Package ‘FEprovideR’

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Title  Fixed Effects Logistic Model with High-Dimensional Parameters

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confint.fe.prov  

**Compute confidence intervals for fitted model**

**Description**

confint.fe.prov computes the (1-alpha)% confidence intervals for the fixed effect parameter estimates. Go to Github\(^1\) for a tutorial.

**Usage**

```r
## S3 method for class 'fe.prov'
confint(object, parm = "all", level = 0.95, data, Y.char, Z.char, prov.char, ...)
```

**Arguments**

- `object`: fitted model object (fit using `fe.prov`)
- `parm`: provider IDs for which confidence intervals are desired. The default is "all". Specify a subset of provider effects with a numeric vector of provider IDs. For example, `parm=c(1,20)` for providers 1 and 20.
- `level`: confidence level (default is 0.95)
- `data`: prepared `data.frame`. Use `fe.data.prep` to prepare the raw data
- `Y.char`: Y.char name of the response variable from `data` as a character string
- `Z.char`: Z.char names of covariates from `data` as vector of character strings
- `prov.char`: name of provider IDs variable as a character string
- `...`: extra arguments to be passed to `confint`

**Value**

Returns a `data.frame` of gamma and SRR lower and upper CI bounds. Each row is a parameter, each column gives a different bound.

**References**


**See Also**

`fe.data.prep, fe.prov, test.fe.prov, funnel.SRR`

\(^1\)https://github.com/umich-biostatistics/FEprovideR
Examples

# Name input variables and other parameters
# a small positive number specifying stopping
# criterion of Newton-Raphson algorithm
tol <- 1e-5
Y.char <- 'Y'
prov.char <- 'prov.ID'
Z.char <- paste0('z', 1:3)
data(hospital_prepared) # build in data set
fe.ls <- fe.prov(hospital_prepared, Y.char, Z.char, prov.char, tol) # model fitting

# confidence intervals
confint.fe.prov(fe.ls, parm = "all", level = 0.95,
               hospital_prepared, Y.char, Z.char, prov.char)

---

fe.data.prep

Prepares data for model fitting (fe.prov)

Description

fe.data.prep prepares the data for model fitting with fe.prov by taking the data with missing values imputed. Go to Github\(^2\) for a tutorial.

Usage

fe.data.prep(data, Y.char, Z.char, prov.char, cutoff = 10)

Arguments

data: a data.frame including response, provider ID, and covariates, with missing values imputed
Y.char: name of the response variable from data as a character string
Z.char: names of covariates from data as vector of character strings
prov.char: name of provider IDs variable as a character string
cutoff: cutoff of provider size as an integer, default value is 10

Value

data.frame: a data frame sorted by provider IDs with additional variables 'included', 'no.readm', 'all.readm' and missing values imputed.

References


\(^2\)https://github.com/umich-biostatistics/FEPprovideR
See Also

fe.prov, test.fe.prov, funnel.SRR, confint.fe.prov

Examples

data(hospital) # build in data set
# Name input variables and other parameters
cutoff <- 10  # an integer as cutoff of facility (or provider) size with 10 as default
alpha <- 0.05 # significance level
Y.char <- 'Y'
prov.char <- 'prov.ID'
Z.char <- paste0('z', 1:3)

hospital_prepared <- fe.data.prep(hospital, Y.char, Z.char, prov.char, cutoff) # data preparation


---

**fe.prov**

*Fit logistic fixed-effect model with high-dimensional predictors*

Description

`fe.prov` fits a fixed-effect logistic model using structured profile likelihood algorithm. Standardized readmission ratios (SRRs) are also computed. Go to Github\(^3\) for a tutorial.

Usage

```r
fe.prov(data, Y.char, Z.char, prov.char, tol = 1e-05, null = "median")
```

Arguments

- **data**: prepared data frame. Use `fe.data.prep` to prepare the raw data
- **Y.char**: name of the response variable from `data` as a character string
- **Z.char**: names of covariates from `data` as a vector of character strings
- **prov.char**: name of provider IDs variable as a character string
- **tol**: tolerance level for convergence. Default is `1e-5`
- **null**: use median for null comparison

Value

An object of class `fe.prov`, which is just a `List` object with the following named elements:

- **beta**: a vector of fixed effect estimates
- **Obs**: a vector of responses for included providers
- **Exp**: a vector of expected probabilities of readmission within 30 days of discharge

\(^3\)[https://github.com/umich-biostatistics/FEprovideR](https://github.com/umich-biostatistics/FEprovideR)
funnel.SRR

- **iter**: number of iterations needed for convergence
- **beta.max.diff**: value of the stopping criterion
- **df.prov**: 

  df.prov is a data.frame of provider-level information with the following items:

  - **Obs**: provider-level observed number of readmissions within 30 days
  - **Exp**: expected number of readmissions within 30 days
  - **SRR**: standardized readmission ratios for each hospital
  - **gamma**: a vector of provider effect estimates for included hospitals

References


See Also

fe.data.prep, test.fe.prov, funnel.SRR, confint.fe.prov

Examples

```r
# Name input variables and other parameters
# a small positive number specifying stopping criterion of Newton-Raphson algorithm
tol <- 1e-5
Y.char <- 'Y'
prov.char <- 'prov.ID'
Z.char <- paste0('z', 1:3)
data(hospital_prepared) # build in data set
fe.ls <- fe.prov(hospital_prepared, Y.char, Z.char, prov.char, tol) # model fitting
```

---

**funnel.SRR**

*Funnel plot for SRR (standardized readmission ratios)*

Description

funnel.SRR produces and returns funnel plots for the analysis using discharge-specific and patient-specific inputs with provider ID. Go to Github[^4] for a tutorial.

Usage

```r
funnel.SRR(input.dis, input.prov, target = 1, alphas = c(0.1, 0.05, 0.01), type = "FE.score", sigma.b = NULL)
```

[^4]: https://github.com/umich-biostatistics/FEprovideR
funnel.SRR

Arguments

input.dis a data.frame consisting of discharge-specific inputs and provider ID
input.prov a data.frame consisting of provider-specific inputs and provider ID
target target standardized readmission ratio (SRR)
alphas numeric vector of alpha levels of interest
type string of length one containing the type of test performed. Currently options include "score", "exact", "FE.score", "FE.exact", "FERE.score", "FERE.exact"
sigma.b sigma for random effects. Should only have value other than null if prefix "FERE." specified in type= argument

Value

Returns a ggplot object. Unless stored in a new object, will be printed automatically.

References


See Also

fe.data.prep, fe.prov, test.fe.prov, confint.fe.prov, ggplot2

Examples

# Name input variables and other parameters
# a small positive number specifying stopping criterion of Newton-Raphson algorithm
tol <- 1e-5
Y.char <- 'Y'
prov.char <- 'prov.ID'
Z.char <- paste0('z', 1:3)
data(hospital_prepared) # build in data set
fe.ls <- fe.prov(hospital_prepared, Y.char, Z.char, prov.char, tol) # model fitting

# Hypothesis tests
null = "median"
alpha <- 0.05 # significance level
score.fe <- test.fe.prov(hospital_prepared, fe.ls, Y.char, Z.char, prov.char, test="score", null, alpha)

# format input data for funnel plot
input.dis <- data.frame(ID=hospital_prepared[hospital_prepared$included==1, prov.char],
prob=fe.ls$Exp)
input.prov <- data.frame(SRR=fe.ls$df.prov$SRR, flag=score.fe$flag)

# render funnel plot
target <- c(1)
hospital

```r
alphas = c(0.1, 0.05, 0.01)
funnel.SRR(input.dis, input.prov, target, alphas, type="FE.score")
```

description

A data set containing simulated readmissions data for 500 hospitals with three continuous covariates. This data needs to be processed with `fe.data.prep`.

usage

hospital

format

A `data.frame` with 24438 rows and 5 variables (columns):

- **Y** Indicator for readmission; 1=Yes, 0=No; numeric
- **prov.ID** Provider ID; numeric
- **z1** Simulated covariate 1, numeric
- **z2** Simulated covariate 2, numeric
- **z3** Simulated covariate 3, numeric

hospital_prepared

Prepared version of simulated readmissions data for 500 hospitals

description

A data set containing simulated and processed readmissions data for 500 hospitals with three continuous covariates. This is the form of the data needed to use `fe.prov`.

usage

hospital_prepared
Format

A `data.frame` with 24438 rows and 8 variables (columns):

- **Y**: Indicator for readmission; 1=Yes, 0=No; numeric
- **prov.ID**: Provider ID; numeric
- **z1**: Simulated covariate 1, numeric
- **z2**: Simulated covariate 2, numeric
- **z3**: Simulated covariate 3, numeric
- **included**: variable 'included' as an indicator
- **no.readm**: providers with no readmission within 30 days
- **all.readm**: providers with all readmissions within 30 days

---

**test.fe.prov**

*Hypothesis tests for fe.prov model object*

---

Description

**test.fe.prov** Conducts hypothesis tests for model parameter estimates. First fit a `fe.prov` model object. Go to Github\(^5\) for a tutorial.

Usage

```
test.fe.prov(data, fe.ls, Y.char, Z.char, prov.char, test = "score",
null = "median", alpha = 0.05, n = 10000)
```

Arguments

- **data**: prepared `data.frame`. Use `fe.data.prep`
- **fe.ls**: fitted model object (fit using `fe.prov`)
- **Y.char**: `Y.char` name of the response variable from `data` as a character string
- **Z.char**: `Z.char` names of covariates from `data` as vector of character strings
- **prov.char**: name of provider IDs variable as a character string
- **test**: string denoting hypothesis test to be conducted. Currently, options include "exact.binom", "exact.poisbinom", "exact.bootstrap", "score". The default is test="score"
- **null**: use median for null comparison
- **alpha**: alpha level for the CIs
- **n**: number of bootstrap draws

\(^5\)https://github.com/umich-biostatistics/FEprovideR
Value

Returns a data.frame of the results of the test for each provider with attributes:

- flag: Either "1" for p<alpha/2, "0" p<=1-alpha/2 and p<alpha/2, or ".1" for neither
- p: p-value for the hypothesis test of the model parameter

References


See Also

fe.data.prep, fe.prov, funnel.SRR, confint.fe.prov

Examples

# Name input variables and other parameters
# a small positive number specifying stopping
# criterion of Newton-Raphson algorithm
tol <- 1e-5
Y.char <- 'Y'
prov.char <- 'prov.ID'
Z.char <- paste0('z', 1:3)
data(hospital_prepared) # build in data set
fe.ls <- fe.prov(hospital_prepared, Y.char, Z.char, prov.char, tol) # model fitting

# Hypothesis tests
null = "median"
alpha = 0.05
score.fe <- test.fe.prov(hospital_prepared, fe.ls, Y.char, Z.char, prov.char, test="score", null, alpha)