Package ‘Bmix’

February 7, 2016

Type Package
Title Bayesian Sampling for Stick-Breaking Mixtures
Version 0.6
Author Matt Taddy <taddy@chicagobooth.edu>
Maintainer Matt Taddy <taddy@chicagobooth.edu>
Description This is a bare-bones implementation of sampling algorithms for a variety of Bayesian stick-breaking (marginally DP) mixture models, including particle learning and Gibbs sampling for static DP mixtures, particle learning for dynamic BAR stick-breaking, and DP mixture regression. The software is designed to be easy to customize to suit different situations and for experimentation with stick-breaking models. Since particles are repeatedly copied, it is not an especially efficient implementation.
License GPL (>= 2)
Depends mvtnorm
URL http://faculty.chicagobooth.edu/matt.taddy
NeedsCompilation yes
Repository CRAN
Date/Publication 2016-02-07 09:18:19

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Bayesian inference for (dynamic) stick-breaking mixtures

Description

Basic implementation for a variety of stick-breaking mixture models, including particle learning and Gibbs sampling for static DP mixtures, particle learning for dynamic BAR stick-breaking, and DP mixture regression.

Usage

mix(Z, alpha, g0params, times=NULL, rho=NULL, cat=0, state=NULL, read=FALSE, print=FALSE, N=100, niter=0)

Arguments

- Z: data.frame of observations, with the last cat columns categorical variables.
- alpha: Stick-breaking precision parameter.
- g0params: A vector of the base measure parameters: \([\gamma, \kappa, \nu, \gamma_\Omega, \Psi_\Omega]\), as in Taddy (2009), followed by a list of Dirichlet parameters for each categorical variable.
- times: Discrete time period for each data row; must be an increasing list of integers starting at 0.
- rho: Stick-breaking correlation parameter (between 0 and 1).
- cat: Number of categorical variables.
- state: Random number generator seed.
- read: Read in existing particle info?
- print: Print out particles for each new time? WARNING: This will litter your working directory with .particle* files!
- N: Number of particles.
- niter: Number of Gibbs sampling iterations after filtering (only for times = NULL).

Details

This is a bare-bones implementation of sampling algorithms for Bayesian stick-breaking mixture models. The software is designed to be easy to customize to suit different situations and for experimentation with stick-breaking models. Since particles are repeatedly copied, it is not especially efficient.

The package implements particle learning (Carvalho et al, 2009) for both dynamic and constant stick-breaking mixture models, and collapsed Gibbs sampling for DP mixtures. Conditional sufficient statistics for each mixture component are output as 'particle' files.

Mixture kernels are the product of independent multinomial densities for each categorical variable, and a multivariate normal density for continuous covariates. The base measure is conditionally conjugate normal-Wishart-Dirichlet product, with Wishart hyperprior for inverse base covariance. Beta-autoregressive stick-breaking is used to model correlated densities.
Refer to Taddy (2009) for all specification details.

See DPreg demo for regression with categorical and continuous covariates, with additional Gibbs sampling for filtered particles.

See bar1D and bar2D demos for dynamic stick-breaking mixture density estimation, Bayes factor calculations, and comparison between correlated and independent model fit.

Value

If print=TRUE particle representations for each time point are printed to files .particle[i][t][rho].txt, where ‘i’ is the particle id, ‘t’ is the time, and ‘rho’ is the stick-breaking correlation parameter. These files are read into R via the particle() function.

Output to R is minimal. The object returned by function mix() is mostly just a list of input variables, except for

`logprob` Filtered marginal log-likelihood

`m` Filtered mean number of mixture components

`k` If kout, this is the list of filtered allocations

Author(s)

Matt Taddy: <matt.taddy@chicagobooth.edu>

References

*An auto-regressive mixture model for dynamic spatial Poisson processes: Application to tracking the intensity of violent crime* (Taddy 2009),

*Particle learning for general mixtures* (Carvalho, Lopes, Polson, and Taddy 2009),

*A Bayesian nonparametric approach to inference for quantile regression* (Taddy and Kottas 2009).

and other papers at [faculty.chicagobooth.edu/matt.taddy/research](http://faculty.chicagobooth.edu/matt.taddy/research).

See Also

particle

Examples

demo(package="Bmix")
Reading particle files

Description

This interprets the .particle[i][t][rho].txt files generated by the mix function and outputs a data.frame of sufficient statistics and posterior predictive information. The demos illustrate how to use the output for posterior inference.

Usage

particle(i, mixobj, t, rho=0)

Arguments

i
  Particle index.

mixobj
  Object returned by the mix function.

t
  Time index.

rho
  BAR process correlation parameter.

Value

Returns a data.frame with each row corresponding to a mixture component (first is the base distribution). The first column, n, is the number of observations allocated to each mixture component, the next set of columns are sufficient statistics, column p is the predictive probability for each component, and the final columns are moments (and degrees of freedom) for the student-t and multinomial posterior predictive mixture densities.

Author(s)

Matt Taddy, <matt.taddy@chicagobooth.edu>

References

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See Also

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