Package 'NPP'

August 21, 2019

Type Package

Title Normalized Power Prior Bayesian Analysis

Version 0.2.0

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Description Posterior sampling in several commonly used distributions using normalized power prior as described in Duan, Ye and Smith (2006) <doi:10.1002/env.752> and Ibrahim et.al. (2015) <doi:10.1002/sim.6728>. Sampling of the power parameter is achieved via either independence Metropolis-Hastings or random walk Metropolis-Hastings based on transformation.

License GPL (>= 2)

LazyData true

Depends R (>= 3.5.0)

Encoding UTF-8

NeedsCompilation no

Repository CRAN

Date/Publication 2019-08-21 08:00:02 UTC

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`BerNPP_MCMC` *MCMC Sampling for Bernoulli Population using Normalized Power Prior*

Description

Conduct posterior sampling for Bernoulli population with normalized power prior. For the power parameter δ, a Metropolis-Hastings algorithm with either independence proposal, or a random walk proposal on its logit scale is used. For the model parameter p, Gibbs sampling is used.

Usage

```
BerNPP_MCMC(Data.Cur = c(100, 50), Data.Hist = c(100, 50),
            CompStat = list(n0 = NULL, y0 = NULL, n1 = NULL, y1 = NULL),
           prior = list(p.alpha = 1, p.beta = 1, delta.alpha = 1, delta.beta = 1),
            MCMCmethod = 'IND', rw.logit.delta = 0.1,
            ind.delta.alpha = 1, ind.delta.beta = 1, nsample = 5000,
            control.mcmc = list(delta.ini = NULL, burnin = 0, thin = 1))
```

Arguments

`Data.Cur`	a non-negative integer vector of two elements: c(number of success, number of failure) in the current data.
`Data.Hist`	a non-negative integer vector of two elements: c(number of success, number of failure) in the historical data.
`CompStat`	a list of four elements that represents the "compatibility(sufficient) statistics" for p. Default is `NULL` so the fitting will be based on the data. If the `CompStat` is provided then the inputs in `Data.Cur` and `Data.Hist` will be ignored. Note: in Bernoulli population providing `CompStat` is equivalent to provide the data summary as in `Data.Cur` and `Data.Cur`. `n0` is the number of trials in the historical data. `y0` is the number of successes in the historical data. `n1` is the number of trials in the current data. `y1` is the number of successes in the current data.

prior	a list of the hyperparameters in the prior for both p and δ. p.alpha is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for p. p.beta is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for p. delta.alpha is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. delta.beta is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.
MCMCmethod	sampling method for δ in MCMC. It can be either 'IND' for independence proposal; or 'RW' for random walk proposal on logit scale.
rw.logit.delta	the stepsize(variance of the normal distribution) for the random walk proposal of logit δ. Only applicable if MCMCmethod = 'RW'.
ind.delta.alpha	specifies the first parameter α when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if MCMCmethod = 'IND'
ind.delta.beta	specifies the first parameter β when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if MCMCmethod = 'IND'
nsample	specifies the number of posterior samples in the output.
control.mcmc	a list of three elements used in posterior sampling. delta.ini is the initial value of δ in MCMC sampling. burnin is the number of burn-ins. The output will only show MCMC samples after bunrin. thin is the thinning parameter in MCMC sampling.

Details

The outputs include posteriors of the model parameter(s) and power parameter, acceptance rate in sampling δ, and the deviance information criteria.

Value

A list of class "NPP" with four elements:

p	posterior of the model parameter p.
delta	posterior of the power parameter δ.
acceptance	the acceptance rate in MCMC sampling for δ using Metropolis-Hastings algorithm.
DIC	the deviance information criteria for model diagnostics.

Author(s)

Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

MultinomialNPP_MCMC; NormalNPP_MCMC; PoissonNPP_MCMC

Examples

```
BerNPP_MCMC(Data.Cur = c(493, 473), Data.Hist = c(680, 669),
            prior = list(p.alpha = 0.5, p.beta = 0.5, delta.alpha = 1, delta.beta = 1),
            MCMCmethod = 'RW', rw.logit.delta = 1, nsample = 5000,
            control.mcmc = list(delta.ini = NULL, burnin = 2000, thin = 5))
```

LaplacelogC *A Function to Calculate $logC(\delta)$ Based on Laplace Approximation*

Description

The function assumes that the prior of the model parameters is very flat that had very minor impact on the shape of the power prior (posterior based on the D0).

Usage

```
LaplacelogC(delta, loglikmle, detHessian, ntheta)
```

Arguments

delta	the power parameter between 0 and 1. The function returns $logC(\delta)$
loglikmle	a scalar; the loglikelihood of the historical data evaluated at the maximum likelihood estimates based on the historical data
detHessian	determinant of the Hessian matrix evaluated at the loglikelihood function with respect to the maximum likelihood estimates based on the historical data
ntheta	an positive integer indicating number of parameters in the model

Value

$logC(\delta)$ based on the Laplace approximation. Can be used for the posterior sampling in the normalized power prior.

Author(s)

Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

logCknot

LMNPP_MCMC *MCMC Sampling for Normal Linear Model using Normalized Power Prior*

Description

Conduct posterior sampling for normal linear model with normalized power prior. For the power parameter δ, a Metropolis-Hastings algorithm with either independence proposal, or a random walk proposal on its logit scale is used. For the regression parameter β and σ^2, Gibbs sampling is used.

Usage

```
LMNPP_MCMC(y.Cur, y.Hist, x.Cur = NULL, x.Hist = NULL,
           prior = list(a = 1.5, b = 0, mu0 = 0,
                  Rinv = matrix(1, nrow = 1), delta.alpha = 1, delta.beta = 1),
           MCMCmethod = 'IND', rw.logit.delta = 0.1,
           ind.delta.alpha= 1, ind.delta.beta= 1, nsample = 5000,
           control.mcmc = list(delta.ini = NULL, burnin = 0, thin = 1))
```

Arguments

y.Cur	a vector of individual level of the response y in current data.
y.Hist	a vector of individual level of the response y in historical data.
x.Cur	a vector or matrix or data frame of covariate observed in the current data. If more than 1 covariate available, the number of rows is equal to the number of observations.
x.Hist	a vector or matrix or data frame of covariate observed in the historical data. If more than 1 covariate available, the number of rows is equal to the number of observations.
prior	a list of the hyperparameters in the prior for model parameters (β, σ^2) and δ. The form of the prior for model parameter (β, σ^2) is in the section "Details". a a positive hyperparameter for prior on model parameters. It is the power a in formula $(1/\sigma^2)^a$; See details. b equals 0 if a flat prior is used for β. Equals 1 if a normal prior is used for β; See details. mu0 a vector of the mean for prior $\beta\|\sigma^2$. Only applicable if b = 1. Rinv inverse of the matrix R. The covariance matrix of the prior for $\beta\|\sigma^2$ is $\sigma^2 R^{-1}$. delta.alpha is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. delta.beta is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.

`MCMCmethod`	sampling method for δ in MCMC. It can be either 'IND' for independence proposal; or 'RW' for random walk proposal on logit scale.
`rw.logit.delta`	the stepsize(variance of the normal distribution) for the random walk proposal of logit δ. Only applicable if `MCMCmethod = 'RW'`.
`ind.delta.alpha`	specifies the first parameter α when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if `MCMCmethod = 'IND'`
`ind.delta.beta`	specifies the first parameter β when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if `MCMCmethod = 'IND'`
`nsample`	specifies the number of posterior samples in the output.
`control.mcmc`	a list of three elements used in posterior sampling. `delta.ini` is the initial value of δ in MCMC sampling. `burnin` is the number of burn-ins. The output will only show MCMC samples after bunrin. `thin` is the thinning parameter in MCMC sampling.

Details

If $b = 1$, prior for (β, σ) is $(1/\sigma^2)^a * N(mu0, \sigma^2 R^{-1})$, which includes the g-prior. If $b = 0$, prior for (β, σ) is $(1/\sigma^2)^a$. The outputs include posteriors of the model parameter(s) and power parameter, acceptance rate when sampling δ, and the deviance information criteria.

Value

A list of class "NPP" with five elements:

`beta`	posterior of the model parameter β in vector or matrix form.
`sigmasq`	posterior of the model parameter σ^2.
`delta`	posterior of the power parameter δ.
`acceptance`	the acceptance rate in MCMC sampling for δ using Metropolis-Hastings algorithm.
`DIC`	the deviance information criteria for model diagnostics.

Author(s)

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References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

Berger, J.O. and Bernardo, J.M. (1992). On the development of reference priors. *Bayesian Statistics 4: Proceedings of the Fourth Valencia International Meeting, Bernardo, J.M, Berger, J.O., Dawid, A.P. and Smith, A.F.M. eds., 35-60, Clarendon Press:Oxford.*

Jeffreys, H. (1946). An Invariant Form for the Prior Probability in Estimation Problems. *Proceedings of the Royal Statistical Society of London, Series A 186:453-461.*

See Also

BerNPP_MCMC; MultinomialNPP_MCMC; PoissonNPP_MCMC; NormalNPP_MCMC

Examples

```
set.seed(123)
x1 = runif(100, min = 0, max = 10)
x0 = runif(100, min = 0, max = 1)
y1 = 10+ 2*x1 + rnorm(100, mean = 0, sd = 1)
y0 = 10+ 1.5*x0 + rnorm(100, mean = 0, sd = 1)

RegPost = LMNPP_MCMC(y.Cur = y1, y.Hist = y0, x.Cur = x1, x.Hist = x0,
                     prior = list(a = 1.5, b = 0, mu0 = c(0, 0),
                                  Rinv = diag(100, nrow = 2),
                     delta.alpha = 1, delta.beta = 1), MCMCmethod = 'IND',
                     ind.delta.alpha= 1, ind.delta.beta= 1, nsample = 5000,
                     control.mcmc = list(delta.ini = NULL,
                                         burnin = 2000, thin = 2))
```

---

logCdelta *A Function to Interpolate $logC(\delta)$ Based on Its Values on Selected Knots*

Description

The function returns the interpolated value (a scalar) of $logC(\delta)$ based on its results on selected knots, given input vector of δ.

Usage

```
logCdelta(delta, deltaknot, lCknot)
```

Arguments

delta	a scalar of the input value of δ.
deltaknot	a vector of the knots for δ. It should be selected before conduct the sampling.
lCknot	a vector of the values $logC(\delta)$ on selected knots, coming from the function logCknot.

Value

A sequence of the values, $logC(\delta)$ on selected knots.

Author(s)

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References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

`loglikNormD0`; `loglikBerD0`; `logCknot`

`logCknot` *A Function to Calculate $logC(\delta)$ on Selected Knots*

Description

The function returns a sequence of the values, $logC(\delta)$ on selected knots, given input vector of δ.

Usage

```
logCknot(deltaknot, llikf0)
```

Arguments

`deltaknot`	a vector of the knots for δ. It should be selected before conduct the sampling.
`llikf0`	a matrix of the log-likelihoods of class "npp".

Value

A sequence of the values, $logC(\delta)$ on selected knots.

Author(s)

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References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

`loglikNormD0`; `loglikBerD0`; `logCdelta`

loglikBerD0 *A Function to Calculate Log-likelihood of the Historical Data, Given Matrix-valued Parameters, for Bernoulli Population*

Description

The function returns a matrix of class "npp", each element is a log-likelihood of the historical data. It is an intermediate step to calculate the "normalizing constant" $C(\delta)$ in the normalized power prior, for the purpose of providing a flexible implementation. Users can specify their own likelihood function of the same class following this structure.

Usage

```
loglikBerD0(D0, thetalist, ntheta = 1)
```

Arguments

D0	a vector of each observation(binary) in historical data.
thetalist	a list of parameter values. The number of elements is equal to ntheta. Each element is a matrix. The sample should come from the posterior of the powered likelihood for historical data, with each column corresponds to a distinct value of the power parameter δ (the corresponding power parameter increases from left to right). The number of rows is the number of Monte Carlo samples for each δ fixed. The number of columns is the number of selected knots (number of distinct δ).
ntheta	a positive integer indicating number of parameters to be estimated in the model. Default is 1 for Bernoulli.

Value

A numeric matrix of log-likelihood, for the historical data given the matrix(or array)-valued parameters.

Author(s)

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References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

loglikNormD0; logCknot; logCdelta

`loglikNormD0` *A Function to Calculate Log-likelihood of the Historical Data, Given Array-valued Parameters, for Normal Population*

Description

The function returns a matrix of class "npp", each element is a log-likelihood of the historical data. It is an intermediate step to calculate the "normalizing constant" $C(\delta)$ in the normalized power prior, for the purpose of providing a flexible implementation. Users can specify their own likelihood function of the same class following this structure.

Usage

```
loglikNormD0(D0, thetalist, ntheta = 2)
```

Arguments

`D0`	a vector of each observation in historical data.
`thetalist`	a list of parameter values. The number of elements is equal to `ntheta`. Each element is a matrix. The sample should come from the posterior of the powered likelihood for historical data, with each column corresponds to a distinct value of the power parameter δ (the corresponding power parameter increases from left to right). The number of rows is the number of Monte Carlo samples for each δ fixed. The number of columns is the number of selected knots (number of distinct δ).
`ntheta`	a positive integer indicating number of parameters to be estimated in the model.

Value

A numeric matrix of log-likelihood, for the historical data given the matrix(or array)-valued parameters.

Author(s)

Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

`loglikBerD0`; `logCknot`; `logCdelta`

ModeDeltaBerNPP *Calculate Posterior Mode of the Power Parameter in Normalized Power Prior with Grid Search, Bernoulli Population*

Description

The function returns the posterior mode of the power parameter δ in Bernoulli population. It calculates the log of the posterior density (up to a normalizing constant), and conduct a grid search to find the approximate mode.

Usage

```
ModeDeltaBerNPP(Data.Cur, Data.Hist,
                CompStat = list(n0 = NULL, y0 = NULL, n1 = NULL, y1 = NULL),
                npoints = 1000,
                prior = list(p.alpha = 1, p.beta = 1,
                             delta.alpha = 1, delta.beta = 1))
```

Arguments

`Data.Cur`	a non-negative integer vector of two elements: c(number of success, number of failure) in the current data.
`Data.Hist`	a non-negative integer vector of two elements: c(number of success, number of failure) in the historical data.
`CompStat`	a list of four elements that represents the "compatibility(sufficient) statistics" for p. Default is `NULL` so the fitting will be based on the data. If the `CompStat` is provided then the inputs in `Data.Cur` and `Data.Hist` will be ignored. Note: in Bernoulli population providing `CompStat` is equivalent to provide the data summary as in `Data.Cur` and `Data.Cur`. `n0` is the number of trials in the historical data. `y0` is the number of successes in the historical data. `n1` is the number of trials in the current data. `y1` is the number of successes in the current data.
`npoints`	is a non-negative integer scalar indicating number of points on a regular spaced grid between [0, 1], where we calculate the log of the posterior and search for the mode.
`prior`	a list of the hyperparameters in the prior for both p and δ. `p.alpha` is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for p. `p.beta` is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for p. `delta.alpha` is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. `delta.beta` is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.

Details

See example.

Value

A numeric value between 0 and 1.

Author(s)

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References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

ModeDeltaNormalNPP; ModeDeltaPoisNPP; ModeDeltaMultinomialNPP

Examples

```
ModeDeltaBerNPP(Data.Cur = c(100, 40), Data.Hist = c(100, 40), npoints = 1000,
                prior = list(p.alpha = 1, p.beta = 1, delta.alpha = 1, delta.beta = 1))

ModeDeltaBerNPP(Data.Cur = c(100, 40), Data.Hist = c(100, 35), npoints = 1000,
                prior = list(p.alpha = 1, p.beta = 1, delta.alpha = 1, delta.beta = 1))

ModeDeltaBerNPP(Data.Cur = c(100, 40), Data.Hist = c(100, 50), npoints = 1000,
                prior = list(p.alpha = 1, p.beta = 1, delta.alpha = 1, delta.beta = 1))
```

ModeDeltaLMNPP — *Calculate Posterior Mode of the Power Parameter in Normalized Power Prior with Grid Search, Normal Linear Model*

Description

The function returns the posterior mode of the power parameter δ in normal linear model. It calculates the log of the posterior density (up to a normalizing constant), and conduct a grid search to find the approximate mode.

Usage

```
ModeDeltaLMNPP(y.Cur, y.Hist, x.Cur = NULL, x.Hist = NULL, npoints = 1000,
               prior = list(a = 1.5, b = 0, mu0 = 0, Rinv = matrix(1, nrow = 1),
                            delta.alpha = 1, delta.beta = 1))
```

Arguments

y.Cur	a vector of individual level of the response y in current data.
y.Hist	a vector of individual level of the response y in historical data.
x.Cur	a vector or matrix or data frame of covariate observed in the current data. If more than 1 covariate available, the number of rows is equal to the number of observations.
x.Hist	a vector or matrix or data frame of covariate observed in the historical data. If more than 1 covariate available, the number of rows is equal to the number of observations.
npoints	is a non-negative integer scalar indicating number of points on a regular spaced grid between [0, 1], where we calculate the log of the posterior and search for the mode.
prior	a list of the hyperparameters in the prior for model parameters (β, σ^2) and δ. The form of the prior for model parameter (β, σ^2) is in the section "Details". a a positive hyperparameter for prior on model parameters. It is the power a in formula $(1/\sigma^2)^a$; See details. b equals 0 if a flat prior is used for β. Equals 1 if a normal prior is used for β; See details. mu0 a vector of the mean for prior $\beta\|\sigma^2$. Only applicable if b = 1. Rinv inverse of the matrix R. The covariance matrix of the prior for $\beta\|\sigma^2$ is $\sigma^2 R^{-1}$. delta.alpha is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. delta.beta is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.

Details

If $b = 1$, prior for (β, σ) is $(1/\sigma^2)^a * N(mu0, \sigma^2 R^{-1})$, which includes the g-prior. If $b = 0$, prior for (β, σ) is $(1/\sigma^2)^a$. The outputs include posteriors of the model parameter(s) and power parameter, acceptance rate when sampling δ, and the deviance information criteria.

Author(s)

Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

Berger, J.O. and Bernardo, J.M. (1992). On the development of reference priors. *Bayesian Statistics 4: Proceedings of the Fourth Valencia International Meeting, Bernardo, J.M, Berger, J.O., Dawid, A.P. and Smith, A.F.M. eds., 35-60, Clarendon Press:Oxford.*

Jeffreys, H. (1946). An Invariant Form for the Prior Probability in Estimation Problems. *Proceedings of the Royal Statistical Society of London, Series A 186:453-461.*

See Also

ModeDeltaBerNPP; ModeDeltaNormalNPP; ModeDeltaMultinomialNPP; ModeDeltaNormalNPP

`ModeDeltaMultinomialNPP`

Calculate Posterior Mode of the Power Parameter in Normalized Power Prior with Grid Search, Multinomial Population

---

Description

The function returns the posterior mode of the power parameter δ in multinomial population. It calculates the log of the posterior density (up to a normalizing constant), and conduct a grid search to find the approximate mode.

Usage

```
ModeDeltaMultinomialNPP(Data.Cur, Data.Hist, CompStat = list(n0 = NULL, n1 = NULL),
                  npoints = 1000, prior = list(theta.dir.alpha = c(0.5, 0.5, 0.5),
                        delta.alpha = 1, delta.beta = 1))
```

Arguments

`Data.Cur`	a non-negative integer vector of K elements: c(number of success in group 1, number of success in group 2, ..., number of success in group K) in the current data.
`Data.Hist`	a non-negative integer vector of K elements: c(number of success in group 1, number of success in group 2, ..., number of success in group K) in the historical data.
`CompStat`	a list of two elements that represents the "compatibility(sufficient) statistics" for θ. Default is `NULL` so the fitting will be based on the data. If the `CompStat` is provided then the inputs in `Data.Cur` and `Data.Hist` will be ignored. Note: in multinomial case providing `CompStat` is equivalent to provide the data summary as in `Data.Cur` and `Data.Cur`. `n0` is a non-negative integer vector of K elements for compatible statistics in historical data: c(number of success in group 1, number of success in group 2, ..., number of success in group K). `n1` is a non-negative integer vector of K elements for compatible statistics in current data: c(number of success in group 1, number of success in group 2, ..., number of success in group K).
`npoints`	is a non-negative integer scalar indicating number of points on a regular spaced grid between [0, 1], where we calculate the log of the posterior and search for the mode.

`prior` a list of the hyperparameters in the prior for both p and δ.

`theta.dir` is a vector of K elements of the hyperparameter α in the prior distribution $Dir(\alpha[1], \alpha[2], ..., \alpha[K])$ for θ.

`delta.alpha` a scalar, the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ.

`delta.beta` a scalar, the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.

Details

See example.

Value

A numeric value between 0 and 1.

Author(s)

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References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

ModeDeltaBerNPP; ModeDeltaNormalNPP; ModeDeltaPoisNPP

Examples

```
ModeDeltaMultinomialNPP(CompStat = list(n0 = c(25,25,25,25), n1 = c(25,25,25,25)),
                        prior = list(theta.dir.alpha = c(0.5, 0.5, 0.5, 0.5),
                                     delta.alpha = 1, delta.beta = 1))

ModeDeltaMultinomialNPP(CompStat = list(n0 = c(22,25,28,25), n1 = c(25,22,25,28)),
                        prior = list(theta.dir.alpha = c(0.5, 0.5, 0.5, 0.5),
                                     delta.alpha = 1, delta.beta = 1))

ModeDeltaMultinomialNPP(CompStat = list(n0 = c(15,25,30,30), n1 = c(25,25,25,25)),
                        prior = list(theta.dir.alpha = c(0.5, 0.5, 0.5, 0.5),
                                     delta.alpha = 1, delta.beta = 1))
```

ModeDeltaNormalNPP *Calculate Posterior Mode of the Power Parameter in Normalized Power Prior with Grid Search, Normal Population*

Description

The function returns the posterior mode of the power parameter δ in multinomial population. It calculates the log of the posterior density (up to a normalizing constant), and conduct a grid search to find the approximate mode.

Usage

```
ModeDeltaNormalNPP(Data.Cur, Data.Hist,
                   CompStat = list(n0 = NULL, mean0 = NULL, var0 = NULL,
                                   n1 = NULL, mean1 = NULL, var1 = NULL),
                   npoints = 1000,
                   prior = list(a = 1.5, delta.alpha = 1, delta.beta = 1))
```

Arguments

Data.Cur	a vector of individual level current data.
Data.Hist	a vector of individual level historical data.
CompStat	a list of six elements(scalar) that represents the "compatibility(sufficient) statistics" for model parameters. Default is NULL so the fitting will be based on the data. If the CompStat is provided then the inputs in Data.Cur and Data.Hist will be ignored. n0 is the sample size of historical data. mean0 is the sample mean of the historical data. var0 is the sample variance of the historical data. n1 is the sample size of current data. mean1 is the sample mean of the current data. var1 is the sample variance of the current data.
npoints	is a non-negative integer scalar indicating number of points on a regular spaced grid between [0, 1], where we calculate the log of the posterior and search for the mode.
prior	a list of the hyperparameters in the prior for both (μ, σ^2) and δ. The form of the prior for model parameter (μ, σ^2) is $(1/\sigma^2)^a$. When $a = 1$ it corresponds to the reference prior, and when $a = 1.5$ it corresponds to the Jeffrey's prior. a is the power a in formula $(1/\sigma^2)^a$, the prior for (μ, σ^2) jointly. delta.alpha is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. delta.beta is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.

Details

See example.

Value

A numeric value between 0 and 1.

Author(s)

Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

Berger, J.O. and Bernardo, J.M. (1992). On the development of reference priors. *Bayesian Statistics 4: Proceedings of the Fourth Valencia International Meeting, Bernardo, J.M, Berger, J.O., Dawid, A.P. and Smith, A.F.M. eds., 35-60, Clarendon Press:Oxford.*

Jeffreys, H. (1946). An Invariant Form for the Prior Probability in Estimation Problems. *Proceedings of the Royal Statistical Society of London, Series A 186:453-461.*

See Also

ModeDeltaBerNPP; ModeDeltaMultinomialNPP; ModeDeltaPoisNPP

Examples

```
ModeDeltaNormalNPP(CompStat = list(n0 = 50, mean0 = 0, var0 = 1,
                                   n1 = 50, mean1 = 0, var1 = 1), npoints = 1000,
                   prior = list(a = 1.5, delta.alpha = 1, delta.beta = 1))

ModeDeltaNormalNPP(CompStat = list(n0 = 50, mean0 = 0, var0 = 1,
                                   n1 = 40, mean1 = 0.2, var1 = 1), npoints = 1000,
                   prior = list(a = 1.5, delta.alpha = 1, delta.beta = 1))

ModeDeltaNormalNPP(CompStat = list(n0 = 50, mean0 = 0, var0 = 1,
                                   n1 = 40, mean1 = 0.6, var1 = 1), npoints = 1000,
                   prior = list(a = 1.5, delta.alpha = 1, delta.beta = 1))
```

ModeDeltaPoisNPP *Calculate Posterior Mode of the Power Parameter in Normalized Power Prior with Grid Search, Poisson Population*

Description

The function returns the posterior mode of the power parameter δ in multinomial population. It calculates the log of the posterior density (up to a normalizing constant), and conduct a grid search to find the approximate mode.

Usage

```
ModeDeltaPoisNPP(Data.Cur, Data.Hist,
               CompStat = list(n0 = NULL, mean0 = NULL, n1 = NULL, mean1 = NULL),
                 npoints = 1000, prior = list(lambda.shape = 1/2,
                 lambda.scale = 100, delta.alpha = 1, delta.beta = 1))
```

Arguments

`Data.Cur`	a non-negative integer vector of each observed current data.
`Data.Hist`	a non-negative integer vector of each observed historical data.
`CompStat`	a list of four elements that represents the "compatibility(sufficient) statistics" for λ. Default is `NULL` so the fitting will be based on the data. If the `CompStat` is provided then the inputs in `Data.Cur` and `Data.Hist` will be ignored. `n0` is the number of observations in the historical data. `mean0` is the sample mean of the historical data. `n1` is the number of observations in the current data. `mean1` is the sample mean of the current data.
`npoints`	is a non-negative integer scalar indicating number of points on a regular spaced grid between [0, 1], where we calculate the log of the posterior and search for the mode.
`prior`	a list of the hyperparameters in the prior for both λ and δ. A Gamma distribution is used as the prior of λ, and a Beta distribution is used as the prior of δ. `lambda.shape` is the shape (hyper)parameter in the prior distribution $Gamma(shape, scale)$ for λ. `lambda.scale` is the scale (hyper)parameter in the prior distribution $Gamma(shape, scale)$ for λ. `delta.alpha` is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. `delta.beta` is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.

Details

See example.

Value

A numeric value between 0 and 1.

Author(s)

Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

ModeDeltaBerNPP; ModeDeltaNormalNPP; ModeDeltaMultinomialNPP

Examples

```
ModeDeltaPoisNPP(CompStat = list(n0 = 50, mean0 = 10, n1 = 50, mean1 = 10), npoints = 1000,
                 prior = list(lambda.shape = 1/2, lambda.scale = 100,
                              delta.alpha = 1, delta.beta = 1))

ModeDeltaPoisNPP(CompStat = list(n0 = 50, mean0 = 10, n1 = 50, mean1 = 9.5), npoints = 1000,
                 prior = list(lambda.shape = 1/2, lambda.scale = 100,
                              delta.alpha = 1, delta.beta = 1))

ModeDeltaPoisNPP(CompStat = list(n0 = 50, mean0 = 10, n1 = 50, mean1 = 9), npoints = 1000,
                 prior = list(lambda.shape = 1/2, lambda.scale = 100,
                              delta.alpha = 1, delta.beta = 1))
```

MultinomialNPP_MCMC *MCMC Sampling for Multinomial Population using Normalized Power Prior*

Description

Conduct posterior sampling for multinomial population with normalized power prior. For the power parameter δ, a Metropolis-Hastings algorithm with either independence proposal, or a random walk proposal on its logit scale is used. For the model parameter vector θ, Gibbs sampling is used. Assume the prior for model parameter θ comes from a Dirichlet distribution.

Usage

```
MultinomialNPP_MCMC(Data.Cur = c(10, 10, 10), Data.Hist = c(10, 10, 10),
                    CompStat = list(n0 = NULL, n1 = NULL),
                    prior = list(theta.dir = c(0.5, 0.5, 0.5),
                                 delta.alpha = 1, delta.beta = 1),
                    MCMCmethod = 'IND', rw.logit.delta = 0.1,
                    ind.delta.alpha = 1, ind.delta.beta = 1, nsample = 5000,
                   control.mcmc = list(delta.ini = NULL, burnin = 0, thin = 1))
```

Arguments

`Data.Cur`	a non-negative integer vector of K elements: c(number of success in group 1, number of success in group 2, ..., number of success in group K) in the current data.
`Data.Hist`	a non-negative integer vector of K elements: c(number of success in group 1, number of success in group 2, ..., number of success in group K) in the historical data.
`CompStat`	a list of two elements that represents the "compatibility(sufficient) statistics" for θ. Default is `NULL` so the fitting will be based on the data. If the `CompStat` is provided then the inputs in `Data.Cur` and `Data.Hist` will be ignored. Note: in multinomial case providing `CompStat` is equivalent to provide the data summary as in `Data.Cur` and `Data.Cur`. `n0` is a non-negative integer vector of K elements for compatible statistics in historical data: c(number of success in group 1, number of success in group 2, ..., number of success in group K). `n1` is a non-negative integer vector of K elements for compatible statistics in current data: c(number of success in group 1, number of success in group 2, ..., number of success in group K).
`prior`	a list of the hyperparameters in the prior for both p and δ. `theta.dir` is a vector of K elements of the hyperparameter α in the prior distribution $Dir(\alpha[1], \alpha[2], ..., \alpha[K])$ for θ. `delta.alpha` a scalar, the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. `delta.beta` a scalar, the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.
`MCMCmethod`	sampling method for δ in MCMC. It can be either 'IND' for independence proposal; or 'RW' for random walk proposal on logit scale.
`rw.logit.delta`	the stepsize(variance of the normal distribution) for the random walk proposal of logit δ. Only applicable if `MCMCmethod = 'RW'`.
`ind.delta.alpha`	specifies the first parameter α when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if `MCMCmethod = 'IND'`
`ind.delta.beta`	specifies the first parameter β when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if `MCMCmethod = 'IND'`
`nsample`	specifies the number of posterior samples in the output.

`control.mcmc` a list of three elements used in posterior sampling.

`delta.ini` is the initial value of δ in MCMC sampling.

`burnin` is the number of burn-ins. The output will only show MCMC samples after bunrin.

`thin` is the thinning parameter in MCMC sampling.

Details

The outputs include posteriors of the model parameter(s) and power parameter, acceptance rate in sampling δ, and the deviance information criteria.

Value

A list of class "NPP" with four elements:

`p`	posterior of the model parameter θ.
`delta`	posterior of the power parameter δ.
`acceptance`	the acceptance rate in MCMC sampling for δ using Metropolis-Hastings algorithm.
`DIC`	the deviance information criteria for model diagnostics.

Author(s)

Tianyu Bai <tianyu.bai24@gmail.com> Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

`BerNPP_MCMC`; `NormalNPP_MCMC`; `PoissonNPP_MCMC`

Examples

```
MultinomialNPP_MCMC(Data.Cur = c(3,11,3,669), Data.Hist = c(9,20,9,473),
                    prior = list(theta.dir = c(1,1,1,1),
                    delta.alpha = 1, delta.beta = 1),
                    MCMCmethod = 'IND', rw.logit.delta = 0.1,
                    ind.delta.alpha = 1, ind.delta.beta = 1, nsample = 10000,
                    control.mcmc = list(delta.ini = NULL,
                    burnin = 2000, thin = 5))
```

NormalNPP_MCMC *MCMC Sampling for Normal Population using Normalized Power Prior*

Description

Conduct posterior sampling for normal population with normalized power prior. The initial prior $\pi(\mu|\sigma^2)$ is a flat prior. For the power parameter δ, a Metropolis-Hastings algorithm with either independence proposal, or a random walk proposal on its logit scale is used. For the model parameter μ and σ^2, Gibbs sampling is used.

Usage

```
NormalNPP_MCMC(Data.Cur, Data.Hist,
               CompStat = list(n0 = NULL, mean0 = NULL, var0 = NULL,
                               n1 = NULL, mean1 = NULL, var1 = NULL),
               prior = list(a = 1.5, delta.alpha = 1, delta.beta = 1),
               MCMCmethod = 'IND', rw.logit.delta = 0.1,
               ind.delta.alpha= 1, ind.delta.beta= 1, nsample = 5000,
               control.mcmc = list(delta.ini = NULL, burnin = 0, thin = 1))
```

Arguments

Data.Cur	a vector of individual level current data.
Data.Hist	a vector of individual level historical data.
CompStat	a list of six elements(scalar) that represents the "compatibility(sufficient) statistics" for model parameters. Default is NULL so the fitting will be based on the data. If the CompStat is provided then the inputs in Data.Cur and Data.Hist will be ignored. n0 is the sample size of historical data. mean0 is the sample mean of the historical data. var0 is the sample variance of the historical data. n1 is the sample size of current data. mean1 is the sample mean of the current data. var1 is the sample variance of the current data.
prior	a list of the hyperparameters in the prior for both (μ, σ^2) and δ. The form of the prior for model parameter (μ, σ^2) is $(1/\sigma^2)^a$. When $a = 1$ it corresponds to the reference prior, and when $a = 1.5$ it corresponds to the Jeffrey's prior. a is the power a in formula $(1/\sigma^2)^a$, the prior for (μ, σ^2) jointly. delta.alpha is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. delta.beta is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.
MCMCmethod	sampling method for δ in MCMC. It can be either 'IND' for independence proposal; or 'RW' for random walk proposal on logit scale.

`rw.logit.delta` the stepsize(variance of the normal distribution) for the random walk proposal of logit δ. Only applicable if `MCMCmethod = 'RW'`.

`ind.delta.alpha`
specifies the first parameter α when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if `MCMCmethod = 'IND'`

`ind.delta.beta` specifies the first parameter β when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if `MCMCmethod = 'IND'`

`nsample` specifies the number of posterior samples in the output.

`control.mcmc` a list of three elements used in posterior sampling.
`delta.ini` is the initial value of δ in MCMC sampling.
`burnin` is the number of burn-ins. The output will only show MCMC samples after bunrin.
`thin` is the thinning parameter in MCMC sampling.

Details

The outputs include posteriors of the model parameter(s) and power parameter, acceptance rate in sampling δ, and the deviance information criteria.

Value

A list of class "NPP" with five elements:

`mu` posterior of the model parameter μ.

`sigmasq` posterior of the model parameter σ^2.

`delta` posterior of the power parameter δ.

`acceptance` the acceptance rate in MCMC sampling for δ using Metropolis-Hastings algorithm.

`DIC` the deviance information criteria for model diagnostics.

Author(s)

Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

Berger, J.O. and Bernardo, J.M. (1992). On the development of reference priors. *Bayesian Statistics 4: Proceedings of the Fourth Valencia International Meeting, Bernardo, J.M, Berger, J.O., Dawid, A.P. and Smith, A.F.M. eds., 35-60, Clarendon Press:Oxford.*

Jeffreys, H. (1946). An Invariant Form for the Prior Probability in Estimation Problems. *Proceedings of the Royal Statistical Society of London, Series A 186:453-461.*

See Also

BerNPP_MCMC; MultinomialNPP_MCMC; PoissonNPP_MCMC;

Examples

```
set.seed(1234)
NormalData0 <- rnorm(n = 100, mean= 20, sd = 1)

set.seed(12345)
NormalData1 <- rnorm(n = 50, mean= 30, sd = 1)

NormalNPP_MCMC(Data.Cur = NormalData1, Data.Hist = NormalData0,
               CompStat = list(n0 = 100, mean0 = 10, var0 = 1,
               n1 = 100, mean1 = 10, var1 = 1),
               prior = list(a = 1.5, delta.alpha = 1, delta.beta = 1),
               MCMCmethod = 'RW', rw.logit.delta = 1,
               ind.delta.alpha= 1, ind.delta.beta= 1, nsample = 10000,
               control.mcmc = list(delta.ini = NULL, burnin = 0, thin = 1))
```

PHData *PH Data on four sites in Virginia*

Description

The dataset is used to assess if there is site impairment. The site impairment is defined as whether the pH values at a site indicate that the site violates a (lower) standard of 6.0 more than 10% of the time.

Usage

```
data("PHData")
```

Format

A data frame with 325 observations on the following 3 variables.

`Station` the site number, labeled as 1 to 4

`Data.Time` indicator of historical data (coded as 0) or current data (coded as 1)

`PH` value of PH on the site

Examples

```
data(PHData)
```

PoissonNPP_MCMC *MCMC Sampling for Bernoulli Population using Normalized Power Prior*

Description

Conduct posterior sampling for Poisson population with normalized power prior. For the power parameter δ, a Metropolis-Hastings algorithm with either independence proposal, or a random walk proposal on its logit scale is used. For the model parameter λ, Gibbs sampling is used.

Usage

```
PoissonNPP_MCMC(Data.Cur, Data.Hist,
              CompStat = list(n0 = NULL, mean0 = NULL, n1 = NULL, mean1 = NULL),
               prior = list(lambda.shape = 1/2, lambda.scale = 100,
                            delta.alpha = 1, delta.beta = 1),
               MCMCmethod = 'IND', rw.logit.delta = 0.1,
               ind.delta.alpha= 1, ind.delta.beta= 1, nsample = 5000,
               control.mcmc = list(delta.ini = NULL, burnin = 0, thin = 1))
```

Arguments

`Data.Cur`	a non-negative integer vector of each observed current data.
`Data.Hist`	a non-negative integer vector of each observed historical data.
`CompStat`	a list of four elements that represents the "compatibility(sufficient) statistics" for λ. Default is `NULL` so the fitting will be based on the data. If the `CompStat` is provided then the inputs in `Data.Cur` and `Data.Hist` will be ignored. `n0` is the number of observations in the historical data. `mean0` is the sample mean of the historical data. `n1` is the number of observations in the current data. `mean1` is the sample mean of the current data.
`prior`	a list of the hyperparameters in the prior for both λ and δ. A Gamma distribution is used as the prior of λ, and a Beta distribution is used as the prior of δ. `lambda.shape` is the shape (hyper)parameter in the prior distribution $Gamma(shape, scale)$ for λ. `lambda.scale` is the scale (hyper)parameter in the prior distribution $Gamma(shape, scale)$ for λ. `delta.alpha` is the hyperparameter α in the prior distribution $Beta(\alpha, \beta)$ for δ. `delta.beta` is the hyperparameter β in the prior distribution $Beta(\alpha, \beta)$ for δ.
`MCMCmethod`	sampling method for δ in MCMC. It can be either 'IND' for independence proposal; or 'RW' for random walk proposal on logit scale.
`rw.logit.delta`	the stepsize(variance of the normal distribution) for the random walk proposal of logit δ. Only applicable if `MCMCmethod = 'RW'`.

`ind.delta.alpha`
: specifies the first parameter α when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if `MCMCmethod = 'IND'`

`ind.delta.beta`
: specifies the first parameter β when independent proposal $Beta(\alpha, \beta)$ for δ is used. Only applicable if `MCMCmethod = 'IND'`

`nsample`
: specifies the number of posterior samples in the output.

`control.mcmc`
: a list of three elements used in posterior sampling.

`delta.ini` is the initial value of δ in MCMC sampling.

`burnin` is the number of burn-ins. The output will only show MCMC samples after bunrin.

`thin` is the thinning parameter in MCMC sampling.

Details

The outputs include posteriors of the model parameter(s) and power parameter, acceptance rate in sampling δ, and the deviance information criteria.

Value

A list of class "NPP" with four elements:

`lambda`
: posterior of the model parameter λ.

`delta`
: posterior of the power parameter δ.

`acceptance`
: the acceptance rate in MCMC sampling for δ using Metropolis-Hastings algorithm.

`DIC`
: the deviance information criteria for model diagnostics.

Author(s)

Zifei Han <hanzifei1@gmail.com>

References

Ibrahim, J.G., Chen, M.-H., Gwon, Y. and Chen, F. (2015). The Power Prior: Theory and Applications. *Statistics in Medicine 34:3724-3749.*

Duan, Y., Ye, K. and Smith, E.P. (2006). Evaluating Water Quality: Using Power Priors to Incorporate Historical Information. *Environmetrics 17:95-106.*

See Also

`MultinomialNPP_MCMC`; `NormalNPP_MCMC`; `BerNPP_MCMC`;

Examples

```
set.seed(1234)
DataHist <- rpois(n = 100, lambda = 49)
set.seed(12345)
DataCur <- rpois(n = 100, lambda = 49)

PoissonNPP_MCMC(Data.Cur = DataCur, Data.Hist = DataHist,
                CompStat = list(n0 = 20, mean0 = 10, n1 = 30, mean1 = 11),
                prior = list(lambda.shape = 1/2, lambda.scale = 100,
                             delta.alpha = 1, delta.beta = 1),
                MCMCmethod = 'RW', rw.logit.delta = 1,
                ind.delta.alpha= 1, ind.delta.beta= 1,nsample = 10000,
                control.mcmc = list(delta.ini = NULL, burnin = 2000, thin = 1))
```

SPDData *Dataset for Diagnostic Test (PartoSure Test, Medical Device) Evaluation for Spontaneous Preterm Delivery*

Description

The diagnostic test was developed to aid in rapidly assess the risk of spontaneouspreterm delivery within 7 days from the time of diagnosis in pre-pregnant women with signs and symptoms. The same diagnostic test was used for two populations in US and EU respectively. The number of counts in the four cells (True positive, false positive, false negative, true negative) was recorded.

Usage

```
data("SPDData")
```

Format

A data frame with 2 observations on the following 5 variables.

`Data.Region` region where the diagnostic test was conducted

`TPDP` number of subjects with tested positive and the disease status positive (true positive)

`TPDN` number of subjects with tested positive but the disease status negative (false positive)

`TNDP` number of subjects with tested negative and the disease status positive (false negative)

`TNDN` number of subjects with tested negative and the disease status negative (true negative)

Source

https://www.accessdata.fda.gov/cdrh_docs/pdf16/P160052C.pdf

Examples

```
data(SPDData)
```

VaccineData *Dataset of a Vaccine Trial for RotaTeq and Multiple Historical Trials for Control Group*

Description

The study was designed to investigate the concomitant use of RotaTeq(Test Vaccine) and some routine pediatric vaccines between 2001-2005. The dataset includes four historical control trials. The purpose of the study is to borrow the historical controls for the non-inferiority trial. The interest is in the response rate to the routine vaccines.

Usage

```
data("VaccineData")
```

Format

A data frame with 6 observations on the following 7 variables.

`Data.Time` indicator of historical data (coded as 0) or current data (coded as 1).

`StudyID` character to distinguish different studies.

`Group` indicator of control group (coded as 0) or treatment group (coded as 1).

`Start.Year` start year of the trial

`End.Year` end year of the trial

`N` total number of patients enrolled and dosed in the group

`y` total number of patients respond to the vaccine

References

Liu, G.F. (2018). A Dynamic Power Prior for Borrowing Historical Data in Noninferiority Trials with Binary Endpoint. *Pharmaceutical Statistics 17:61-73.*

Examples

```
data(VaccineData)
```

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