Package 'SumcaVer1'

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Type Package

Title Mean Square Prediction Error Estimation in Small Area Estimation

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Maintainer Mahmoud Torabi <mahmoud.torabi@umanitoba.ca>

Description Estimation of mean squared prediction error of a small area predictor is provided. In particular, the recent method of Simple, Unified, Monte-Carlo Assisted approach for the mean squared prediction error estimation of small area predictor is provided. We also provide other existing methods of mean squared prediction error estimation such as jackknife method for the mixed logistic model.

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Author Mahmoud Torabi [aut, cre],
Jiming Jiang [ctb]

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Contents

`mspe_FH_Boot` *MSPE estimation in FH model using double-phase bootstrap method.Calculate the mspe of Fay-Herriot model in SAE using double-phase bootstrap method.*

Description

MSPE estimation in FH model using double-phase bootstrap method.Calculate the mspe of Fay-Herriot model in SAE using double-phase bootstrap method.

Usage

```
mspe_FH_Boot(m, p, X, beta, A, D, B1, B2, R)
```

Arguments

`m`	number of small areas
`p`	number of fixed model parameters
`X`	covariates
`beta`	regression coefficients
`A`	variance of area-specific random effects
`D`	sampling variance
`B1`	number of first-phase bootstrap method
`B2`	number of second-phase bootstrap method
`R`	number of simulation runs

Value

Par: return estimation of model parameters

MSPE.TRUE.Final: return empirical MSPE of small area predictor

mspe.Boot1.Final: return mspe of small area predictor using the bootstrap method 1

mspe.Boot2.Final: return mspe of small area predictor using the bootstrap method 2

RB.Boot1: return relative bias (RB) of mspe of small area predictor using the bootstrap method 1

RB.Boot2: return relative bias (RB) of mspe of small area predictor using the bootstrap method 2

Examples

```
mspe_FH_Boot(20,3,matrix(runif(60,0,1),nrow=20,byrow=TRUE),c(1,1,1),10,2.5,20,20,10)
```

`mspe_FH_PR` *MSPE estimation in FH model using Prasad-Rao method. Calculate the mspe of Fay-Herriot model in SAE using Prasad-Rao method.*

Description

MSPE estimation in FH model using Prasad-Rao method. Calculate the mspe of Fay-Herriot model in SAE using Prasad-Rao method.

Usage

```
mspe_FH_PR(m, p, X, beta, A, D, R)
```

Arguments

`m`	number of small areas
`p`	number of fixed model parameters
`X`	Covariates
`beta`	regression coefficients
`A`	variance of area-specific random effects
`D`	sampling variance
`R`	number of simulation runs

Value

Par: return estimation of model parameters

MSPE.TRUE.Final: return empirical MSPE of small area predictor

mspe.PR.Final: return mspe of small area predictor using the Prasad-Rao method

RB.PR: return relative bias (RB) of mspe of small area predictor using the Prasad-Rao method

Examples

```
mspe_FH_PR(20,3,matrix(runif(60,0,1),nrow=20,byrow=TRUE),c(1,1,1),10,2.5,10)
```

`mspe_FH_Sumca` *MSPE estimation in FH model using SUMCA method. Calculate the mspe of Fay-Herriot model in SAE using Sumca method.*

Description

MSPE estimation in FH model using SUMCA method. Calculate the mspe of Fay-Herriot model in SAE using Sumca method.

Usage

```
mspe_FH_Sumca(m, p, X, beta, A, D, K, R)
```

Arguments

`m`	number of small areas
`p`	number of fixed model parameters
`X`	covariates
`beta`	regression coefficients
`A`	variance of area-specific random effects
`D`	sampling variance
`K`	number of Monte Carlo for the SUMCA method
`R`	number of simulation runs

Value

Par: return estimation of model parameters

MSPE.TRUE.Final: return empirical MSPE of small area predictor

mspe.Sumca.Final: return mspe of small area predictor using the SUMCA method

RB.SUMCA: return relative bias (RB) of mspe of small area predictor using the SUMCA method

Examples

```
mspe_FH_Sumca(20,3,matrix(runif(60,0,1),nrow=20,byrow=TRUE),c(1,1,1),10,2.5,10,10)
```

mspe_LOGISTIC_HealthData_BOOT

MSPE estimation in mixed logistic model (Health Insurance data) using bootstrap method. Calculate the mspe of mixed logistic model (Health Insurance data) using bootstrap method.

Description

MSPE estimation in mixed logistic model (Health Insurance data) using bootstrap method. Calculate the mspe of mixed logistic model (Health Insurance data) using bootstrap method.

Usage

```
mspe_LOGISTIC_HealthData_BOOT(
  m,
  p,
  n.new,
  y.new,
  cum.n.new,
  Xi,
  yi.tem,
  X.tem,
  county.tem,
  B
)
```

Arguments

m	number of domains
p	number of complete model parameters
n.new	sample size of each domain
y.new	response variable
cum.n.new	Cummulaticve sum of n
Xi	covariates
yi.tem	response variable for each individual
X.tem	Individual level covariates
county.tem	county
B	number of bootstrap iterations

Value

Par: return estimation of model parameters

Mu.hat: return prediction of domain parameters

mspe.boot: return mspe of small area (domain) predictor using the bootstrap method

sq.mspe.boot: return square root of mspe of small area predictor for non-zero domains using the bootstrap method

Examples

```
mspe_LOGISTIC_HealthData_BOOT(20,3,c(2,1,2,2,1,2,3,1,1,3,1,3,2,3,3,
1,2,1,3,3),c(3,4,2,2,3,3,4,3,4,1,4,1,3,5,4,7,1,3,1,2),c(2,3,5,7,8,10,13,14,15
,18,19,22,24,27,30,31,33,34,37,40),
matrix(runif(60,0,1),nrow=20,byrow=TRUE),sample(c(0,1),replace=TRUE,40),
matrix(c(runif(40,7,10),runif(40,14,22),runif(40,2,4)),nrow=40,byrow=FALSE),
rep(1:20,each=2),10)
```

---

mspe_LOGISTIC_HealthData_JLW

MSPE estimation in mixed logistic model (Health Insurance data) using jackknife method.Calculate the mspe of mixed logistic model (Health Insurance data) using jackknife method.

Description

MSPE estimation in mixed logistic model (Health Insurance data) using jackknife method.Calculate the mspe of mixed logistic model (Health Insurance data) using jackknife method.

Usage

```
mspe_LOGISTIC_HealthData_JLW(
  m,
  p,
  n.new,
  y.new,
  Xi,
  yi.tem,
  cum.n.new,
  county.tem,
  X.tem
)
```

Arguments

m	number of domains
p	number of complete model parameters
n.new	sample size of each domain
y.new	response variable
Xi	covariates for each domain

yi.tem	response variable for each individual
cum.n.new	Cummulative sum of n
county.tem	county
X.tem	Individual level covariates

Value

Par: return estimation of model parameters

Mu.hat: return prediction of domain parameters

mspe.JLW: return mspe of small area (domain) predictor using the jackknife method

sq.mspe.JLW: return square root of mspe of small area predictor for non-zero domains using the jackknife method

Examples

```
mspe_LOGISTIC_HealthData_JLW(20,3,c(2,1,2,2,1,2,3,1,1,3,1,3,2,3,3,
1,2,1,3,3),c(3,4,2,2,3,3,4,3,4,1,4,1,3,5,4,7,1,3,1,2),
matrix(runif(60,0,1),nrow=20,byrow=TRUE),sample(c(0,1),replace=TRUE,40),
c(2,3,5,7,8,10,13,14,15,18,19,22,24,27,30,31,33,34,37,40),rep(1:20,each=2),
matrix(c(runif(40,7,10),runif(40,14,22),runif(40,2,4)),nrow=40,byrow=FALSE))
```

---

mspe_LOGISTIC_HealthData_SUMCA

MSPE estimation in mixed logistic model (Health Insurance data) using SUMCA method.Calculate the mspe of mixed logistic model (Health Insurance data) using SUMCA method.

Description

MSPE estimation in mixed logistic model (Health Insurance data) using SUMCA method.Calculate the mspe of mixed logistic model (Health Insurance data) using SUMCA method.

Usage

```
mspe_LOGISTIC_HealthData_SUMCA(
  m,
  p,
  n.new,
  y.new,
  Xi,
  cum.n.new,
  yi.tem,
  X.tem,
  county.tem,
  K
)
```

Arguments

m	number of domains
p	number of complete model parameters
n.new	sample size of each domain
y.new	response variable
Xi	covariates
cum.n.new	Cummulative sum of n
yi.tem	response variable for each individual
X.tem	Individual level covariates
county.tem	county
K	number of Monte Carlo for the SUMCA method

Value

Par: return estimation of model parameters

Mu.hat: return prediction of domain parameters

mspe.Sumca: return mspe of small area (domain) predictor using the SUMCA method

sq.mspe.Sumca: return square root of mspe of small area predictor for non-zero domains using the SUMCA method

Examples

```
mspe_LOGISTIC_HealthData_SUMCA(20,3,c(2,1,2,2,1,2,3,1,1,3,1,3,2,3,
3,1,2,1,3,3),c(3,4,2,2,3,3,4,3,4,1,4,1,3,5,4,7,1,3,1,2),
matrix(runif(60,0,1),nrow=20,byrow=TRUE),c(2,3,5,7,8,10,13,14,15
,18,19,22,24,27,30,31,33,34,37,40),sample(c(0,1),replace=TRUE,40),
matrix(c(runif(40,7,10),runif(40,14,22),runif(40,2,4)),nrow=40,byrow=FALSE),
rep(1:20,each=2),10)
```

---

mspe_MS_LOGISTIC_JLW *Model selection MSPE estimation in mixed logistic model using jackknife method.Calculate the model selection mspe of mixed logistic model using jackknife method.*

Description

Model selection MSPE estimation in mixed logistic model using jackknife method.Calculate the model selection mspe of mixed logistic model using jackknife method.

Usage

```
mspe_MS_LOGISTIC_JLW(m, p, ni, X, beta, A, R)
```

Arguments

m	number of small areas
p	number of complete model parameters
ni	sample size of each small area
X	covariates for the complete model
beta	regression coefficients of the complete model
A	variance of area-specific random effects
R	number of simulation runs

Value

Par1: return estimation of model parameters of the complete model

Par2: return estimation of model parameters of the reduced model

MSPE: return empirical MSPE of small area predictor

mspe.JLW: return mspe of small area predictor using the jackknife method

RB.JLW: return relative bias (RB) of mspe of small area predictor using the jackknife method

BIC: return BIC of the complete and reduced models

Examples

```
mspe_MS_LOGISTIC_JLW(20,3,2,
matrix(runif(60,0,1),nrow=20,byrow=TRUE),c(1,1,1),10,2)
```

---

mspe_MS_LOGISTIC_SUMCA

Model selection MSPE estimation in mixed logistic model using SUMCA method. Calculate the model selection mspe of mixed logistic model using SUMCA method.

Description

Model selection MSPE estimation in mixed logistic model using SUMCA method. Calculate the model selection mspe of mixed logistic model using SUMCA method.

Usage

```
mspe_MS_LOGISTIC_SUMCA(m, p, ni, X, beta, A, K, R)
```

Arguments

m	number of small areas
p	number of complete model parameters
ni	sample size of each small area
X	covariates for the complete model
beta	regression coefficients of the complete model
A	variance of area-specific random effects
K	number of Monte Carlo for the SUMCA method
R	number of simulation runs

Value

Par1: return estimation of model parameters of the complete model

Par2: return estimation of model parameters of the reduced model

MSPE: return empirical MSPE of small area predictor

mspe.Sumca: return mspe of small area predictor using the SUMCA method

RB.SUMCA: return relative bias (RB) of mspe of small area predictor using the SUMCA method

BIC: return BIC of the complete and reduced models

Examples

```
mspe_MS_LOGISTIC_SUMCA(20,3,2,matrix(runif(60,0,1),nrow=20,byrow=TRUE),c(1,1,1),10,5,5)
```

---

mspe_PMS_FH_DHM *Post model selection MSPE estimation in FH model using Datta-Hall-Mandal method. Calculate the post-model selection mspe of Fay-Herriot model using Datta-Hall-Mandal method.*

Description

Post model selection MSPE estimation in FH model using Datta-Hall-Mandal method. Calculate the post-model selection mspe of Fay-Herriot model using Datta-Hall-Mandal method.

Usage

```
mspe_PMS_FH_DHM(m, p, X, beta, A, D, R)
```

Arguments

m	number of small areas
p	number of fixed model parameters
X	covariates
beta	regression coefficients
A	variance of area-specific random effects
D	sampling variance
R	number of simulation runs

Value

Par: return estimation of model parameters

MSPE.TRUE.Final: return empirical MSPE of small area predictor

mspe.DHM.Final: return mspe of small area predictor using the Datta-Hall-Mandal method

RB.DHM: return relative bias (RB) of mspe of small area predictor using the Datta-Hall-Mandal method

Rate: return the probability of rejection (nominal level= 0.2)

Examples

```
mspe_PMS_FH_DHM(20,3,matrix(runif(60,0,1),nrow=20,byrow=TRUE),
c(1,1,1),10,2.5,10)
```

---

mspe_PMS_FH_SUMCA *Post model selection MSPE estimation in FH model using SUMCA method. Calculate the post-model selection mspe of Fay-Herriot model using SUMCA method.*

Description

Post model selection MSPE estimation in FH model using SUMCA method. Calculate the post-model selection mspe of Fay-Herriot model using SUMCA method.

Usage

```
mspe_PMS_FH_SUMCA(m, p, X, beta, A, D, K, R)
```

Arguments

m	number of small areas
p	number of fixed model parameters
X	covariates
beta	regression coefficients
A	variance of area-specific random effects
D	sampling variance
K	number of Monte Carlo for the SUMCA method
R	number of simulation runs

Value

Par: return estimation of model parameters

MSPE.TRUE.Final: return empirical MSPE of small area predictor

mspe.Sumca.Final: return mspe of small area predictor using the SUMCA method

RB.SUMCA: return relative bias (RB) of mspe of small area predictor using the SUMCA method

Examples

```
mspe_PMS_FH_SUMCA(20,3,matrix(runif(60,0,1),nrow=20,byrow=TRUE),
c(1,1,1),10,2.5,10,10)
```

---

mspe_PMS_Mis_FH_DHM *Post model selection MSPE estimation in FH model with mean mis-specification using Datta-Hall-Mandal method. Calculate the post-model selection mspe of Fay-Herriot model with mean mis-specification using Datta-Hall-Mandal method.*

Description

Post model selection MSPE estimation in FH model with mean mis-specification using Datta-Hall-Mandal method. Calculate the post-model selection mspe of Fay-Herriot model with mean mis-specification using Datta-Hall-Mandal method.

Usage

```
mspe_PMS_Mis_FH_DHM(m, p, X, beta1, beta2, A, D, R)
```

Arguments

m	number of small areas
p	number of fixed model parameters
X	covariates
beta1	regression coefficients
beta2	regression coefficients
A	variance of area-specific random effects
D	sampling variance
R	number of simulation runs

Value

Par: return estimation of model parameters

MSPE.TRUE.Final: return empirical MSPE of small area predictor

mspe.DHM.Final: return mspe of small area predictor using the Datta-Hall-Mandal method

RB.DHM: return relative bias (RB) of mspe of small area predictor using the Datta-Hall-Mandal method

Rate: return the probability of rejection (nominal level= 0.2)

Examples

```
mspe_PMS_Mis_FH_DHM(20,3,matrix(runif(60,0,1),nrow=20,byrow=TRUE),
c(1,1,1),c(1,1,1),10,2.5,10)
```

---

mspe_PMS_Mis_FH_SUMCA *Post model selection MSPE estimation in FH model with mean mis-specification using SUMCA method. Calculate the post-model selection mspe of Fay-Herriot model with mean mis-specification using SUMCA method.*

Description

Post model selection MSPE estimation in FH model with mean mis-specification using SUMCA method. Calculate the post-model selection mspe of Fay-Herriot model with mean mis-specification using SUMCA method.

Usage

```
mspe_PMS_Mis_FH_SUMCA(m, p, X, beta1, beta2, A, D, K, R)
```

Arguments

m	number of small areas
p	number of fixed model parameters
X	covariates
beta1	regression coefficient
beta2	regression coefficient
A	variance of area-specific random effects
D	sampling variance
K	number of Monte Carlo for the SUMCA method
R	number of simulation runs

Value

Par: return estimation of model parameters

MSPE.TRUE.Final: return empirical MSPE of small area predictor

mspe.Sumca.Final: return mspe of small area predictor using the SUMCA method

RB.SUMCA: return relative bias (RB) of mspe of small area predictor using the SUMCA method

Examples

```
mspe_PMS_Mis_FH_SUMCA(20,3,matrix(runif(60,0,1),nrow=20,byrow=TRUE)
,c(1,1,1),c(1,1,1),10,2.5,10,10)
```

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