

Package ‘hab’

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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 adehabitatLT,
adehabitatHR

Imports adehabitatMA

Suggests survival,
tkrplot

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

R topics documented:

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| | |
|----------|--|
| acf.test | <i>Test of autocorrelation in SSFs</i> |
|----------|--|

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

| | |
|----------------------|---|
| <code>from</code> | A <code>ltraj</code> object. |
| <code>to</code> | A <code>ltraj</code> object, supposed to be different from <code>from</code> . |
| <code>dt</code> | A numeric of length 2, giving the boundaries of the temporal window. See Details. |
| <code>units</code> | A character string indicating the time units for <code>dt</code> . |
| <code>ref</code> | A character string indicating whether the distance should be computed from the start (<code>ref = start</code>), or the end (<code>ref = "end"</code>) of the step. |
| <code>prefix</code> | A character string attached to the names of the variables returned. |
| <code>by</code> | Character. Only if <code>to == NULL</code> , either <code>"id"</code> to exclude the relocations from the same individual in the computation of distances, or <code>"burst"</code> to exclude relocations from the same burst. |
| <code>range</code> | 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, <code>"["</code> includes the beginning, but not the end of the interval. |
| <code>protect</code> | A character string indicating other variables to keep from <code>to</code> in <code>infolocs</code> . |

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 lttraj 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)
```

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>

infolocs

Infolocs of an Object of Class ltraj

Description

Modified version of `infolocs` that returns NULL if `infolocs` exists, but which is not a column 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")
```

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

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

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

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)
```

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 ordered 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' directly
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 successive 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 | <i>Handle Missing Values in Objects of Class 'ltraj'</i> |
|---------------|--|

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) otherwise). |
| 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 <- adehabitatMA::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) otherwise). |

| | |
|-------------------|---|
| <code>ppar</code> | A list of arguments that allows the user to modify point display, using any argument available to <code>points</code> . Default is <code>list(pch = 21, col = "black", bg = "white")</code> . |
| <code>lpar</code> | A list of arguments that allows the user to modify line display, using any argument available to <code>lines</code> . Default is <code>list()</code> , 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)
```

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

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

| | |
|----------------------|---|
| <code>mod</code> | A coxph or clogit model. |
| <code>...</code> | Optionally more fitted model objects. |
| <code>details</code> | 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 parameters 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

| | |
|----------------------|--------------------------|
| <code>rdSteps</code> | <i>Draw random steps</i> |
|----------------------|--------------------------|

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

| | |
|--------------------------|--|
| <code>x</code> | A <code>ltraj</code> object. |
| <code>nrs</code> | The number of random steps to draw for each observed step (default = 10). |
| <code>rand.dis</code> | The random distributions for step lengths and turning angles to use. If <code>NULL</code> (default), it uses <code>x</code> as a basis; otherwise, another <code>ltraj</code> object must be provided, or a <code>data.frame</code> with columns "dist", "rel.angle" and "id". |
| <code>only.others</code> | Logical, draws step lengths and turning angles from all other individuals, excluding the current one. |
| <code>simult</code> | 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. |
| <code>distMax</code> | Only draw step lengths and turning angles using steps shorter than this threshold. Default is <code>Inf</code> , 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 transferred 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(puehcirc)
##'
## Simple example to check the distributions of step lengths and turning
## angles
bla <- rdSteps(puehcirc)
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(puehcirc, reproducible = TRUE)

## 2) Explicitly use the same ltraj for the random distributions:
bli <- rdSteps(puehcirc, rand.dis = puehcirc, 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 | <i>Recalculates the descriptive parameters of a lttraj</i> |
|-----|--|

Description

Modified version of [rec](#) that keeps the original row.names. Also throws an error if the row.names are different between the lttraj 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 | <i>Place Missing Values in Objects of Class lttraj</i> |
|-------|--|

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 lttraj object. See [setNA](#) for further details on the function and all available arguments.

Usage

```
setNA(lttraj, 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 highlight 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 <code>list(pch = 16)</code> . See Details. |

| | |
|-------------------|--|
| <code>lpar</code> | A list of arguments that allows the user to modify line display, using any argument available to <code>lines</code> . Default is <code>list(lwd = 2)</code> . See Details. |
| <code>nvar</code> | 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:

`w e t u f h j x c m`

On a AZERTY keyboard:

`e t u f h j m w x c`

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(puehcirc)
##'
## Use of `by` and `only` to select the previous k points/steps:
trajdyn(puehcirc, by = 10, only = 20)
##'
## Use of `ppar` and `lpar` globally:
trajdyn(puehcirc, 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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