Package ‘saebnocov’

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Title  Small Area Estimation using Empirical Bayes without Auxiliary Variable

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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.

License  GPL (>= 3)

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alphabetaEB

Estimates alpha and beta parameter to obtain EB estimator

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

```r
## 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$direst, pcap = temp$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$direst, pcap = temp$pcap,
method = "claire", opt = "moment", maxiter = 100, tol = 0.00001)
```

#### Description

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

#### Usage

```r
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


Examples

```r
## 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
**EBnaive**

**Format**

A sample data has 3 columns, 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**

```r
data(dataEB)
```

---

**Description**

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

**Usage**

```r
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

```r
## 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)
```

```r
## 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**

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

---

**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

```r
## 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$direst, pcap = temp$pcap,
                   method = "rao", opt = "moment",
                   maxiter = 100, tol = 0.00001)

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

---

**jackknifeEB**

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

**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

```r
## 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

```r
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

```r
## 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$direst, pcap = temp$pcap,
```
## matrixRao

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

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

---

**Description**

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

**Usage**

```r
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**

```r
## 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$direst,pcap = temp$pcap,
method = "rao", opt = "moment",
maxiter = 100,tol = 0.00001)

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

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

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

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

momentRao

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

### 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

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

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

---

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

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
newtonRaphsonR

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$direst, pcap = temp$pcap,
maxiter = 100, tol = 0.00001)

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

newtonRaphsonR

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

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

```r
## 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

```r
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

```r
## 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**

```r
## 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$direst, pcap = temp$pcap,
    method = "rao", opt = "moment",
    maxiter = 100, tol = 0.00001)

## calculates vector g
vectorClaire(alpha = temp1$alpha_cap, beta = temp1$beta_cap, p = temp1$direst$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)
vectorRao

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

```r
## 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$direst, pcap = temp$pcap,
                     method = "rao", opt = "moment",
                     maxiter = 100, tol = 0.00001)

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