

Package ‘imprecise101’

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Title Introduction to Imprecise Probabilities

Version 0.2.2.4

Description An imprecise inference presented in the study of Walley (1996) <doi:10.1111/j.2517-6161.1996.tb02065.x> is one of the statistical reasoning methods when prior information is unavailable. Functions and utils needed for illustrating this inferential paradigm are implemented for classroom teaching and further comprehensive research. Two imprecise models are demonstrated using multinomial data and 2x2 contingency table data. The concepts of prior ignorance and imprecision are discussed in lower and upper probabilities. Representation invariance principle, hypothesis testing, decision-making, and further generalization are also illustrated.

License GPL-3

Encoding UTF-8

RoxygenNote 7.1.2

Suggests covr, knitr, rmarkdown

VignetteBuilder knitr

Imports stats, tolerance, graphics, pscl

NeedsCompilation no

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dbetabinom

Beta-Binomial Distribution

Description

This function computes the predictive posterior density of the outcome of interest under the imprecise Dirichlet prior distribution. It follows a beta-binomial distribution.

Usage

```
dbetabinom(i, M, x, s, N, tA)
```

```
pbetabinom(M, x, s, N, y)
```

Arguments

i	number of occurrences of event A in the M future trials
M	number of future trials
x	number of occurrence of event A in the N previous trials
s	learning parameter
N	total number of previous trials
tA	prior probability of event A under the Dirichlet prior
y	maximum number of occurrences of event A in the M future trials

Value

dbetabinom returns a scalar value of density and pbetabinom returns a list of scalars corresponding to the lower and upper probabilities of the distribution.

Examples

```
pbetabinom(M=6, x=1, s=1, N=6, y=0)
```

dbetadif

Distribution of Difference of Two Proportions

Description

Distribution of Difference of Two Proportions

Usage

```
dbetadif(x, a1, b1, a2, b2)
```

Arguments

x	difference of two beta distributions
a1	shape 1 parameter of Beta distribution with control
b1	shape 2 parameter of Beta distribution with control
a2	shape 1 parameter of Beta distribution with treatment
b2	shape 2 parameter of Beta distribution with treatment

Value

betadif gives a scalar value of density.

References

Chen, Y., & Luo, S. (2011). A few remarks on 'Statistical distribution of the difference of two proportions' by Nadarajah and Kotz, *Statistics in Medicine* 2007; 26 (18): 3518-3523. *Statistics in Medicine*, 30(15), 1913-1915.

ibm	<i>Imprecise Beta Model</i>
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Description

This function computes lower and upper posterior probabilities under an imprecise Beta model when prior information is not available.

Usage

```
ibm(n = 10, m = 6, s0 = 2, showplot = TRUE, xlab1 = NA, main1 = NA)
```

Arguments

n	total of trials
m	number of observations realized
s0	learning parameter
showplot	logical, TRUE by default
xlab1	x axis text
main1	main title text

Value

ibm returns data.frame containing posterior probabilities on the mean parameter space.

References

Walley, P. (1996), Inferences from Multinomial Data: Learning About a Bag of Marbles. Journal of the Royal Statistical Society: Series B (Methodological), 58: 3-34. <https://doi.org/10.1111/j.2517-6161.1996.tb02065.x>

Examples

```
tc <- seq(0,1,0.1)
s <- 2
ibm(n=10, m=6)
```

idm

Imprecise Dirichlet Model

Description

This function computes lower and upper posterior probabilities under an imprecise Dirichlet model when prior information is not available.

This function searches for the lower and upper bounds of a given level of the highest posterior density interval under the imprecise Dirichlet prior.

Usage

```
idm(nj, s = 1, N, tj = NA_real_, k, cA = 1)

hpd(
  alpha = 3,
  beta = 5,
  p = 0.95,
  tolerance = 1e-04,
  maxiter = 100,
  verbose = FALSE
)
```

Arguments

nj	number of observations in the j th category
s	learning parameter
N	total number of drawings
tj	mean probability associated with the j th category
k	number of elements in the sample space
cA	the number of elements in the event A
alpha	shape1 parameter of beta distribution
beta	shape2 parameter of beta distribution

p	level of credible interval
tolerance	level of error allowed
maxiter	maximum number of iterations
verbose	logical option suppressing messages

Value

idm returns a list of lower and upper probabilities.

p.lower	Minimum of imprecise probabilities
p.upper	Maximum of imprecise probabilities
v.lower	Variance of lower bound
v.upper	Variance of upper bound
s.lower	Standard deviation of lower bound
s.upper	Standard deviation of upper bound
p	Precise probability
p.delta	Degree of imprecision

hpd gives a list of scalar values corresponding to the lower and upper bounds of highest posterior probability density region.

References

Walley, P. (1996), Inferences from Multinomial Data: Learning About a Bag of Marbles. *Journal of the Royal Statistical Society: Series B (Methodological)*, 58: 3-34. <https://doi.org/10.1111/j.2517-6161.1996.tb02065.x>

Examples

```
idm(nj=1, N=6, s=2, k=4)
x <- hpd(alpha=3, beta=5, p=0.95) # c(0.0031, 0.6587) when s=2
# round(x,4); x*(1-x)^5
```

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