Package ‘cumulcalib’

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Title Cumulative Calibration Assessment for Prediction Models

Version 0.0.1

Description Tools for visualization of, and inference on, the calibration of prediction models on the cumulative domain. This provides a method for evaluating calibration of risk prediction models without having to group the data or use tuning parameters (e.g., loess bandwidth). This package implements the methodology described in Sadatsafavi and Patkau (2024) <doi:10.1002/sim.10138>. The core of the package is cumulcalib(), which takes in vectors of binary responses and predicted risks. The plot() and summary() methods are implemented for the results returned by cumulcalib().

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URL https://github.com/resplab/cumulcalib

Imports graphics, stats

Suggests knitr, predtools, markdown, markdown, spelling, testthat (>= 3.0.0)

VignetteBuilder knitr

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Author Mohsen Sadatsafavi [aut, cre] (<https://orcid.org/0000-0002-0419-7862>)

Maintainer Mohsen Sadatsafavi <mohsen.sadatsafavi@ubc.ca>

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cumulcalib

Cumulative calibration assessment

Description

This is the core function for performing cumulative calibration assessment.

Usage

cumulcalib(y, p, method = c("BB", "BM"), ordered = FALSE, n_sim = 0)

Arguments

y
vector of binary responses.

p
vector of predicted probabilities.

method
string with either BB (Brownian bridge test, default method), BM (Brownian motion test), BM2p (two-part BM test - experimental), BB1p (one-part BB test wit only the ‘bridge’ component). Multiple methods can be specified. The first one will be the ‘main’ method (e.g., when submitting the resulting object to plot()). Default is c("BB","BM")

ordered
if TRUE, y and p are already ordered based on ascending values of p. This is to speed up simulations.

n_sim
if >0, indicates a simulation-based test is requested for inference.

Value

an objective of class cumulcalib that can be printed or plotted

Examples

pi <- rbeta(1000,1,2)
Y <- rbinom(length(pi),1,pi)
res <- cumulcalib(Y, pi, method="BB")
summary(res)
plot(res)
Description

CDF of the Kolmogorov distribution

Usage

\texttt{pKolmogorov(q, summands = ceiling(q \ast \sqrt{72} + 3/2))}

Arguments

- **q**: the quantity at which CDF will be evaluated. Currently accepts only a scalar
- **summands**: maximum number of terms to be evaluated in the infinite series (default=ceiling(q*sqrt(72)+3/2))

Value

a scalar value

Description

Generates cumulative calibration plots

Usage

```r
# S3 method for class 'cumulcalib'
plot(
  x,
  method = NULL,
  draw_stat = TRUE,
  stat_col = c("blue", "red"),
  draw_sig = TRUE,
  sig_level = c(0.95, 0.95),
  x2axis = TRUE,
  y2axis = TRUE,
  ...
)
```

```r
# S3 method for class 'cumulcalib'
plot(
  x,
```
method = NULL,
draw_stat = TRUE,
stat_col = c("blue", "red"),
draw_sig = TRUE,
sig_level = c(0.95, 0.95),
x2axis = TRUE,
y2axis = TRUE,
...  
)

Arguments

x
An object of class cumulcalib generated by cumulcalib()

method
Which method to use. Options are BB (Brownian bridge test), BM (Brownian motion test), BB1p (1-part Brownian bridge test), and BM2p (2-part Brownian bridge test). If unspecified, returns the default method used in the cumulcalib() call

draw_stat
Should the statistic (terminal value an/or maximum drift, depending on method) be drawn? Default is TRUE

stat_col
The color(s) to draw the stat. Default is c('blue','red'). For single-part tests (BM and BB1p) only the first element is used

draw_sig
Whether significance lines should be drawn. Default is T. Colors will be the same as stat_col

sig_level
If to draw significance lines, at what level? Default is c(0.95,0.95). For single-part tests (BM and BB1p) only the first element is used

x2axis
If true, draws a second x-axis (on top) showing predicted risks

y2axis
If true, draws a second y-axis (on right) showing scaled partial sums

Value
None

pMAD_BM

CDF of the distribution of the maximum absolute deviation of Brownian motion in [0,1] interval

Description

CDF of the distribution of the maximum absolute deviation of Brownian motion in [0,1] interval

Usage

pMAD_BM(q, summands = 100)
**Arguments**

- **q**
  - the quantity at which CDF will be evaluated. Currently accepts only a scalar
- **summands**
  - maximum number of terms to be evaluated in the infinite series (default=100)

**Value**

- a scalar value

---

**Description**

CDF of the distribution of the maximum absolute deviation of Brownian motion in [0,1] interval, conditional on its terminal value

**Usage**

```r
pMAD_BM_c(  
    q,  
    w1,  
    method = 1,  
    exp_tolerance = -30,  
    summands = ceiling(q * sqrt(72) + 3/2)  
)
```

**Arguments**

- **q**
  - the quantity at which CDF will be evaluated. Currently accepts only a scalar
- **w1**
  - the terminal value
- **method**
  - different infinite series to use (1,2,3)
- **exp_tolerance**
  - numerical tolerance as the stopping rule when evaluating the infinite sum (default -30 on the exponential scale)
- **summands**
  - number of terms to evaluate (default is ceiling(q * sqrt(72) + 3/2))

**Value**

- a scalar value
qKolmogorov  Quantile function of the Kolmogorov distribution

Description
Quantile function of the Kolmogorov distribution

Usage
qKolmogorov(p)

Arguments
p  the quantity at which the quantile function will be evaluated. Currently accepts only a scalar

Value
a scalar value

qMAD_BM  Quantile function of the distribution of the maximum absolute deviation of Brownian motion in [0,1] interval

Description
Quantile function of the distribution of the maximum absolute deviation of Brownian motion in [0,1] interval

Usage
qMAD_BM(p)

Arguments
p  the quantity at which the quantile function will be evaluated. Currently accepts only a scalar

Value
a scalar value
qMAD_BM_c

Quantile function of the distribution of the maximum absolute deviation of Brownian motion in [0,1] interval, conditional on its terminal value

Description
Quantile function of the distribution of the maximum absolute deviation of Brownian motion in [0,1] interval, conditional on its terminal value

Usage
qMAD_BM_c(p, w1)

Arguments
p the quantity at which the quantile function will be evaluated. Currently accepts only a scalar
w1 the terminal value

Value
a scalar value

summary.cumulcalib
Summarizes a cumulcalib object

Description
Summarizes a cumulcalib object

Usage
## S3 method for class 'cumulcalib'
summary(object, method = NULL, ...)

## S3 method for class 'cumulcalib'
summary(object, method = NULL, ...)
**Arguments**

- **object**: An object of class `cumulcalib` generated by `cumulcalib()`
- **method**: Which method to use. Options are BB (Brownian bridge test), BM (Brownian motion test), BB1p (1-part Brownian bridge test), and BM2p (2-part Brownian bridge test). If unspecified, returns the default method used in the `cumulcalib()` call
- ... Other parameters passed to `summary()`

**Value**

None

None
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