

Package ‘secrfunc’

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Type Package

Title Helper Functions for Package 'secr'

Version 1.1.4

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Description Functions are provided for internal use by the spatial capture-recapture package 'secr' (from version 5.4.0). The idea is to speed up the installation of 'secr', and possibly reduce its size. Initially the functions are those for area and transect search that use numerical integration code from 'RcppNumerical' and 'RcppEigen'. The functions are not intended to be user-friendly and require considerable preprocessing of data.

Depends R (>= 3.5.0)

Imports Rcpp (>= 0.12.14), RcppNumerical, RcppParallel (>= 5.1.1)

Suggests knitr, rmarkdown, testthat

LinkingTo BH, Rcpp, RcppEigen, RcppNumerical, RcppParallel

License GPL (>= 2)

SystemRequirements GNU make

URL <https://www.otago.ac.nz/density/>

Encoding UTF-8

NeedsCompilation yes

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Description

This package provides some functions used internally by the spatial capture-recapture package **secr** (from version 5.4.0). The idea is to speed up the installation of **secr**, and possibly reduce its size. Initially the functions are those for area and transect search that use numerical integration code from RcppNumerical (Qiu et al. 2026) and RcppEigen.

The functions are not intended to be user-friendly and require considerable pre-processing of data. Examples and tests use data pre-formatted and saved in the 'extdata' folder.

Details

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License: GNU General Public License Version 2 or later

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References

- Borchers, D. L. and Efford, M. G. (2008) Spatially explicit maximum likelihood methods for capture–recapture studies. *Biometrics* **64**, 377–385.
- Efford, M. G. (2011) Estimation of population density by spatially explicit capture–recapture with area searches. *Ecology* **92**, 2202–2207.
- Efford, M. G. (2025) The SECR book. A handbook of spatially explicit capture–recapture methods. Version 1.0.1. Zenodo [doi:10.5281/zenodo.15109938](https://doi.org/10.5281/zenodo.15109938). Online at <https://murrayefford.github.io/SECRbook/>.
- Qiu, Y., Balan, S., Beall, M., Sauder, M., Okazaki, N., and Hahn, T. (2026). RcppNumerical: 'Rcpp' Integration for Numerical Computing Libraries. R package version 0.7-0. <https://CRAN.R-project.org/package=RcppNumerical>

See Also

[hdotpolycpp](#)
[makegkPolygoncpp](#)
[polygonhistoriescpp](#)
[polygonhistories2cpp](#)
[polygonfxicpp](#)

hdotpolycpp

*Net Detection Hazard for Polygon and Transect Detectors***Description**

Compute spatially explicit net probability of detection for individual(s) at given coordinates. Used by `secr::pdot()`.

Usage

```
hdotpolycpp(xy, traps, Tsk, markocc, cumk, detectfn, gsb, convex, dim, grain, ncores)
```

Arguments

<code>xy</code>	2-column matrix of coordinates
<code>traps</code>	2-column matrix; coordinates of detector polygon vertices
<code>Tsk</code>	detector usage (numeric matrix detectors x occasions)
<code>markocc</code>	integer vector of marking occasion codes (1 = marking)
<code>cumk</code>	integer vector of start indices of vertices for each detector
<code>detectfn</code>	integer detector code (see secr)
<code>gsb</code>	numeric vector of real parameter values (lambda0, sigma)
<code>convex</code>	logical; if TRUE all detector polygons are convex (non-convex untested)
<code>dim</code>	integer; 1 = transect, 2 = polygon
<code>grain</code>	integer grain argument of <code>RcppParallel::parallelFor</code>
<code>ncores</code>	integer number of threads

Details

Uses 'integrate' function from `RcppNumerical`. Sighting occasions are ignored.

Value

`Rcpp NumericVector` with one hazard for each row in `'xy'`.

Examples

```
set.seed(123)

# 50 random points
xy <- matrix(runif(100), ncol = 2) * 2 - 1

# centred unit polygon
traps <- matrix(c(0,0,1,1,0,0,1,1,0,0), ncol = 2) - 0.5

Tsk <- matrix(1, nrow = 1, ncol = 5)
markocc <- rep(1,5)
cumk <- c(0,5)
detectfn <- 14 # hazard half-normal
gsb <- c(lambda0 = 0.2, sigma = 0.5)

h <- hdotpolycpp(xy, traps, Tsk, markocc, cumk, detectfn, gsb,
  convex = TRUE, dim = 2, grain = 1, ncores = 2)
```

makegkPolygoncpp

Pre-compute Detection Hazard

Description

Hazards and probabilities are computed for each parameter combination, detector and mask point. Used by **secr** internal functions `generalsecrloglik()` and `secr_makegk()`.

Usage

```
makegkPolygoncpp(detectfn, dim, convex, grain, ncores, gsbval, cumk, traps, mask)
```

Arguments

<code>detectfn</code>	integer detector code (see secr)
<code>dim</code>	integer; 1 = transect, 2 = polygon
<code>convex</code>	logical; if TRUE all detector polygons are convex
<code>grain</code>	integer grain argument of <code>RcppParallel::parallelFor</code>
<code>ncores</code>	integer number of threads
<code>gsbval</code>	matrix of real parameter values, one row per combination
<code>cumk</code>	integer vector of start indices of vertices for each detector
<code>traps</code>	2-column matrix; coordinates of detector polygon vertices
<code>mask</code>	2-column matrix; coordinates of mask points

Value

List with components

H	unbounded integrated hazard from radial function
gk	probability vector for elements of cc x detector x mask array
hk	hazard vector for elements of cc x detector x mask array

Examples

```

detectfn <- 14 # hazard half-normal
dim <- 2
convex <- TRUE
grain <- 1
ncores <- 2
# for a single parameter combination
gsbval <- matrix(c(0.2,1), nrow = 1)
cumk <- c(0,5)
# centred unit polygon
traps <- matrix(c(0,0,1,1,0,0,1,1,0,0), ncol = 2) - 0.5
mask <- as.matrix(expand.grid(x=-2:2, y=-2:2))

makegkPolygoncpp(detectfn, dim, convex, grain, ncores, gsbval, cumk, traps, mask)

```

`polygonhistoriescpp` *Probability of Polygon Capture Histories*

Description

`polygonhistoriescpp` is the core function for the contribution of individual histories to likelihood. It is called by internal **secr** function `generalsecrloglik()`.

`polygonhistories2cpp` is an updated version that returns logarithms for consistency with `secr 5.5`.

`polygonfxicpp` is the core code for 'fxi' calculations in **secr** when the detector type is polygon or transect based. It is called by the internal **secr** function `allhistpolygonfxi`.

Usage

```

polygonhistoriescpp(nc, detectfn, grain, ncores, minp, binomN, w, xy, start,
  group, hk, H, gsbval, pID, mask, density, PIA, Tsk, h, hindex, debug)

```

```

polygonhistories2cpp(nc, detectfn, grain, ncores, safeLL, uselog, minp, binomN,
  w, xy, start, group, hk, H, gsbval, pID, mask, density, PIA, Tsk, h, hindex,
  mask_indices, mask_offsets, mask_id, debug)

```

```

polygonfxicpp(nc, detectfn, grain, ncores, minp, binomN, w, xy, start,
  group, hk, H, gsbval, pID, mask, density, PIA, Tsk, h, hindex)

```

Arguments

nc	integer number of individuals
detectfn	integer detector code (see secr)
grain	integer grain argument of RcppParallel::parallelFor
ncores	integer number of threads
safeLL	logical; if TRUE the LSE trick is used to improve robustness
uselog	logical; if TRUE then logs are used for greater robustness
minp	double minimum probability
binomN	integer vector binomial code
w	3-D integer array of capture histories (individual x occasion x detector)
xy	2-column matrix of detection location coordinates
start	integer vector of index of row in xy for each first detection
group	integer vector; code for group of each individual (zero-based)
hk	numeric array of detection hazards from makegkPolygoncpp
H	numeric unbounded integrated hazard from radial function from makegkPolygoncpp
gsbval	matrix of real parameter values, one row per combination
pID	numeric matrix occasions x nmix. NOT USED?
mask	2-column matrix of mask coordinates
density	matrix relative density at each mask point (row) for each group? (column)
PIA	integer vector for the slice of the parameter index array for a given mixture component and session
Tsk	detector usage (numeric matrix detectors x occasions)
h	for exclusive detectors, pre-computed hazard; otherwise -1
hindex	for exclusive detectors, index to precomputed hazard; otherwise -1
mask_indices	integer vector
mask_offsets	integer vector
mask_id	integer vector
debug	logical; if TRUE...

Details

The capture history 'w' merely records detection/nondetection on a particular occasion. 'xy' records the location of each positive detection.

Value

For polygonhistoriescpp – Numeric vector of probabilities, one per individual.

For polygonhistories2cpp – Numeric vector of log probabilities, one per individual.

For polygonfxicpp – Numeric matrix with probability density for each individual (rows) at each mask point (columns).

See Also[makegkPolygoncpp](#)**Examples**

```
datafilename <- system.file("extdata/testdata.RData", package = "secrefunc")
load(datafilename) # loads w, dimw, xy, start, traps, mask, gsbval, cumk, binomN

detectfn <- 14 # hazard half-normal
dim <- 2
convex <- TRUE
grain <- 1
ncores <- 2

gkhk <- makegkPolygoncpp(detectfn, dim, convex, grain, ncores, gsbval, cumk, traps, mask)
# see tests for expected result

nc <- dimw[1] # individuals
S <- dimw[2] # occasions
K <- dimw[3] # single polygon
minp <- 1e-200
group <- rep(0,nc)
pID <- matrix(1, nrow = S, ncol = 1)
density <- matrix(1/nrow(mask), nrow(mask), 1)
PIA <- as.integer(array (1, dim = c(nc, S, K)))
Tsk <- matrix(1, nrow = K, ncol = S)
h <- matrix(-1)
hindex <- matrix(-1)
debug <- FALSE

prw <- polygonhistoriescpp(nc, detectfn, grain, ncores, minp, binomN, w, xy, start,
  group, gkhk$hk, gkhk$H, gsbval, pID, mask, density, PIA, Tsk, h, hindex, debug)
# see tests for expected result

fxi <- polygonfxicpp(nc, detectfn, grain, ncores, minp, binomN, w, xy, start,
  group, gkhk$hk, gkhk$H, gsbval, pID, mask, density, PIA, Tsk, h, hindex)
# see tests for expected result
```

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