessary to provide nclust to get at least that many clusters (if possible). The argument nloc can be set instead, if one wants exactly a number of successive steps in a cluster (much faster computation).

Value

A vector of the same length as seq, strata and case, with the cluster number for each step, and three attributes giving the number of clusters (nclust), the number of successive steps kept per cluster (nstep) and the number of successive steps dropped between each cluster (ndrop).

Author(s)

Mathieu Basille <basille@ase-research.org>

Examples

```
## case (1 observed + 9 random)
case <- rep(rep(1:0, c(1, 9)), 100)
## 100 stratas of 10 steps (1 observed + 9 random)
strata <- rep(1:100, each = 10)
## 5 sequences of 20*10 steps
```

```
seq <- rep(1:5, each = 200)
head(data.frame(case, strata, seq), 22)
## Make at least 15 clusters by dropping 2 steps between each of them
makeCluster(seq, strata, case, ndrop = 2, nclust = 15)
## Same result with 'nstep = 7' direcly
makeCluster(seq, strata, case, ndrop = 2, nstep = 7)
```

---

makeSeq *Define sequences of a trajectory*

Description

Define sequences of a trajectory based on the chronology of steps, allowing for gaps.

Usage

```
makeSeq(x, gap = 1, units = c("hours", "mins", "secs", "days", "weeks"),
  na.omit = TRUE, name = "seq")

summarySeq(x, name = "seq")

## S3 method for class 'summarySeq'
print(x, ...)
```

Arguments

x	A ltraj object.
gap	The maximum time interval between two successives steps before starting a new sequence (note that the time interval needs to be strictly greater than gap for a new sequence to start).
units	The unit of gap (default is hour).
na.omit	Logical, whether to remove missing locations to form the sequence (default).
name	A character string indicating the column name of the sequence to be stored in infolocs.
x	A ltraj object.
name	A character string indicating the column name of the sequence computed by makeSeq.
x	An object of class summarySeq.

Value

For makeSeq, a ltraj with a new variable name in infolocs, with the sequence number for each location, in the form of an integer series for each burst.

For summarySeq, an object of class summarySeq.

Author(s)

Mathieu Basille <basille@ase-research.org>

Examples

```
data(puechcirc)

puechcirc <- makeSeq(puechcirc, gap = 15, units = "mins", name = "seq15")
infolocs(puechcirc, which = "seq15", simplify = TRUE)
summarySeq(puechcirc, "seq15")

puechcirc <- makeSeq(puechcirc, gap = 25, units = "mins", name = "seq25")
summarySeq(puechcirc, "seq25")
```

---

modWeights *Model weights using Information Theory*

Description

Compute model weights using Information Theory criteria.

Usage

```
modWeights(..., criterion = QIC, names = TRUE)
```

Arguments

`...`	All fitted model objects.
`criterion`	The function to be used as the Information Theory criterion. Only tested with `QIC` (default).
`names`	Logical, whether to assign names to the result.

Value

A numeric vector with the corresponding weights.

Author(s)

Mathieu Basille <basille@ase-research.org>

na.omit.ltraj *Handle Missing Values in Objects of Class 'ltraj'*

Description

na.omit removes missing locations from a ltraj object.

Usage

```
## S3 method for class 'ltraj'
na.omit(object, rec = TRUE, complete.steps = FALSE, ...)
```

Arguments

object	An object of class ltraj.
rec	Logical, whether to recompute descriptive parameters of the trajectory (in particular dx, dy, and angles). Use FALSE with care.
complete.steps	Logical, whether to keep only complete steps, i.e. steps characterized by start and end points, and turning angle (i.e. relative angle to the previous step).
...	Further arguments not used.

Value

A ltraj object, without missing locations.

Author(s)

Mathieu Basille <basille@ase-research.org>

Examples

```
data(puechcirc)
puechcirc
na.omit(puechcirc)
## Note the direct call to hab:::
hab:::na.omit.ltraj(puechcirc, rec = FALSE, complete.steps = TRUE)
```

plot.ltraj *Graphical Display of an Object of Class "ltraj"*

Description

New arguments to allow a better control by the user, plus a computation of xlim/ylim that ensures that the bounding box of the maps are the same for each burst (see parameter center). Also enables the plot of a SpatialPoints(DataFrame) in the background.

Usage

```
plot.ltraj(x, id = unique(adehabitatLT::id(x)),
  burst = adehabitatLT::burst(x), by = c("burst", "id", "none"),
  na.rm = TRUE, spixdf = NULL, spoldf = NULL, spotdf = NULL,
  xlim = NULL, ylim = NULL, center = FALSE, addpoints = TRUE,
  addlines = TRUE, box = FALSE, final = TRUE, mfrow, ppar = list(pch =
  21, col = "black", bg = "white"), lpar = list(), spixdfpar = list(col =
  gray((240:1)/256)), spoldfpar = list(col = "green"), spotdfpar = list(pch
  = 3, col = "darkgreen"), ...)
```

Arguments

by	Character, replaces perani. Either "burst" (identical to perani = FALSE), "id" (identical to perani = TRUE), or "none" to plot all bursts at once.
na.rm	Logical, whether to remove missing locations.
spotdf	An object of class SpatialPoints.
center	Logical, whether to center each plot around the current burst (default = FALSE).
box	Logical, whether to add a box after plotting each individual plot (useful when a map overlaps the plot borders, default = FALSE).
mfrow	A vector of the form c(nr, nc), which allows the user to define the numbers of rows (nr) and columns (nc) in the device (the default uses n2mfrow(length(id)) if length(id) <= 12, and mfrow = c(3, 4) otherwhise).
ppar	A list of arguments that allows the user to modify point display, using any argument available to points. Default is list(pch = 21, col = "black", bg = "white"). See Details.
lpar	A list of arguments that allows the user to modify line display, using any argument available to lines. Default is list(), i.e. an empty list. See Details.
spixdfpar	A list of arguments that allows the user to modify SpatialPixelsDataFrame display, using any argument available to image. Default is list(col = gray((240:1)/256)).
spoldfpar	A list of arguments that allows the user to modify SpatialPolygons display, using any argument available to plot. Default is list(col = "green").
spotdfpar	A list of arguments that allows the user to modify SpatialPoints display, using any argument available to plot. Default is list(pch = 3, col = "darkgreen").

Details

It is possible to use point and line parameters globally for every trajectory displayed. In this case, `ppar` and `lpar` need just be a list of graphical parameters, such as `list(pch = 21, col = "black", bg = "white")`. It is also possible to use parameters for single bursts or individual, using atomic vectors with the same numbers of named elements than bursts/id, such as `list(col = c(b1 = "blue", b2 = "red"))`. Finally, it is also possible to use parameters for single steps, using as graphical parameter a list of vectors of length equal to each trajectory. Such information can be based on `infolocs`, see Examples.

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See `plot.ltraj` for further details on the function and all available arguments.

Examples

```
data(puechcirc)

## Point and line parameters
plot(puechcirc)
plot(puechcirc, ppar = list(pch = 2, cex = .5), lpar = list(lty = 2,
    col = grey(.5)))
## By burst
plot(puechcirc, ppar = list(col = c(CH930824 = "blue", CH930827 = "green",
    JE930827 = "red"), pch = 20), lpar = list(col = c(CH930824 = "blue",
    CH930827 = "green", JE930827 = "red")))

## Parameter 'by', 'mfrow' and 'id'
plot(puechcirc, by = "id")
plot(puechcirc, by = "id", mfrow = c(1, 2))
plot(puechcirc, id = "JE93")
plot(puechcirc, by = "none", ppar = list(col = c(CH930824 = "blue",
    CH930827 = "green", JE930827 = "red"), pch = 20), lpar = list(col =
    c(CH930824 = "blue", CH930827 = "green", JE930827 = "red")))

## Using parameters for single steps
info <- list(data.frame(col = sample(c("red",
         "grey"), 80, rep = TRUE), stringsAsFactors = FALSE),
         data.frame(col = sample(c("blue", "darkred"),
             69, rep = TRUE), stringsAsFactors = FALSE),
         data.frame(col = sample(c("darkgreen", "purple"),
             66, rep = TRUE), stringsAsFactors = FALSE))
info <- mapply(function(x, y) {
    row.names(x) <- row.names(y)
    return(x)
}, info, puechcirc, SIMPLIFY = FALSE)
infolocs(puechcirc) <- info
```

```
## By burst (default)
plot(puechcirc, ppar = list(pch = 19, col = infolocs(puechcirc,
    "col", simplify = TRUE)), lpar = list(col = infolocs(puechcirc,
    "col", simplify = TRUE)), na.rm = FALSE)

## By animal
plot(puechcirc, by = "id",
    ppar = list(pch = 19, col = infolocs(puechcirc, "col", by = "id",
        simplify = TRUE)),
    lpar = list(col = infolocs(puechcirc, "col", by = "id",
        simplify = TRUE)), na.rm = FALSE)

## Using a SpatialPixelsDataFrame
data(puechabonsp)

plot(puechcirc, spixdf = puechabonsp$map[,1])
plot(puechcirc, spixdf = puechabonsp$map[,1],
    ppar = list(pch = 2, cex = .5), lpar = list(lty = 2, col = "white"),
    spixdfpar = list(col = gray((1:240)/256)))

## Using a SpatialPolygonsDataFrame
cont <- getcontour(puechabonsp$map[,1])
plot(puechcirc, spoldf = cont)
plot(puechcirc, spoldf = cont, ppar = list(pch = 2, cex = .5),
    lpar = list(lty = 2, col = grey(.5)), spoldfpar = list(col = "cornsilk",
        border = grey(.5)))
```

---

plotltr *Changes in Traject Parameters Over Time*

Description

Four new arguments to allow a better control by the user (note that arguments pch and cex have been removed and are now used in ppar).

Usage

```
plotltr(x, which = "dist", perani = FALSE, addlines = TRUE, mfrow,
  ppar = list(pch = 16, cex = 0.7), lpar = list(), ...)
```

Arguments

perani	logical. If FALSE (default), one plot is drawn for each value of burst. If TRUE, one plot is drawn for each value of id, and the several bursts are superposed on the same plot for a given animal.
mfrow	A vector of the form c(nr, nc), which allows the user to define the numbers of rows (nr) and columns (nc) in the device (the default uses n2mfrow(length(id)) if length(id) <= 12, and mfrow = c(3, 4) otherwhise).

ppar	A list of arguments that allows the user to modify point display, using any argument available to points. Default is list(pch = 21, col = "black", bg = "white").
lpar	A list of arguments that allows the user to modify line display, using any argument available to lines. Default is list(), i.e. an empty list.

Details

Also corrects a bug if the burst contains infolocs, in which case other attributes (notably burst and id) were lost.

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See plotltr for further details on the function and all available arguments.

Examples

```
data(puechcirc)

adehabitatLT:::plotltr(puechcirc, "cos(rel.angle)")
plotltr(puechcirc, "cos(rel.angle)")
## Not run:
plotltr(puechcirc, "cos(rel.angle)", ppar = list(pch = 2, cex = 2),
    lpar = list(lty = 2, lwd = 2), mfrow = c(2, 1))
## End(Not run)

adehabitatLT:::plotltr(puechcirc, "dist")
plotltr(puechcirc, "dist")
plotltr(puechcirc, "dist", ppar = list(pch = 3, col = "blue"),
    lpar = list(lty = 3, col = "red"), perani = TRUE)

adehabitatLT:::plotltr(puechcirc, "dx")
plotltr(puechcirc, "dx")
plotltr(puechcirc, "dx", ppar = list(col = rep(1:8, each = 6)),
    addlines = FALSE)
```

---

plotNAltraj *Highlighting the Patterns in Missing Values in Trajects*

Description

Five new arguments to allow a better control by the user.

Usage

```
plotNAltraj(x, perani = FALSE, addlines = TRUE, mfrow, ppar = list(pch =
  16, cex = 0.3), lpar = list(), ...)
```

Arguments

perani	logical. If FALSE (default), one plot is drawn for each value of burst. If TRUE, one plot is drawn for each value of id, and the several bursts are superposed on the same plot for a given animal.
addlines	Logical. Indicates whether lines should be added to the plot.
mfrow	A vector of the form c(nr, nc), which allows the user to define the numbers of rows (nr) and columns (nc) in the device (the default uses n2mfrow(length(id)) if length(id) <= 12, and mfrow = c(3, 4) otherwhise).
ppar	A list of arguments that allows the user to modify point display, using any argument available to points. Default is list(pch = 21, col = "black", bg = "white").
lpar	A list of arguments that allows the user to modify line display, using any argument available to lines. Default is list(), i.e. an empty list.

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See plotNAltraj for further details on the function and all available arguments.

Examples

```
data(puechcirc)
adehabitatLT:::plotNAltraj(puechcirc)
plotNAltraj(puechcirc, perani = TRUE, addlines = FALSE, mfrow = c(1,
    2), ppar = list(pch = 15, cex = 0.5))
```

QIC *QIC: Quasi-likelihood under Independence Criterion*

Description

Generic function calculating the Quasi-likelihood under Independence Criterion for one or several fitted model objects.

Usage

```
QIC(mod, ...)

## S3 method for class 'coxph'
QIC(mod, ..., details = FALSE)
```

Arguments

mod	A coxph or clogit model.
...	Optionally more fitted model objects.
details	Logical, whether to provide detailed outputs (turned automatically to TRUE when several models are fitted).

Value

If details = FALSE, simply returns the QIC. If details = TRUE, returns a data frame presenting the QIC, the quasi-likelihood, the number of observations, the number of events, the number of paramaters and the trace. If several models are provided, two additional columns present the delta QIC and the model weights.

Author(s)

Mathieu Basille <basille@ase-research.org> and Thierry Duchesne

---

rdSteps *Draw random steps*

Description

Draw random steps from a ltraj object using empirical distributions of step lengths and turning angles.

Usage

```
rdSteps(x, nrs = 10, rand.dis = NULL, only.others = FALSE,
  simult = FALSE, distMax = Inf, strata = NULL, mask = NULL,
  reproducible = FALSE)
```

Arguments

x	A ltraj object.
nrs	The number of random steps to draw for each observed step (default = 10).
rand.dis	The random distributions for step lengths and turning angles to use. If NULL (default), it uses x as a basis; otherwise, another ltraj object must be provided, or a data.frame with columns "dist", "rel.angle" and "id".
only.others	Logical, draws step lengths and turning angles from all other individuals, excluding the current one.
simult	Logical, whether to draw step lengths and turning angles simultaneously, i.e. both measurements come from a single observed step, instead of being drawn independently.
distMax	Only draw step lengths and turning angles using steps shorter than this threshold. Default is Inf, i.e. all steps are kept.

strata	Character. How to name the stratas. In all cases, a new column strata is created. If NULL, a series of integer from 1 to the total number of steps (on every individuals) is used; if "row.names", the row names are used; otherwise the column provided is used.
mask	A SpatialPolygons used to redraw steps that end outside of the polygon. Use with caution: there is absolutely no guarantee that the function is not caught in an endless loop (warnings are issued if there are long or very long loops). Note that it is assumed that steps are in the same projection as the mask (if it is not the case, project the mask first using spTransform).
reproducible	Logical. If TRUE, results are made reproducible with the use of a seed, otherwise new random step lengths and turning angles are sampled at each call.

Details

Note that 1) only complete steps are kept (i.e. steps characterized by start and end points, and turning angle (i.e. relative angle to the previous step); and 2) the information stored in infolocs is transfered to all random steps within a strata (i.e. it assumes it is the same for all steps within a strata).

Value

A data frame, with new columns case (1 for observed steps and 0 for random steps) and strata (a unique value for each set of paired observed and random steps).

Author(s)

Mathieu Basille <basille@ase-research.org>

Examples

```
## Load the data
data(puechcirc)
##'
## Simple example to check the distributions of step lengths and turning
## angles
bla <- rdSteps(puechcirc)
boxplot(bla$rel.angle ~ bla$case)
boxplot(bla$dist ~ bla$case)

## Reproducibility and alternative random distributions

## 1) Default: using the same ltraj for the random distributions:
bla <- rdSteps(puechcirc, reproducible = TRUE)

## 2) Explicitly use the same ltraj for the random distributions:
bli <- rdSteps(puechcirc, rand.dis = puechcirc, reproducible = TRUE)

## Check that 2) is the same as 1)
all.equal(bla, bli)
```

```
## 3) Explicitly uses random distributions in a data.frame:
rand <- subset(ld(puechcirc), !(is.na(x) | is.na(dx) | is.na(rel.angle)) &
    dist <= Inf, select = c("dist", "rel.angle", "id"))
blo <- rdSteps(puechcirc, rand.dis = rand, reproducible = TRUE)

## Check that 3) is the same as 1)
all.equal(bla, blo)
```

---

rec *Recalculates the descriptive parameters of a ltraj*

Description

Modified version of rec that keeps the original row.names. Also throws an error if the row.names are different between the ltraj and its infolocs.

Usage

```
rec(x, slsp = c("remove", "missing"))
```

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See rec for further details on the function and all available arguments.

Examples

```
data(puechcirc)
(bla <- rec(puechcirc))
head(puechcirc[[2]])
head(bla[[2]])
```

---

setNA *Place Missing Values in Objects of Class* ltraj

Description

The function does not allow a numeric for date.ref anymore. In addition, a warning is issued if the length of date.ref is not 1 or the length of the ltraj object. See setNA for further details on the function and all available arguments.

Usage

```
setNA(ltraj, date.ref, dt, tol = dt/10, units = c("sec", "min", "hour",
  "day"), ...)
```

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

See Also

See setNA for further details on the function and all available arguments.

---

subset.ltraj *Subsetting a ltraj*

Description

Return subsets of a ltraj which meet conditions (over the descriptive parameters of the ltraj or its infolocs).

Usage

```
## S3 method for class 'ltraj'
subset(x, subset, rec = FALSE, ...)
```

Arguments

x	A ltraj object.
subset	Logical expression indicating elements or rows to keep: missing values are taken as false.
rec	Logical, whether to recompute the ltraj parameters or not (default = FALSE).

Value

A ltraj object.

Author(s)

Mathieu Basille <basille@ase-research.org>

See Also

See which.ltraj to identify the relocations fullfilling a condition.

Examples

```
## Load puechcirc data and add some infolocs:
data(puechcirc)
info <- list(data.frame(A = rnorm(80), B = runif(80), C = rpois(80,
    1)), data.frame(A = rnorm(69, 10), B = runif(69, 10, 11),
    C = rpois(69, 10)), data.frame(A = rnorm(66, -10), B = runif(66,
    -10, -9), C = rpois(66, 100)))
## Watch the row names:
info <- mapply(function(x, y) {
    row.names(x) <- row.names(y)
    return(x)
}, info, puechcirc, SIMPLIFY = FALSE)
infolocs(puechcirc) <- info

## Different subsets:
(xsub1 <- subset(puechcirc, dist > 200, rec = FALSE))
(xsub2 <- subset(puechcirc, C == 3, rec = TRUE))
(xsub3 <- subset(puechcirc, C == 3, rec = FALSE))
```

---

trajdyn *Interactive Display of Objects of Class* ltraj

Description

Modified version of trajdyn, which allows to 1) increment by by points/steps, 2) only display k previous points/steps, 3) show the current step as a vector, 4) to modify point and line display, 5) show the current burst/loc/(infolocs) and 6) to update interactively a new or existing variable in infolocs.

Usage

```
trajdyn(x, burst = attr(x[[1]], "burst"), na.rm = TRUE, hscale = 1,
  vscale = 1, addvec = 1, by = 1, only = Inf, recycle = TRUE,
  ppar = list(pch = 16), lpar = list(lwd = 2), nvar = NULL,
  display = c("guess", "windows", "tk"), ...)
```

Arguments

na.rm	Logical, whether to remove missing locations.
addvec	Numeric, whether to hihglight the current location (1, default), the current step (2) or nothing (0).
by	The number of previous points/steps to increment at each step. Default is an increment of 1 point/step.
only	The number of previous points/steps to display. Default is Inf, i.e. all points/steps.
ppar	A list of arguments that allows the user to modify point display, using any argument available to points. Default is list(pch = 16). See Details.

lpar	A list of arguments that allows the user to modify line display, using any argument available to lines. Default is list(lwd = 2). See Details.
nvar	A character string giving the name of a variable.

Details

y selects the number of previous points/steps to increment at each step. It defaults to 1, i.e. an increment of 1 point/step. Choosing anything different than a positive number sets it back to 1.

k selects the number of previous points/steps to display. It defaults to Inf, i.e. all points/steps. Choosing anything different than a positive number sets it back to Inf.

v shows (or removes) the current step as a vector. Note that the vector connects the current location to the next available location (even if there are NAs in the data set).

s shows the current buffer and localisation numbers, together with the associated infolocs (if it exists). If a nvar is requested, only this variable is shown.

The argument nvar allows to work on a given variable: if a variable of that name already exists in infolocs(x), the values of the variable are retrieved from there; otherwise, a variable filled with NAs is used. If a nvar is requested, d "deletes" the value and resets it to NA; every other letter not in use in any option is saved in nvar. The letters available are: "c", "e", "f", "h", "j", "m", "t", "u", "w", "x".

On a QWERTY keyboard:

we t u f hj xcm

On a AZERTY keyboard:

e t u f hj m wxc

It is possible to use point and line parameters globally for every trajectory displayed. In this case, ppar and lpar need just be a list of graphical parameters, such as list(pch = 21,col = "black", bg = "white"). It is also possible to use parameters for single steps, using as graphical parameter a list of vectors of length equal to each trajectory. Such information can be based on infolocs, see Example.

Value

If a nvar is provided, return the original ltraj with updated values in infolocs(nvar).

Author(s)

Modified by Mathieu Basille <basille@ase-research.org>

Examples

```
## Not run:
data(puechcirc)
##'
## Use of `by` and `only` to select the previous k points/steps:
trajdyn(puechcirc, by = 10, only = 20)
##'
## Use of `ppar` and `lpar` globally:
trajdyn(puechcirc, ppar = list(col = "red"), lpar = list(col = "blue"))
##'
```

```
## Create some random `infolocs`:
info <- list(data.frame(col = sample(c("red", "grey"),
         80, rep = TRUE), stringsAsFactors = FALSE),
     data.frame(col = sample(c("blue", "darkred"),
         69, rep = TRUE), stringsAsFactors = FALSE),
     data.frame(col = sample(c("darkgreen", "purple"),
         66, rep = TRUE), stringsAsFactors = FALSE))
## Watch the row names:
info <- mapply(function(x, y) {
    row.names(x) <- row.names(y)
    return(x)
}, info, puechcirc, SIMPLIFY = FALSE)
infolocs(puechcirc) <- info
##'
## Use the infolocs to color points and steps:
trajdyn(puechcirc, by = 1, only = 20, ppar = list(pch = 19,
    col = infolocs(puechcirc, "col", simplify = TRUE)),
    lpar = list(col = infolocs(puechcirc, "col", simplify = TRUE)))
##'
## The same without removing the missing locations:
trajdyn(puechcirc, by = 1, only = 20, ppar = list(pch = 19,
    col = infolocs(puechcirc, "col", simplify = TRUE)),
    lpar = list(col = infolocs(puechcirc, "col", simplify = TRUE)),
    na.rm = FALSE)
##'
## Use of `nvar` to dynamically fill in new data:
(newtraj <- trajdyn(puechcirc, nvar = "Var"))

## End(Not run)
```

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