Package ‘pom’

February 20, 2015

Type Package
Title POM - Patch Occupancy Models
Version 1.1
Date 2012-05-19
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Depends matrixcalc
Description This package fits a patch occupancy model
License GNU General Public License
NeedsCompilation no
Repository CRAN
Date/Publication 2013-05-20 00:33:39

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Description

The package implements models to analyze site occupancy data with detection error.

Details
Package: pom
Type: Package
Version: 1.0
Date: 2012-11-17
License: GNU General Public License
LazyData: yes

List of routines:

- **siteocc**: Routine for Estimating the Patch Occupancy Model.
- **print**: Printing Patch Occupancy Model Fits.
- **F.2nd.deriv**: Generic Routine for calculating the hessian matrix of a function.

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**References**


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**F.2nd.deriv**

*Calculate the Hessian Matrix*

**Description**

Compute numeric 2nd derivative (Hessian) of the function FUN().

**Usage**

`F.2nd.deriv(pt, FUN, ...)`
Arguments

pt Vector input to FUN.
FUN Name of a function to evaluate. Must return a scalar when FUN(pt) is called.
... Optional Items to FUN()

Details

This function is sourced by the siteocc function.

Value

Returns the Hessian Matrix of the input function.

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References


See Also

weta.data
siteocc

Examples

F.test <- function(x){
}
F.2nd.deriv( c(2,3,4), F.test )

# Another Example using siteocc function to get standard errors.
data(weta.data)

fit1 <- siteocc(~1, ~1, histories=weta.data$detection.histories)
print(fit1)
Printing Patch Occupancy Model Fits For a Beta-binomial Mixture

Description

This function summarizes the results from class `mixed.pom`. This function is called when a "~Beta.mixture" is specified as the model for p (probability of detection).

Usage

```r
## S3 method for class 'mixed.pom'
print(x, digits = max(3, getOption("digits") - 3), ...)
```

Arguments

- `x`: an object of class `mixed.pom`; usually, a result of a call to `siteocc`.
- `digits`: the number of significant digits to use when printing.
- `...`: further arguments passed to or from other methods. They are ignored in this function.

Value

The output includes the matched call, the convergence code, PSI Coefficients with Estimates, Standard Errors, Z-values, and 2-sided p-values, Beta mixture parameters for P, AIC, BIC, the average estimated Probability of Occupancy (PSI).

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See Also

- `weta.data`
- `siteocc`

Examples

```r
data(weta.data)
fit1 <- siteocc(~1, ~1, histories=weta.data$detection.histories)
print(fit1)
```
Description

This function summarizes the results from class `pom`. This function is called when covariate(s) or
the intercept only model is specified as the model for p (probability of detection).

Usage

```r
## S3 method for class 'pom'
print(x, digits = max(3, getOption("digits") - 3), ...)
```

Arguments

- `x` an object of class `pom`; usually, a result of a call to `siteocc`.
- `digits` the number of significant digits to use when printing.
- `...` further arguments passed to or from other methods. They are ignored in this function.

Value

The output includes the matched call, the convergence code, PSI Coefficients with Estimates, Stan-
dard Errors, Z-values, and 2-sided p-values, P Coefficients also with Estimates, Standard Errors,
and t-values, AIC, BIC, the average estimated Probability of Occupancy (PSI) and the average
estimated Probability of Detection (P).

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See Also

- `weta.data`
- `siteocc`

Examples

```r
data(weta.data)
fit1 <- siteocc(~1, ~1, histories=weta.data$detection.histories)
print(fit1)
```
siteocc will fit a patch occupancy model to histories of observations and can account for an imperfect probability of detection.

Usage

```
siteocc(psi, p, histories, start=NULL, lower=NULL, ...)  
```

Arguments

- `psi`: an object of class `formula` (or one that can be coerced to that class): model formula for the site occupancy parameters. Each covariate called should be a vector of size nsites x 1.
- `p`: an object of class `formula` (or one that can be coerced to that class): model formula for probability of detection given presence parameters. Each covariate called should be a matrix of size nsites x nvisits. To fit a beta-binomial mixture to probability of detection, specify "~ Beta.mixture" (case-sensitive) as the model for p. This argument specification assumes p's come from a beta-binomial mixture.
- `histories`: matrix of encounter histories. One row per site, one column per visit. This argument should be of size nsites x nvisits. A NA may be used in the `histories` dataframe to represent instances when a survey could not be completed at a particular site for a particular visit.
- `start`: vector of starting values passed to the `nlminb` function. If `start=NULL`, then the default starting values will be used. See details.
- `lower`: vector of lower bounds passed to the `nlminb` function. If `lower=NULL`, then the default lower bounds will be used. See details.
- ... other arguments passed to the `nlminb` function. See `?nlminb`.

Details

The log-likelihood is maximized using the `nlminb` function. If the user decides to provide starting values, then they will need to specify values for each PSI covariate as well as each P covariate, including intercepts. The starting values should be listed in the order of the specified covariates (i.e., the PSI intercept starting value first, the PSI coefficient(s) starting value(s) next, then the P intercept starting value, and finally the P Coefficient(s) starting value(s)). See below for an example of format. If specifying a Beta-mixture model, then the starting values are 0.5 for all of the covariates including the intercept. Otherwise, 0 is used for the starting value of each covariate.

The same format used to specify starting values should also be used to specify the lower bounds for the `lower` argument. The default lower bounds for a Beta-mixture are -Inf for all PSI covariates and 0 for both of the beta-binomial parameters. If you specify a lower bound of less than 0 for the beta-binomial parameters, your model will most likely not converge. This is because both parameters
must be strictly greater than 0. If a Beta-mixture is not specified, then -Inf will be the lower bound for all covariates.

Unless otherwise specified, the default values of the nlminb function are used.

The example datasets are detailed in pages 116-122 of MacKenzie et al. (2006) and also included with the program PRESENCE.

Value

loglik Optimized log-likelihood.

convergence An integer code. 0 indicates successful convergence. See the Value section of ?nlminb.

convergence.message A character string giving any additional information returned by the optimizer, or NULL. See the Value section of ?nlminb.

call The matched call.

naive.psi.est Naive Estimate of Occupancy.

nsites Number of Sites.

nvisits Number of Visits.

psi.coefs Estimate(s) of psi coefficient(s).

p.coefs Estimate(s) of p coefficient(s) or the shape parameters if a Beta-Binomial mixture model was specified.

se.psi.coefs Standard Error of the psi coefficient(s).

se.p.coefs Standard Error of the p coefficient(s).

hessian Hessian matrix used to compute the standard error of the psi and p coefficient(s).

psi.est Matrix of Psi Estimates corresponding to each site.

p.est Matrix of P Estimates corresponding to each site and visit.

aic Akaike’s information criterion.

bic Bayesian information criterion.

Warning

Be sure to check for convergence. Some tips if you are having trouble getting your models to converge:
1. Choose different starting values.
2. Make sure your covariates are on similar scales.
3. Check for high correlations among covariates.

Note

Currently, this function does not fit visit-specific P-covariates.

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References


See Also

weta.data
print.pom
print.mixed.pom
F.2nd.deriv

Examples

data(weta.data)

# INTERCEPT-ONLY MODEL
fit1 <- siteocc(~1, -1, histories=weta.data$detection.histories, start=c(1,1))

# BETA-BINOMIAL MIXTURE MODEL
fit2 <- siteocc(~1, -Beta.mixture, histories=weta.data$detection.histories, lower=log(c(0.01,0.0001,0.0001)))

# MODEL TESTING BROWSED AND OBSERVER EFFECTS
fit3 <- siteocc(~weta.data$siteCovar$Browsed, ~weta.data$Obs1 + weta.data$Obs2, histories=weta.data$detection.histories, start=c(0,2,0,-1,0), control=list(iter.max=50))

# MODEL WHICH ALSO FITS A SITE COVARIATE TO THE PROBABILITY OF DETECTION
numvisits=5
p.Browse <- matrix(rep(weta.data$siteCovar$Browsed, numvisits), ncol=numvisits)
fit4 <- siteocc(~1, ~p.Browse + weta.data$Obs1 + weta.data$Obs2, histories=weta.data$detection.histories)

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weta.data

Occupancy data for the New Zealand Mahoenui Giant Weta

Description

A list of datasets used in modeling the Mahoenui Giant Weta probability of occupancy. 72 sites were surveyed with up to 5 visits completed for each site. This list also includes covariates to model an observer effect for three observers and whether a site was browsed.
Usage

```r
data(weta.data)
```

Format

A list containing 5 datasets:

- `$ detection.histories`: A data frame with 72 observations (one row for each site) on the following 5 variables (one column for each visit to a particular site). A 1 indicates that at least one weta was observed and 0 indicates that no weta were observed on a particular visit. A NA indicates the site was not surveyed for that particular visit.

- `$ siteCovar` : A data frame used to define the effect of browsing.
  - `$ Browsed` : a vector of 1's and 0's, with 1 indicating that a site was browsed and 0 indicating the site was unbrowsed.
  - `$ Unbrowsed`: a vector of 1’s and 0’s, with 1 indicating that a site was unbrowsed and 0 indicating the site was browsed.

- `$ Obs1`: Observer 1 Covariate matrix. Each row refers to a specific site and each column refers to one of five total visits. Thus, this matrix is of size 72x5. A 1 indicates that Observer 1 conducted the survey for a particular visit, while a 0 indicates that Observer 1 did not conduct the survey for a particular visit. A NA indicates the site was not surveyed by any observer for that particular visit.

- `$ Obs2`: Observer 2 Covariate matrix. Each row refers to a specific site and each column refers to one of five total visits. Thus, this matrix is of size 72x5. A 1 indicates that Observer 2 conducted the survey for a particular visit, while a 0 indicates that Observer 2 did not conduct the survey for a particular visit. A NA indicates the site was not surveyed by any observer for that particular visit.

- `$ Obs3`: Observer 3 Covariate matrix. Each row refers to a specific site and each column refers to one of five total visits. Thus, this matrix is of size 72x5. A 1 indicates that Observer 3 conducted the survey for a particular visit, while a 0 indicates that Observer 3 did not conduct the survey for a particular visit. A NA indicates the site was not surveyed by any observer for that particular visit.

Details

The example datasets are detailed in pages 116-122 of MacKenzie et al. (2006) and also included with the program PRESENCE.

Coding was used to define an observer effect using Obs1 and Obs2 as factor covariates (see table 4.6 on page 118 of MacKenzie et al., 2006). obs3 has been included in this package for completeness.

Source


See Also

`sitocc`
Examples

data(weta.data)

fit1 <- siteocc(~weta.data$siteCovar$Browsed, ~weta.data$Obs1 + weta.data$Obs2,
               histories=weta.data$detection.histories)
print(fit1)
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