

Package ‘saebnocov’

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Title Small Area Estimation using Empirical Bayes without Auxiliary Variable

Version 0.1.0

Description Estimates the parameter of small area in binary data without auxiliary variable using Empirical Bayes technique, mainly from Rao and Molina (2015,ISBN:9781118735787) with book entitled “Small Area Estimation Second Edition”.

This package provides another option of direct estimation using weight.

This package also features alpha and beta parameter estimation on calculating process of small area.

Those methods are Newton-

Raphson and Moment which based on Wilcox (1979) <doi:10.1177/001316447903900302> and Kleinman (1973) <doi:10.1080/01621459.1973.10481332>.

License GPL (>= 3)

Encoding UTF-8

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alphabetaEB	<i>Estimates alpha and beta parameter to obtain EB estimator</i>
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Description

Estimates alpha and beta parameter to obtain EB estimator

Usage

```
alphabetaEB(data.dir, pcap, method, opt, maxiter, tol)
```

Arguments

data.dir	Direct estimates of the data from function pcapdir
pcap	weighted sample mean and variance from function pcapdir
method	Method to estimate alpha and beta parameter according to person(rao or claire)
opt	Method to estimate alpha and beta parameter according to the way of calculation (moment or nr)
maxiter	the Maximum iteration value
tol	Tolerance error value at iteration

Value

This function returns a data frame with following objects :

alpha_cap	an alpha estimator by user's choice method
beta_cap	an beta estimator by user's choice method

Examples

```

## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])
## estimates alpha and beta parameter
## in EB estimate with Moment method by J.N.K.Rao
alphabetaEB(data.dir = temp$direct ,pcap = temp$pcap,
method = "rao", opt = "moment",maxiter = 100,tol = 0.00001)

##load dataset with weight value
data(dataEB)
temp = pcapdir(dataEB)
## estimates alpha and beta parameter
## in EB estimate with Moment method by Claire E.B.O.
alphabetaEB(data.dir = temp$direct ,pcap = temp$pcap,
method = "claire", opt = "moment",maxiter = 100,tol = 0.00001)

```

bootstrapEB	<i>Small Area Estimation method with Empirical Bayes and its RRMSE value by Bootstrap Method</i>
-------------	--

Description

Small Area Estimation method with Empirical Bayes and its RRMSE value by Bootstrap Method

Usage

```
bootstrapEB(data, method, opt, seed = NA, maxiter = 25, tol = 1e-05, B = 50)
```

Arguments

data	the data must contain two or three columns : code, y, and weight data if exist.
method	Method to estimate alpha and beta parameter according to person(rao or claire)
opt	Method to estimate alpha and beta parameter according to the way of calculation (moment or nr)
seed	Setting a seed in set.seed() function to initialize a pseudorandom number generator with default number 0
maxiter	the Maximum iteration value with default 100
tol	Tolerance error value at iteration with default 0.00001
B	The number of iteration of bootstrap resampling with default 200

Value

This function returns a list with following objects :

finalres an information about direct estimator and EB estimator in each area with its RRMSE value obtained by bootstrap method

eb.estimation an information about EB estimator in each area with its RRMSE value obtained by Naive method

References

Rao J, Peralta IM (2015). *Small Area Estimation Second Edition*. John Wiley & Sons, Inc., Hoboken, New Jersey, Canada. ISBN 978-1-118-73578-7.

Examples

```
## load dataset with no weight value
data(dataEB)
## Calculates EB estimator with its
## RRMSE value by Bootstrap method.
## Its alpha and beta estimator obtained
## by Moment method by J.N.K.Rao
bootstrapEB(data = dataEB[, -c(3)], method = "rao",
  opt = "moment", maxiter = 20, tol = 1e-5, B=20, seed=0)

##load dataset with weight value
data(dataEB)
## Calculates EB estimator with its
## RRMSE value by Bootstrap method.
## Its alpha and beta estimator obtained
## by Moment method by Claire E.B.O.
bootstrapEB(data = dataEB, method = "rao",
  opt = "moment", maxiter = 20, tol = 1e-5, B=20, seed=0)
```

dataEB

Sample Data for Practice

Description

An example data for trying and testing in saebnocov package

Usage

dataEB

Format

A sample data has 3 column, which are:

code code of each area

y status "success" or not in each unit sample of each area

weight a weight value in each unit sample of each area

Examples

```
data(dataEB)
```

EBnaive	<i>Small Area Estimation method with Empirical Bayes and its RRMSE value by Naive Method</i>
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Description

Small Area Estimation method with Empirical Bayes and its RRMSE value by Naive Method

Usage

```
EBnaive(data, method, opt, maxiter = 100, tol = 1e-05)
```

Arguments

data	the data must contain two or three columns : code, y, and weight data if exist.
method	Method to estimate alpha and beta parameter according to person(rao or claire)
opt	Method to estimate alpha and beta parameter according to the way of calculation (moment or nr)
maxiter	the Maximum iteration value with default 100
tol	Tolerance error value at iteration with default 0.00001

Value

This function returns a list with following objects :

finalres	an information about direct estimator and EB estimator in each area
estimation	an information about EB estimator and its RRMSE value obtained by Naive method
parameter	Alpha and beta estimator
pcap	pcap (the weighted sample mean), vardir (the weighted sample variance),yt (the total number of the "success" category from each area), and nt (the total number of sample from each area)
dir.est	an information about direct estimator

Examples

```

## load dataset with no weight value
data(dataEB)
## Calculates EB estimator
## with its RRMSE value by Naive method.
## Its alpha and beta estimator obtained
## by Moment method by J.N.K.Rao
EBnaive(data = dataEB[, -c(3)], method = "rao", opt = "moment", maxiter = 100, tol = 1e-5)

##load dataset with weight value
data(dataEB)
## Calculates EB estimator
## with its RRMSE value by Naive method.
## Its alpha and beta estimator obtained
## by Moment method by Claire E.B.O.
EBnaive(data = dataEB, method = "claire", opt = "moment", maxiter = 100, tol = 1e-5)

```

estEBnaive	<i>Small Area Estimation method with Empirical Bayes and its RRMSE value by Naive Method</i>
------------	--

Description

Small Area Estimation method with Empirical Bayes and its RRMSE value by Naive Method

Usage

```
estEBnaive(data.dir, pcap, param)
```

Arguments

data.dir	direct estimator information from function direct.est
pcap	pcap (the weighted sample mean), vardir (the weighted sample variance), yt (the total number of the "success" category from each area), and nt (the total number of sample from each area)
param	Alpha and Beta estimator

Value

This function returns a list with following objects :

eb.est	EB estimator in each area
mse	MSE of EB estimator obtained by Naive method
rrmse	RRMSE of EB estimator obtained by Naive method

Examples

```

## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])

## estimates alpha and beta parameter
## in EB estimate with Moment method by J.N.K.Rao
temp1 = alphabetaEB(data.dir = temp$direct ,pcap = temp$pcap,
                    method = "rao", opt = "moment",
                    maxiter = 100, tol = 0.00001)

## calculates EB estimator
## and its MSE by naive method
estEBnaive(data.dir = temp$direct, pcap = temp$pcap, param = temp1)

```

jackknifeEB	<i>Small Area Estimation method with Empirical Bayes and its RRMSE value by Jackknife Method</i>
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Description

Small Area Estimation method with Empirical Bayes and its RRMSE value by Jackknife Method

Usage

```
jackknifeEB(data, method, opt, maxiter = 100, tol = 1e-05)
```

Arguments

data	the data must contain two or three columns : code, y, and weight data if exist.
method	Method to estimate alpha and beta parameter according to person(rao or claire)
opt	Method to estimate alpha and beta parameter according to the way of calculation (moment or nr)
maxiter	the Maximum iteration value with default 100
tol	Tolerance error value at iteration with default 0.00001

Value

This function returns a list with following objects :

finalres	an information about direct estimator and EB estimator in each area with its RRMSE value obtained by jackknife method
eb.estimation	an information about EB estimator in each area with its RRMSE value obtained by Naive method

Examples

```
## load dataset with no weight value
data(dataEB)
## Calculates EB estimator with
## its RRMSE value by Jackknife method.
## Its alpha and beta estimator obtained
## by Moment method by J.N.K.Rao
jackknifeEB(data = dataEB[,-c(3)], method = "rao",
  opt = "moment", maxiter = 20, tol = 1e-5)

##load dataset with weight value
data(dataEB)
## Calculates EB estimator with
## its RRMSE value by Jackknife method.
## Its alpha and beta estimator obtained
## by Moment method by Claire E.B.O.
jackknifeEB(data = dataEB, method = "rao",
  opt = "moment", maxiter = 20, tol = 1e-5)
```

matrixClaire

Matrix G in Newton Raphson method by Claire E.B.O.

Description

Matrix G in Newton Raphson method by Claire E.B.O.

Usage

```
matrixClaire(alpha, beta)
```

Arguments

alpha	An alpha estimate value on iterating process
beta	A beta estimate value on iterating process

Value

This function returns a value of matrix G.

Examples

```
## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[,-c(3)])

## estimates alpha and beta parameter
## in EB estimate with Moment method by J.N.K.Rao
temp1 = alphabetaEB(data.dir = temp$direct ,pcap = temp$pcap,
```

```

method = "rao", opt = "moment",
maxiter = 100,tol = 0.00001)

##calculates matrix G
matrixClaire(alpha = temp1$alpha_cap, beta = temp1$beta_cap)

```

matrixRao

*Matrix G in Newton Raphson method by J.N.K.Rao***Description**

Matrix G in Newton Raphson method by J.N.K.Rao

Usage

```
matrixRao(alpha, beta, ni, yi)
```

Arguments

alpha	An alpha estimate value on iterating process
beta	A beta estimate value on iterating process
ni	The number of sample in each area
yi	The number of "success" value in each area

Value

This function returns a value of matrix G.

Examples

```

## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])

## estimates alpha and beta parameter
## in EB estimate with Moment method by J.N.K.Rao
temp1 = alphabetaEB(data.dir = temp$direct ,pcap = temp$pcap,
                    method = "rao", opt = "moment",
                    maxiter = 100,tol = 0.00001)

##calculates matrix G
matrixRao(alpha = temp1$alpha_cap,
beta = temp1$beta_cap, ni = temp$direct$ni,
yi = temp$direct$yi)

```

momentClaire	<i>Estimates alpha and beta parameter with Moment method by Claire E.B.O.</i>
--------------	---

Description

Estimates alpha and beta parameter with Moment method by Claire E.B.O.

Usage

```
momentClaire(data.dir, pcap)
```

Arguments

data.dir	Direct estimates of the data from function pcapdir
pcap	weighted sample mean and variance from function pcapdir

Value

This function returns a data frame with following objects :

alpha_cap	an alpha estimator by Moment method of Claire E.B.O.
beta_cap	a beta estimator by Moment method of Claire E.B.O.

Examples

```
## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[,-c(3)])
momentClaire(data.dir = temp$direct, pcap = temp$pcap)

##load dataset with weight value
data(dataEB)
temp = pcapdir(dataEB[,-c(3)])
momentClaire(data.dir = temp$direct, pcap = temp$pcap)
```

momentRao	<i>Estimates alpha and beta parameter with Moment method by J.N.K.Rao</i>
-----------	---

Description

Estimates alpha and beta parameter with Moment method by J.N.K.Rao

Usage

```
momentRao(data.dir, pcap)
```

Arguments

```
data.dir      Direct estimates of the data from function pcapdir
pcap          weighted sample mean and variance from function pcapdir
```

Value

This function returns a data frame with following objects :

```
alpha_cap     an alpha estimator by Moment method of Claire E.B.O.
beta_cap      an beta estimator by Moment method of Claire E.B.O.
```

Examples

```
## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])
momentRao(data.dir = temp$direct, pcap = temp$pcap)

##load dataset with weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])
momentRao(data.dir = temp$direct, pcap = temp$pcap)
```

newtonRaphsonC	<i>Estimates alpha and beta parameter with Newton Raphson method by Claire E.B.O.</i>
----------------	---

Description

Estimates alpha and beta parameter with Newton Raphson method by Claire E.B.O.

Usage

```
newtonRaphsonC(data.dir, pcap, maxiter, tol)
```

Arguments

```
data.dir      Direct estimates of the data from function pcapdir
pcap          weighted sample mean and variance from function pcapdir
maxiter       the Maximum iteration value
tol           Tolerance error value in iteration
```

Value

This function returns a data frame with following objects :

alpha_cap an alpha estimator by Newton Raphson method of Claire E.B.O.
 beta_cap an beta estimator by Newton Raphson method of Claire E.B.O.

Examples

```
## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])
newtonRaphsonC(data.dir = temp$direct, pcap = temp$pcap,
  maxiter = 100, tol = 0.00001)

##load dataset with weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])
newtonRaphsonC(data.dir = temp$direct, pcap = temp$pcap,
  maxiter = 100, tol = 0.00001)
```

newtonRaphsonR	<i>Estimates alpha and beta parameter with Newton Raphson method by J.N.K. Rao</i>
----------------	--

Description

Estimates alpha and beta parameter with Newton Raphson method by J.N.K. Rao

Usage

```
newtonRaphsonR(data.dir, pcap, maxiter, tol)
```

Arguments

data.dir Direct estimates of the data from function pcapdir
 pcap weighted sample mean and variance from function pcapdir
 maxiter the Maximum iteration value
 tol Tolerance error value in iteration

Value

This function returns a data frame with following objects :

alpha_cap an alpha estimator by Newton Raphson method of J.N.K.Rao
 beta_cap an beta estimator by Newton Raphson method of J.N.K.Rao

Examples

```
## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])
newtonRaphsonR(data.dir = temp$direst, pcap = temp$pcap,
  maxiter = 100, tol = 0.00001)

##load dataset with weight value
data(dataEB)
temp = pcapdir(dataEB)
newtonRaphsonR(data.dir = temp$direst, pcap = temp$pcap,
  maxiter = 100, tol = 0.00001)
```

pcapdir

*Weighted Sample Mean and Variance***Description**

Weighted Sample Mean and Variance

Usage

pcapdir(data)

Arguments

data the data must contain two or three columns : code, y, and weight data if exist.

Value

This function returns a list with following objects :

direst an information about direct estimator in each area

pcap pcap (the weighted sample mean), vardir (the weighted sample variance), yt (the total number of the "success" category from each area), and nt (the total number of sample from each area)

Examples

```
## load dataset with no weight value
data(dataEB)
pcapdir(dataEB[, -c(3)])

##load dataset with weight value
data(dataEB)
pcapdir(dataEB)
```

vectorClaire *Vector g in Newton Raphson Method by Claire E.B.O.*

Description

Vector g in Newton Raphson Method by Claire E.B.O.

Usage

```
vectorClaire(alpha, beta, p)
```

Arguments

alpha	An alpha estimate value on iterating process
beta	A beta estimate value on iterating process
p	direct estimator or proportion value

Value

This function returns a value of vector g.

Examples

```
## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])

## estimates alpha and beta parameter
## in EB estimate with Moment method by J.N.K.Rao
temp1 = alphabetaEB(data.dir = temp$direct ,pcap = temp$pcap,
                    method = "rao", opt = "moment",
                    maxiter = 100, tol = 0.00001)

##calculates vector g
vectorClaire(alpha = temp1$alpha_cap, beta = temp1$beta_cap, p = temp$direct$p)
```

vectorRao *Vector g in Newton Raphson Method by J.N.K.Rao*

Description

Vector g in Newton Raphson Method by J.N.K.Rao

Usage

```
vectorRao(alpha, beta, ni, yi)
```

Arguments

alpha	An alpha estimate value on iterating process
beta	A beta estimate value on iterating process
ni	The number of sample in each area
yi	The number of "success" value in each area

Value

This function returns a value of vector g.

Examples

```
## load dataset with no weight value
data(dataEB)
temp = pcapdir(dataEB[, -c(3)])

## estimates alpha and beta parameter
## in EB estimate with Moment method by J.N.K.Rao
temp1 = alphabetaEB(data.dir = temp$direct ,pcap = temp$pcap,
                    method = "rao", opt = "moment",
                    maxiter = 100, tol = 0.00001)

##calculates vector g
vectorRao(alpha = temp1$alpha_cap, beta = temp1$beta_cap,
          ni = temp$direct$ni, yi = temp$direct$yi)
```

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