Package: multAbund (via r-universe)

September 3, 2024

Type Package

Title Model Multivariate Abundance and Occurence Using the Dirichlet
Process Prior

Version 0.03.9002

Date 2018-3-28

Author Devin S. Johnson

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Description This package provides RJMCMC samplers to make Bayesian
inference for Joint Species Distribution models (JSDM) using a
Dirichlet Process clustering method. The DP clustering method
allows species to be grouped into functional guilds for
modeling between species associations in abundance or occurence
values at surveyed sites.

License CC0

Imports Rcpp, copula

Suggests ggplot2, cowplot, magrittr, reshape2, knitr, rmarkdown,
ggdendro

LinkingTo Rcpp, RcppArmadillo, RcppProgress

ByteCompile TRUE

NeedsCompilation yes

RoxygenNote 7.1.2

Repository https://dsjohnson.r-universe.dev

RemoteUrl https://github.com/dsjohnson/multAbund

RemoteRef HEAD

RemoteSha 91880bfd4473139054b623dd42444b91f01c472f

Contents

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multAbund-package   *Use Dirichlet Process Prior to Model Multivariate Animal Abundance and Occurance*

Description

Functions for implementing the RJMCMC estimation of multivariate abundence and occurence. These functions model multivariate abundence with latent group designations for each species. The associations between species are functions of common group membership.

Package:	multAbund
Type:	Package
Version:	0.03.9001
Date:	March 28, 2018
License:	CC0
LazyLoad:	yes

Author(s)

Devin S. Johnson

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get_opt_alpha_prior   *Obtain parameters for gamma prior such that the distribution of the number of groups is equal to the* target *argument*

Description

This function uses the method of Dorazio (2009) to calculate the parameters of a gamma prior on the Dirichlet process such that the induced distribution function of the number of clusters is equal to 1/k.

Usage

```
get_opt_alpha_prior(n, target = NULL)
```

Arguments

n	An integer representing the maximum number of groups. Typically this is the number of individuals.
target	The desired prior probability mass function for the number of groups. This function must return a vector of length n which contains the prior probabilities for each group size.

Author(s)

Devin S. Johnson

References

Dorazio, R. M. (2009) On selecting a prior for the precision parameter of Dirichlet process mixture models. Journal of Statistical Planning and Inference 139:3384-3390.

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make_data_list	*Make necessary data matrices for multivariate abundance and oc-curence RJMCMC functions*

Description

Makes the necessary lists for imput into the RJMCMC fitting functions

Usage

```
make_data_list(
  counts = NULL,
  occur = NULL,
  z_col = NULL,
  delta_model,
  X_model,
  sigma_model = ~1,
  gamma_model = ~1,
  data
)
```

Arguments

counts	A character string providing the name of the column in data that contains the counts
occur	A character string providing the name of the column in data that contains the binary occurence data
z_col	A character string providing the name of the column in data that contains the continuous abundance data
delta_model	A formula decribing the variables for which delta will be the coefficients.

X_model	A formula giveng additional variables to be used for all groups.
sigma_model	A formula describing the sigma vector. Must be of the form `~factorVariable-1`.
gamma_model	A formula describing the gamma vector for ZIP models
data	Data.frame containing counts and environmental variables

Value

A list containing the following elements:

counts	The column containing count data
occur	The column containing occurence data
z_col	The column containing Gaussian response data
H	The environmental variables from which the clustering is based
X	The design matrix for the global covariates
D	Design matrix defining sigma_ij
M	Design matrix defining the gamma_ij
data	Data frame containing the original data

Author(s)

Devin S. Johnson

| mult_abund_norm | *Perform RJMCMC for posterior sampling of multivariate cluster abundance model with Gaussian observations* |

Description

Fit a Dirichlet Process random effect model for joint species distribution inference of Gaussian abundance (typically resulting from a log transformation) data using a RJMCMC procedure. THIS IS CURRENTLY A TEST FUNCTION THAT IS NOT FULLY DEVELOPED YET! IT USES A DIFFERENT VARIANCE MODEL FOR DELTA PARAMETERS.

Usage

```
mult_abund_norm(
  data_list,
  initial_list,
  prior_list,
  block,
  begin_group_update,
  update_omega = T,
  burn,
  iter
)
```

Arguments

`data_list`	A named list created of data items created from user data with the function `multAbund::make_data_list`. This data will be used for model fitting.
`initial_list`	A named list of initial values for the parameters (see details). The functions `multAbund::sugs` or `multAbund::make_inits` can be used to create this list.
`prior_list`	A named list of prior distribution parameters. See details.
`block`	Number of iterations between Metropolis proposal adaptation.
`begin_group_update`	
	The iteration at with the group clusters begin updating. The RJMCMC often performs better when the chain is allowed to sample only the parameters before the groups begin updating.
`update_omega`	Logical. Should omega be updated or not?
`burn`	Number of burnin iterations that are discarded.
`iter`	Number of iterations retained for posterior inference.

Details

The `prior_list` argument needs to contain the following items:

- a_alpha numeric. shape parameter for gamma prior on alpha,
- b_alpha numeric. scale parameter for gamma prior on alpha,
- Sigma_beta_inv numeric matrix. precision matrix for global regression coefficients, beta
- mu_beta numeric vector. prior mean of beta parameters
- phi_omega numeric. scale for half t/normal prior on delta variance parameter (omega),
- df_omega numeric. degrees of freedom for half-t prior on omega (df_omega>=50 means a half-normal will be assumed)
- phi_sigma numeric. scale parameter for half-t/normal prior for sigma parameters
- df_sigma numeric. degrees of freedom for sigma prior (>=50 implies half-normal will be used)

Vignette

A demonstration using simulated data is available in vignette form and can be accessed by typing `vignette("simulation_demo", package="multAbund")`. The vignette demo uses a realistic number of iterations, so, if the user decides to run the associated R code it will take some time.

Author(s)

Devin S. Johnson

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mult_abund_pois	*Perform RJMCMC for posterior sampling of multivariate cluster abundance model with Poisson observations*

Description

Fit a Dirichlet Process random effect model for joint species distribution inference of Poisson count data using a RJMCMC procedure.

Usage

```
mult_abund_pois(
  data_list,
  initial_list,
  prior_list,
  block,
  begin_group_update,
  burn,
  iter
)
```

Arguments

data_list	A named list created of data items created from user data with the function `multAbund::make_data_list`. This data will be used for model fitting.
initial_list	A named list of initial values for the parameters (see details). The functions `multAbund::sugs` or `multAbund::make_inits` can be used to create this list.
prior_list	A named list of prior parameters. See details.
block	Number of iterations between Metropolis proposal adaptation.
begin_group_update	
	The iteration at with the group clusters begin updating. The RJMCMC often performs better when the chain is allowed to sample only the parameters before the groups begin updating.
burn	Number of burnin iterations that are discarded.
iter	Number of iterations retained for posterior inference.

Details

The `prior_list` argument needs to contain the following items:

- a_alpha numeric. shape parameter for gamma prior on alpha,
- b_alpha numeric. scale parameter for gamma prior on alpha,
- Sigma_beta_inv numeric matrix. precision matrix for global regression coefficients, beta
- mu_beta numeric vector. prior mean of beta parameters
- phi_omega numeric. scale for half t/normal prior on delta variance parameter (omega),

- df_omega numeric. degrees of freedom for half-t prior on omega (df_omega>=50 means a half-normal will be assumed)
- phi_sigma numeric. scale parameter for half-t/normal prior for sigma parameters
- df_sigma numeric. degrees of freedom for sigma prior (>=50 implies half-normal will be used)

Vignette

A demonstration using simulated data is available in vignette form and can be accessed by typing `vignette("simulation_demo", package="multAbund")`. The vignette demo uses a realistic number of iterations, so, if the user decides to run the associated R code it will take some time.

Author(s)

Devin S. Johnson

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mult_abund_probit	*Perform RJMCMC for posterior sampling of multivariate cluster oc-curence model with Bernoulli observations*

Description

Fit a Dirichlet Process random effect model for joint species distribution inference of binary oc-curence data using a RJMCMC procedure.

Usage

```
mult_abund_probit(
  data_list,
  prior_list,
  initial_list,
  block,
  begin_group_update,
  update_omega,
  burn,
  iter
)
```

Arguments

data_list	A named list created of data items created from user data with the function `multAbund::make_data_list`. This data will be used for model fitting.
prior_list	A named list of prior parameters. See details.
initial_list	A named list of initial values for the parameters (see details). The functions `multAbund::sugs` or `multAbund::make_inits` can be used to create this list.
block	Number of iterations between Metropolis proposal adaptation.

begin_group_update

                The iteration at with the group clusters begin updating. The RJMCMC often performs better when the chain is allowed to sample only the parameters before the groups begin updating.

update_omega   logical. Should omega be updated during the MCMC or remain fixed.

burn   Number of burnin iterations that are discarded.

iter   Number of iterations retained for posterior inference.

Details

The `prior_list` argument needs to contain the following items:

- a_alpha numeric. shape parameter for gamma prior on alpha,
- b_alpha numeric. scale parameter for gamma prior on alpha,
- Sigma_beta_inv numeric matrix. precision matrix for global regression coefficients, beta
- mu_beta numeric vector. prior mean of beta parameters
- phi_omega numeric. scale for half t/normal prior on delta variance parameter (omega),
- df_omega numeric. degrees of freedom for half-t prior on omega (df_omega>=50 means a half-normal will be assumed)
- phi_sigma numeric. scale parameter for half-t/normal prior for sigma parameters
- df_sigma numeric. degrees of freedom for sigma prior (>=50 implies half-normal will be used)

Author(s)

Devin S. Johnson

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mult_abund_zip   *Perform RJMCMC for posterior sampling of multivariate cluster abundance model with Zero-Inflated Poisson observations*

Description

Fit a Dirichlet Process random effect model for joint species distribution inference of Zero-Inflated Poisson count data using a RJMCMC procedure.

Usage

```
mult_abund_zip(
  data_list,
  initial_list,
  prior_list,
  block,
  begin_group_update,
  update_omega = T,
  burn,
  iter
)
```

Arguments

`data_list`	A named list created of data items created from user data with the function `multAbund::make_data_list`. This data will be used for model fitting.
`initial_list`	A named list of initial values for the parameters (see details). The functions `multAbund::sugs` or `multAbund::make_inits` can be used to create this list.
`prior_list`	A named list of prior distribution parameters. See details.
`block`	Number of iterations between Metropolis proposal adaptation.
`begin_group_update`	
	The iteration at with the group clusters begin updating. The RJMCMC often performs better when the chain is allowed to sample only the parameters before the groups begin updating.
`update_omega`	Logical. Should omega be updated or not?
`burn`	Number of burnin iterations that are discarded.
`iter`	Number of iterations retained for posterior inference.

Details

The `prior_list` argument needs to contain the following items:

- a_alpha numeric. shape parameter for gamma prior on alpha,

- b_alpha numeric. scale parameter for gamma prior on alpha,

- Sigma_beta_inv numeric matrix. precision matrix for global regression coefficients, beta

- mu_beta numeric vector. prior mean of beta parameters

- phi_omega numeric. scale for half t/normal prior on delta variance parameter (omega),

- df_omega numeric. degrees of freedom for half-t prior on omega (df_omega>=50 means a half-normal will be assumed)

- phi_sigma numeric. scale parameter for half-t/normal prior for sigma parameters

- df_sigma numeric. degrees of freedom for sigma prior (>=50 implies half-normal will be used)

Vignette

A demonstration using simulated data is available in vignette form and can be accessed by typing `vignette("simulation_demo", package="multAbund")`. The vignette demo uses a realistic number of iterations, so, if the user decides to run the associated R code it will take some time.

Author(s)

Devin S. Johnson

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view_example   *View simulation example*

Description

Users can view an .html file that contains an example with simulated abundance data. The demo is similar to a vigette but it takes much too long to build.

Usage

```
view_example()
```

Author(s)

Devin S. Johnson

Index