Package ‘bayesloglin’

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Title Bayesian Analysis of Contingency Table Data
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Description The function MC3() searches for log-linear models with the highest posterior probability. The function gibbsSampler() is a blocked Gibbs sampler for sampling from the posterior distribution of the log-linear parameters. The functions findPostMean() and findPostCov() compute the posterior mean and covariance matrix for decomposable models which, for these models, is available in closed form.

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Bayesian analysis of contingency table data

Description

Functions for Bayesian model selection and inference for log-linear models.

Details

Package:  bayesloglin  
Type:  Package  
Version:  1.0  
Date:  2016-12-23  
License:  GPL-2

The function MC3 searches for log-linear models with the highest posterior probability. The function gibbsSampler is a blocked Gibbs sampler for sampling from the posterior distribution of the log-linear parameters. The functions findPostMean and findPostCov compute the posterior mean and covariance matrix for decomposable models which, for these models, is available in closed form.

Author(s)

Author:  Matthew Friedlander  
Maintainer:  Matthew Friedlander <friedla@yorku.ca>

References

see vignette

Examples

data(czech)
s1 <- MC3 (init = NULL, alpha = 1, iterations = 5,  
replicates = 1, data = czech, mode = "Decomposable")
s2 <- MC3 (init = NULL, alpha = 1, iterations = 5,  
replicates = 1, data = czech, mode = "Graphical")
s3 <- MC3 (init = NULL, alpha = 1, iterations = 5,  
replicates = 1, data = czech, mode = "Hierarchical")

czech  
The Czech autoworkers data
findPostCov

Description
A 6 way contingency table representing the cross classification of 1841 men. All 6 classification criteria are binary. The variables are (a) smoking, (b) strenuous mental work, (c) strenuous physical work, (d) systolic blood pressure, (e) ratio of beta and alpha lipoproteins and (f) family anamnesis of coronary heart disease.

Usage
data(czech)

Source
Edwards and Havranek (1985)

References

findPostCov

Posterior covariance matrix for a decomposable model.

Description
Computes the posterior covariance matrix of the log-linear parameters, which for decomposable models, is known in closed form.

Usage
findPostCov(formula, alpha, data)

Arguments
formula A decomposable model formula.
alpha The value of the hyperparameter alpha.
data A data frame containing the contingency table. All cells must be included in data and the last column must be the cell counts. The number of variables in the contingency table must be at least 2.

Value
theta An array giving the posterior covariance matrix of the log-linear parameters.

Author(s)
Matthew Friedlander
findPostMean

Posterior covariance matrix for a decomposable model.

Description
Computes the posterior mean, which for decomposable models, is known in closed form.

Usage
findPostMean(formula, alpha, data)

Arguments
- formula: A decomposable model formula.
- alpha: The value of the hyperparameter alpha.
- data: A data frame containing the contingency table. All cells must be included in data and the last column must be the cell counts. The number of variables in the contingency table must be at least 2.

Value
theta: An array giving the posterior mean of the log-linear parameters.

Author(s)
Matthew Friedlander

References
see vignette

Examples
data(czech)
formula <- freq ~ b*c + a*c*e + d*e + f
s <- findPostCov(formula, alpha = 1, data = czech)
print(s)
gibbsSampler

A blocked Gibbs sampler.

Description
Generates samples from the posterior distribution of the log-linear parameters.

Usage
gibbsSampler (formula, alpha = 1, data, nSamples = 10000, verbose = T)

Arguments
- formula: A model formula.
- alpha: The value of the hyperparameter alpha.
- data: A data frame containing the contingency table. All cells must be included in data and the last column must be the cell counts. The number of variables in the contingency table must be at least 2.
- nSamples: Number of iterations of the Gibbs sampler.
- verbose: Displays current iteration number of the sampler.

Value
- theta: An array where each row represents a sample from the Posterior distribution of the log-linear parameters. The first 5000 or so samples should be discarded as a burn-in period.

Author(s)
Matthew Friedlander

References
see vignette

Examples
data(czech)
formula <- freq ~ a*c + b*c + a*d + a*e + c*e + d*e + f
# s <- gibbsSampler (formula, alpha = 1, data = czech,
#   nSamples = 15000, verbose = TRUE)
# postMean <- colSums(s[5000:15000,]) / 10000
# postCov <- cov(s[5000:15000,])
# postVar <- diag(postCov)
Implementation of the MC3 algorithm

Description

The MC3 algorithm is used to find the log-linear models with the highest posterior probability. The function is capable of searching the space of decomposable, graphical, and hierarchical models.

Usage

MC3 (init = NULL, alpha = 1, iterations = 5000, replicates = 1, data, mode = c("Hierarchical", "Graphical", "Decomposable"))

Arguments

- init: A starting list of models for the MOSS algorithm. If not NULL, this list should consist of R formulas.
- alpha: The value of the hyperparameter alpha.
- iterations: Number of iterations of the MC3 algorithm.
- replicates: The number of instances the MC3 algorithm will be run. The top models are culled from the results of all the replicates.
- data: A data frame containing the contingency table. All cells must be included in data and the last column must be the cell counts. The number of variables in the contingency table must be at least 3.
- mode: The scope of the loglinear model search. The search can be over the space of decomposable, graphical, or hierarchical models.

Value

A data frame with the top models found and their log posterior probability up to a constant.

Author(s)

Matthew Friedlander

References

see vignette

Examples

data(czech)
s1 <- MC3 (init = NULL, alpha = 1, iterations = 5,
replicates = 1, data = czech,
mode = "Decomposable")
s2 <- MC3 (init = NULL, alpha = 1, iterations = 5,
replicates = 1, data = czech,
mode = "Graphical")
s3 <- MC3 (init = NULL, alpha = 1, iterations = 5,
replicates = 1, data = czech,
mode = "Hierarchical")
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