Package ‘VDSPCalibration’

September 5, 2017

Type Package
Title Statistical Methods for Designing and Analyzing a Calibration Study
Version 1.0
Date 2017-09-01
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Description Provides statistical methods for the design and analysis of a calibration study, which aims for calibrating measurements using two different methods. The package includes sample size calculation, sample selection, regression analysis with error-in measurements and change-point regression. The method is described in Tian, Durazo-Arvizu, Myers, et al. (2014) <DOI:10.1002/sim.6235>.
License GPL
NeedsCompilation no
Repository CRAN
Date/Publication 2017-09-05 18:19:47 UTC

R topics documented:

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Description

Implements statistical methods for designing and analyzing a calibration study

Details

Implements statistical methods for design and analysis of a calibration study. The important functions are "samplesize": for sample size estimation; "sampletot": for sample selection, "calfun": for estimating calibrating equation and "chngpt": for estimating the piece-wise linear equation.

Author(s)

Ramon Durazo-Arvizu, Chris Sempos, and Lu Tian

References


calfun

Estimating the Calibration Equation

Description

Estimates the calibration equation based on CV information

Usage

calfun(x, y, CVx, CVy = CVx, lambda0 = 1)

Arguments

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>old VD measurements</td>
</tr>
<tr>
<td>y</td>
<td>reference (new) VD measurements</td>
</tr>
<tr>
<td>CVx</td>
<td>CV% of the old VD measurements</td>
</tr>
<tr>
<td>CVy</td>
<td>CV% of the new VD measurements</td>
</tr>
<tr>
<td>lambda0</td>
<td>the CV ratio of the new vs old measurements</td>
</tr>
</tbody>
</table>
Details

Estimation of the calibration equation. It covers 4 scenarios: Only CVx is known; only CVy is known; both CVx and CVy are known; and Only the ratio of CVy to CVx is known.

Value

<table>
<thead>
<tr>
<th>coef</th>
<th>estimated coefficients of the linear function</th>
</tr>
</thead>
<tbody>
<tr>
<td>se</td>
<td>standard errors of the estimated coefficients</td>
</tr>
<tr>
<td>lower CI</td>
<td>the lower end of the 95% CI of the regression coefficients</td>
</tr>
<tr>
<td>upper CI</td>
<td>the upper end of the 95% CI of the regression coefficients</td>
</tr>
</tbody>
</table>

Author(s)

Durazo-Arvizu, Ramon; Sempos, Chris; Tian, Lu

References


Examples

```r
n=100
sigma0=10
beta0=5
beta1=1.2
CVx=0.15
CVy=0.07
lambda0=CVy^2/CVx^2
x0=runif(n, 20, 200)
y0=beta0+beta1*x0+rnorm(n)*sigma0
x=x0+x0*CVx*rnorm(n)
y=y0+y0*CVy*rnorm(n)
fit=calfun(x, y, CVx, CVy, lambda0)
fit
```
**Description**

Estimate a piecewise linear regression equation

**Usage**

```r
chngpt(x, y, start = quantile(x, probs = 0.1, na.rm = "TRUE"),
        finish = quantile(x, probs = 0.9, na.rm = "TRUE"),
        NbrSteps = 500)
```

**Arguments**

- `x`: old VD measurements
- `y`: reference (new) VD measurements
- `start`: lower bound of the changing point
- `finish`: upper bound of the changing point
- `NbrSteps`: number of points used in grid search

**Details**

This function uses grid search method to fit a piecewise linear regression model with one changing point

**Value**

- `x`: old VD levels
- `y`: new VD levels
- `yfitted`: calibrated VD levels based on the fitted piecewise linear regression
- `chngpt`: the estimated chang point
- `coefficients`: the estimated regression coefficients for the piecewise linear regression

**Author(s)**

Durazo-Arvizu, Ramon and Sempos, Chris

**References**

samplefun

Examples

```r
### Generate equally spaced TEST VALUES in the interval [20, 200]
set.seed(123456789)
x = 20 + 180 * 1:100/100
x2 = (x - 95) * (x > 95)

# Generate REFERENCE VALUES
y = -8 + 1.5 * x - 0.85 * x2 + 15 * rnorm(100)

# Plot test values versus reference values along with fitted piecewise model
plot(x, y)
fit.chngpt = chngpt(x, y)
plot(fit.chngpt$x[order(fit.chngpt$yfitted)],
     fit.chngpt$y[order(fit.chngpt$yfitted)],
     ylim = c(0, 200), ylab = "25-Hydroxyvitamin D (nmol/mL), IDS",
     ylab = "25-Hydroxyvitamin D (nmol/mL), LC/MS", bty = "n", las = 1)
lines(fit.chngpt$x[order(fit.chngpt$yfitted)],
      fit.chngpt$yfitted[order(fit.chngpt$yfitted)], lty = 2, col = 2, lwd = 2)
abline(v = fit.chngpt$chngpt, lty = 2, col = 3, lwd = 2)
arrows(fit.chngpt$chngpt + 20, 15, fit.chngpt$chngpt - 8, length = 0.1, lwd = 2, col = 4)
legend(fit.chngpt$chngpt + 5, 30, legend = round(fit.chngpt$chngpt, digits = 1),
       bty = "n", col = 4)
```

samplefun

Uniformly Sampling

Description

Draws samples uniformly (for internal use only)

Usage

```r
samplefun(x, index, n0)
```

Arguments

- `x` The VD values
- `index` the index for VD value, it can be 1, 2, 3,....
- `n0` Sample size

Details

Uniform sampling (internal use only)
samplesize

Value

<table>
<thead>
<tr>
<th>index</th>
<th>selected ids</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>selected VD levels</td>
</tr>
</tbody>
</table>

Author(s)

Durazo-Arvizu, Ramon, Sempos, Chris and Tian, Lu

See Also

sampletot

Examples

```r
x=rnorm(100)
index=1:100
samplefun(x, index, 40)
```

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samplesize

*Uniform Sampling Within Quartiles*

Description

Estimates the sample size to achieve the specified precision in the estimated calibration equation.

Usage

```r
samplesize(x0, d0, cutpts = c(7.5, 42.5, 57.5, 72.5, 200), CVx, CVy)
```

Arguments

- **x0**: The value at which calibration will be estimated (e.g., 30 nmol/L)
- **d0**: Targeted width of the 95% confidence interval of the calibrated value (e.g., 5 nmol/L)
- **cutpts**: Cut points used to define intervals, within which samples would be selected uniformly
- **CVx**: CV% of the old method (e.g., 12%)
- **CVy**: CV% of the reference (new) method (e.g., 5%)

Details

The function estimates the sample size to achieve the specified precision in the estimated calibration equation. The precision is defined via x0 and d0.

Value

Required sample size to achieve the specified precision in the estimated calibration equation.
Author(s)
Durazo-Arvizu, Ramon, Sempos, Chris and Tian, Lu

References

Examples
samplesize(30, 5, cutpts=c(7,42,57,72,200),0.12, 0.05)

sampletot

Description
Selects samples used in a calibration study

Usage
sampletot(x, index, n0, K)

Arguments
x the old sample measurements needing calibration
index the ID list of the old sample measurements needing calibration
n0 the required sample size
K the number of quantiles, it is 4 if we use quartiles (recommended)

Details
The function selects samples used in the calibration study

Value
x the selected sample measurements to be used in the calibration study
index the id list of the selected samples to be used in the calibration study

Author(s)
Durazo-Arvizu, Ramon, Sempos, Chris and Tian, Lu
References


Examples

VD.value= 60 + 25*rnorm(1000)
VD.index=1:1000

### x: the VD value
### index: the index for VD value, it can be 1, 2, 3,...
### n0: the number of samples we want to select
### K: the number of quantiles, it is 4 if we use quartiles

sampletot(x=VD.value, index=VD.index, n0=100, K=4)
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