# Package 'saebnocov'

October 14, 2022

**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

**RoxygenNote** 7.2.1

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

**Imports** descr, dplyr, rlang, stats

**Depends** R (>= 3.5.0)

**LazyData** true

**NeedsCompilation** no

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**Repository** CRAN

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## R **topics documented:**

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alphabetaEB *Estimates alpha and beta parameter to obtain EB estimator*

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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$direst ,pcap = temp$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)
```

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| bootstrapEB | *Small Area Estimation method with Empirical Bayes and its RRMSE value by Bootstrap Method* |
|---|---|

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## 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)
```

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dataEB                          *Sample Data for Practice*

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**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)
```

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| EBnaive | *Small Area Estimation method with Empirical Bayes and its RRMSE value by Naive Method* |
|---|---|

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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 estimatior 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)
```

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| estEBnaive | *Small Area Estimation method with Empirical Bayes and its RRMSE value by Naive Method* |
|---|---|

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## 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$direst ,pcap = temp$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)
```

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| 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**

```
## 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)
```

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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$direst ,pcap = temp$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$direst ,pcap = temp$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)
```

---

momentClaire                    *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

```
## 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

```
## 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 |

**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

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

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

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

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

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