Package ‘alphaN’

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Title  Set Alpha Based on Sample Size Using Bayes Factors
Version  0.1.0
Description  Sets the alpha level for coefficients in a regression model
            as a decreasing function of the sample size through the use of
            Jeffreys' Approximate Bayes factor. You tell alphaN() your sample
            size, and it tells you to which value you must lower alpha to avoid
            Lindley’s Paradox. For details, see Wulff and Taylor (2023)
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alphaN

Set the alpha level based on sample size for coefficients in a regression models.

Description

Set the alpha level based on sample size for coefficients in a regression models.

Usage

alphaN(n, BF = 1, method = "JAB", upper = 1)

Arguments

n  Sample size
BF Bayes factor you would like to match. 1 to avoid Lindley's Paradox, 3 to achieve moderate evidence and 10 to achieve strong evidence.
method Used for the choice of 'b'. Currently one of:
  • "JAB": this choice of b produces Jeffery's approximate BF (Wagenmakers, 2022)
  • "min": uses the minimal training sample for the prior (Gu et al., 2018)
  • "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995)
  • "balanced": this choice of b balances the type I and type II errors (Gu et al, 2016)
upper The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, U(0,1).

Value

Numeric alpha level required to achieve the desired level of evidence.

References

Gu et al. (2016). Error probabilities in default Bayesian hypothesis testing. Journal of Mathematical Psychology, 72, 130–143.


Wagenmakers (2002). Approximate Objective Bayes Factors From PValues and Sample Size: The
Examples

# Plot of alpha level as a function of n
seqN <- seq(50, 1000, 1)
plot(seqN, alphaN(seqN), type = "l")

alphaN_plot

Creates a plot of alpha as function of sample size for each of the four prior options

Description

Creates a plot of alpha as function of sample size for each of the four prior options

Usage

alphaN_plot(BF = 1, max = 10000)

Arguments

BF Bayes factor you would like to match. 1 to avoid Lindley’s Paradox, 3 to achieve moderate evidence and 10 to achieve strong evidence.

max The maximum number of sample size. Defaults to 10,000.

Value

Prints a plot.

Examples

# Plot of alpha level as a function of n for a Bayes factor of 3
alphaN_plot(BF = 3)
JAB

Transforms a t-statistic from a glm or lm object into Jeffreys’ approximate Bayes factor

Description

Transforms a t-statistic from a glm or lm object into Jeffreys’ approximate Bayes factor

Usage

JAB(glm_obj, covariate, method = "JAB", upper = 1)

Arguments

glm_obj a glm or lm object.
covariate the name of the covariate that you want a BF for as a string.
method Used for the choice of b. Currently one of:
  • "JAB": this choice of b produces Jeffery’s approximate BF (Wagenmakers, 2022)
  • "min": uses the minimal training sample for the prior (Gu et al., 2018)
  • "robust": a robust version of "min" that prevents too small b (O’Hagan, 1995)
  • "balanced": this choice of b balances the type I and type II errors (Gu et al, 2016)
upper The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, U(0,1).

Value

A numeric value for the BF in favour of H1.

Examples

# Simulate data

## Sample size
n <- 200

## Regressors
Z1 <- runif(n, -1, 1)
Z2 <- runif(n, -1, 1)
Z3 <- runif(n, -1, 1)
Z4 <- runif(n, -1, 1)
X <- runif(n, -1, 1)

## Error term
JABp

### Description

Title

### Usage

```r
JABp(n, p, z = TRUE, df = NULL, method = "JAB", upper = 1)
```

### Arguments

- **n**: Sample size.
- **p**: The p-value.
- **z**: Is the p-value based on a z- or t-statistic? TRUE if z.
- **df**: If z=FALSE, provide the degrees of freedom for the t-statistic.
- **method**: Used for the choice of 'b'. Currently one of:
  1. "JAB": this choice of b produces Jeffery’s approximate BF (Wagenmakers, 2022)
  2. "min": uses the minimal training sample for the prior (Gu et al., 2018)
  3. "robust": a robust version of "min" that prevents too small b (O’Hagan, 1995)
  4. "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016)
- **upper**: The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, U(0,1).

### Value

A numeric value for the BF in favour of H1.
JABt

Transforms a t-statistic into Jeffreys' approximate Bayes factor

Description

Transforms a t-statistic into Jeffreys' approximate Bayes factor

Usage

JABt(n, t, method = "JAB", upper = 1)

Arguments

n
Sample size.

t
The t-statistic.

method
Used for the choice of 'b'. Currently one of:

- "JAB": this choice of b produces Jeffery's approximate BF (Wagenmakers, 2022)
- "min": uses the minimal training sample for the prior (Gu et al., 2018)
- "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995)
- "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016)

upper
The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, U(0,1).

Value

A numeric value for the BF in favour of H1.

Examples

# Transform a t-statistic of 2.695 computed based on a sample size of 200 into JAB
JABt(200, 2.695)
Description

Plots JAB as a function of the p-value

Usage

\[ \text{JAB\_plot}(n, \text{BF} = 1, \text{method} = \text{"JAB"}) \]

Arguments

- \( n \): Sample size
- \( \text{BF} \): Bayes factor you would like to match. 1 to avoid the Lindley Paradox, 3 to achieve moderate evidence and 10 to achieve strong evidence.
- \( \text{method} \): Used for the choice of 'b'. Currently one of:
  - "JAB": this choice of b produces Jeffery's approximate BF
  - "min": uses the minimal training sample for the prior (Gu et al., '17)
  - "robust": a robust version of "min" that prevents too small b (O'Hagan, '95)
  - "balanced": this choice of b balances the type I and type II errors

Value

Prints a plot.

Examples

\# Plot JAB as function of the p-value for a sample size of 2000
\text{JAB\_plot}(2000)
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