Package ‘hdbm’

August 28, 2019

Title High Dimensional Bayesian Mediation Analysis
Version 0.9.0
Description Perform mediation analysis in the presence of high-dimensional mediators based on the potential outcome framework. High dimensional Bayesian mediation (HDBM), developed by Song et al (2018) <doi:10.1101/467399>, relies on two Bayesian sparse linear mixed models to simultaneously analyze a relatively large number of mediators for a continuous exposure and outcome assuming a small number of mediators are truly active. This sparsity assumption also allows the extension of univariate mediator analysis by casting the identification of active mediators as a variable selection problem and applying Bayesian methods with continuous shrinkage priors on the effects.
License GPL-3
Encoding UTF-8
LazyData true
RoxygenNote 6.1.1
LinkingTo Rcpp, RcppArmadillo
Imports Rcpp
Suggests knitr, rmarkdown
VignetteBuilder knitr
NeedsCompilation yes
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Repository CRAN
Date/Publication 2019-08-28 14:20:03 UTC

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**Description**

`hdbm` is a Bayesian inference method that uses continuous shrinkage priors for high-dimensional mediation analysis, developed by Song et al (2018). `hdbm` provides estimates for the regression coefficients as well as the posterior inclusion probability for ranking mediators.

**Usage**

```r
hdbm(Y, A, M, C1, C2, beta.m, alpha.a, burnin, ndraws)
```

**Arguments**

- `Y` numeric outcome vector.
- `A` numeric exposure vector.
- `M` numeric matrix of mediators of Y and A.
- `C1` numeric matrix of extra covariates in the outcome model
- `C2` numeric matrix of extra covariates in the mediator model
- `beta.m` numeric vector of initial beta.m in the outcome model
- `alpha.a` numeric vector of initial alpha.a in the mediator model
- `burnin` number of iterations to run the MCMC before sampling
- `ndraws` number of draws to take from MCMC after the burnin period

**Details**

`hdbm` uses two regression models for the two conditional relationships, \( Y \mid A, M, C1 \) and \( M \mid A, C2 \). For the outcome model, `hdbm` uses

\[
Y = M \beta_M + A \beta_A + C1 \beta_C Y + \epsilon_Y
\]

For the mediator model, `hdbm` uses the model

\[
M = A \alpha_A + C2 \alpha_C Y + \epsilon_M
\]

For high dimensional tractability, `hdbm` employs continuous Bayesian shrinkage priors to select mediators and makes the two following assumptions: First, it assumes that all the potential mediators contribute small effects in mediating the exposure-outcome relationship. Second, it assumes that only a small proportion of mediators exhibit large effects ("active" mediators). `hdbm` uses a Metropolis-Hastings within Gibbs MCMC to generate posterior samples from the model.
Value

`hdbm` returns a list with 11 elements (each of length `ndraws`), sampled from the burned in MCMC:

- `beta.m` Outcome model mediator coefficients
- `r1` Whether or not each `beta.m` belongs to the larger normal component (1) or smaller normal component (0)
- `alpha.a` Mediator model exposure coefficients
- `r3` Whether or not each `alpha.a` belongs to the larger normal component (1) or smaller normal component (0)
- `beta.a` `beta.a` coefficient
- `pi.m` Proportion of non zero `beta.m` coefficients
- `pi.a` Proportion of non zero `alpha.a` coefficients
- `sigma.m0` Standard deviation of the smaller normal component for mediator-outcome coefficients (`beta.m`)
- `sigma.m1` Standard deviation of the larger normal component for mediator-outcome coefficients (`beta.m`)
- `sigma.ma0` Standard deviation of the smaller normal component for exposure-mediator coefficients (`alpha.a`)
- `sigma.ma1` Standard deviation of the larger normal component for exposure-mediator coefficients (`alpha.a`)

Author(s)

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References


Examples

```r
library(hdbm)

Y <- hdbm.data$y
A <- hdbm.data$a

# grab the mediators from the example data.frame
M <- as.matrix(hdbm.data[, paste0("m", 1:100)], nrow(hdbm.data))

# We just include the intercept term in this example.
C <- matrix(1, 1000, 1)
beta.m <- rep(0, 100)
alpha.a <- rep(0, 100)

set.seed(12345)
hdbm.out <- hdbm(Y, A, M, C, beta.m, alpha.a,
```

burnin = 1000, ndraws = 100)

# Which mediators are active?
active <- which(colSums(hdbm.out$r1 * hdbm.out$r3) > 50)

colnames(M)[active]

hdbm.data

Synthetic example data for hdbm

Description

Synthetic example data for hdbm

Usage

hdbm.data

Format

A data.frame with 1000 observations on 102 variables:

y Numeric response variable.
a Numeric exposure variable.
m[1-100] Numeric mediator variables
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