Package ‘vcmeta’

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Type Package

Title Varying Coefficient Meta-Analysis

Version 1.1.0

Description Implements functions for varying coefficient meta-analysis methods. These methods do not assume effect size homogeneity. Subgroup effect size comparisons, general linear effect size contrasts, and linear models of effect sizes based on varying coefficient methods can be used to describe effect size heterogeneity. Varying coefficient meta-analysis methods do not require the unrealistic assumptions of the traditional fixed-effect and random-effects meta-analysis methods.
For details see: Statistical Methods for Psychologists, Volume 5, <https://dgbonett.sites.ucsc.edu/>.

URL https://github.com/dgbonett/vcmeta

BugReports https://github.com/dgbonett/vcmeta/issues

License GPL-3

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Imports stats, mathjaxr, Rdpack, ggplot2

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R topics documented:

`ci.fisher` *Fisher confidence interval for any type of correlation.*

Description

This function computes a confidence interval for any type correlation using an estimated correlation and its standard error. This function should be used with the meta.ave.gen function when the effect size is a correlation. Use the estimated average correlation and it standard error from meta.ave.gen (when the effect size is a correlation) in the ci.fisher function to obtain a more accurate confidence interval for the population average correlation.

Usage

```
ci.fisher(alpha, cor, se)
```

Arguments

`alpha`	alpha value for 1-alpha confidence
`cor`	estimate of correlation
`se`	standard error of estimated correlation

Value

A 2-element vector with lower and upper bounds of the confidence interval

Examples

```
ci.fisher(0.05, 0.50, .10)

# Should return:
# [1] 0.2802723 0.6699402
```

`cor.from.t` *Compute Pearson correlation between paired measurements from t statistic*

Description

This function computes the Pearson correlation between paired measurements using a reported paired-samples t statistic and other sample information. This correlation estimate is needed in several functions that analyze mean differences and standardized mean differences in paired-samples studies.

Usage

```
cor.from.t(m1, m2, sd1, sd2, t, n)
```

Arguments

m1	estimated mean for measurement 1
m2	estimated mean for measurement 2
sd1	estimated standard deviation for measurement 1
sd2	estimated standard deviation for measurement 2
t	value for paired-samples t-test
n	sample size

Value

Returns the sample Pearson correlation between the two paired measurements

Examples

```
cor.from.t(9.4, 9.8, 1.26, 1.40, 2.27, 30)

# Should return:
# [1] 0.7415209
```

---

meta.ave.agree *Confidence interval for an average G-index agreement coefficient*

Description

Computes the estimate, standard error, and confidence interval for an G-index of agreement from two or more studies. This function assumes that two raters each provide a dichotomous rating to a sample of objects. The G-index of agreement is usually preferred to Cohen's kappa.

Usage

```
meta.ave.agree(alpha, f11, f12, f21, f22, bystudy = TRUE)
```

Arguments

alpha	alpha level for 1-alpha confidence
f11	vector of frequencies in cell 1,1
f12	vector of frequencies in cell 1,2
f21	vector of frequencies in cell 2,1
f22	vector of frequencies in cell 2,2
bystudy	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
f11 <- c(17, 28, 19)
f12 <- c(43, 56, 49)
f21 <- c(3, 5, 5)
f22 <- c(37, 54, 39)
meta.ave.agree(.05, f11, f12, f21, f22, bystudy = TRUE)

# Should return:
#           Estimate         SE          LL        UL
# Average 0.08657934 0.05312584 -0.01754538 0.1907041
# Study 1 0.07692308 0.09776752 -0.11469775 0.2685439
# Study 2 0.14285714 0.08163265 -0.01713992 0.3028542
# Study 3 0.03448276 0.09279245 -0.14738711 0.2163526
```

---

meta.ave.cor *Confidence interval for an average Pearson or partial correlation*

Description

Computes the estimate, standard error, and confidence interval for an average Pearson or partial correlation from two or more studies. The sample correlations must be all Pearson correlations or all partial correlations. Use the meta.ave.gen function to meta-analyze any combination of Pearson, partial, or Spearman correlations.

Usage

```
meta.ave.cor(alpha, n, cor, s, bystudy = TRUE)
```

Arguments

alpha	alpha level for 1-alpha confidence
n	vector of sample sizes
cor	vector of estimated correlations
s	number of control variables
bystudy	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2008). "Meta-analytic interval estimation for bivariate correlations." *Psychological Methods*, **13**(3), 173–181. ISSN 1939-1463, doi: 10.1037/a0012868, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0012868.

Examples

```
n <- c(55, 190, 65, 35)
cor <- c(.40, .65, .60, .45)
meta.ave.cor(.05, n, cor, 0, bystudy = TRUE)

# Should return:
#          Estimate         SE        LL        UL
# Average     0.525 0.05113361 0.4176678 0.6178816
# Study 1     0.400 0.11430952 0.1506943 0.6014699
# Study 2     0.650 0.04200694 0.5594086 0.7252465
# Study 3     0.600 0.08000000 0.4171458 0.7361686
# Study 4     0.450 0.13677012 0.1373507 0.6811071
```

meta.ave.cronbach *Confidence interval for an average Cronbach alpha reliability*

Description

Computes the estimate, standard error, and confidence interval for an average Cronbach reliability coefficient from two or more studies.

Usage

```
meta.ave.cronbach(alpha, n, rel, r, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`rel`	vector of sample reliabilities
`r`	number of measurements (e.g., items) used to compute each reliability
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2010). "Varying coefficient meta-analytic methods for alpha reliability." *Psychological Methods*, **15**(4), 368–385. ISSN 1939-1463, doi: 10.1037/a0020142, `https://doi.apa.org/getdoi.cfm?doi=10.1037/a0020142`.

Examples

```
n <- c(583, 470, 546, 680)
rel <- c(.91, .89, .90, .89)
meta.ave.cronbach(.05, n, rel, 10, bystudy = TRUE)

# Should return:
#          Estimate          SE        LL        UL
# Average    0.8975 0.003256081 0.8911102 0.9038592
# Study 1    0.9100 0.005566064 0.8985763 0.9204108
# Study 2    0.8900 0.007579900 0.8743616 0.9041013
# Study 3    0.9000 0.006391375 0.8868623 0.9119356
# Study 4    0.8900 0.006297549 0.8771189 0.9018203
```

`meta.ave.gen` *Confidence interval for an average of any parameter*

Description

Computes the estimate, standard error, and confidence interval for an average of any type of parameter from two or more studies.

Usage

```
meta.ave.gen(alpha, est, se, bystudy = TRUE)
```

Arguments

alpha	alpha level for 1-alpha confidence
est	vector of parameter estimates
se	vector of standard errors
bystudy	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
est <- c(.022, .751, .421, .287, .052, .146, .562, .904)
se <- c(.124, .464, .102, .592, .864, .241, .252, .318)
meta.ave.gen(.05, est, se, bystudy = TRUE)

# Should return:
#          Estimate        SE          LL        UL
# Average  0.393125 0.1561622  0.08705266 0.6991973
# Study 1  0.022000 0.1240000 -0.22103553 0.2650355
# Study 2  0.751000 0.4640000 -0.15842329 1.6604233
# Study 3  0.421000 0.1020000  0.22108367 0.6209163
# Study 4  0.287000 0.5920000 -0.87329868 1.4472987
# Study 5  0.052000 0.8640000 -1.64140888 1.7454089
# Study 6  0.146000 0.2410000 -0.32635132 0.6183513
# Study 7  0.562000 0.2520000  0.06808908 1.0559109
# Study 8  0.904000 0.3180000  0.28073145 1.5272685
```

`meta.ave.gen.cc` *Confidence interval for an average effect size using a constant coefficient model*

Description

Computes the estimate, standard error, and confidence interval for a weighted average effect from two or more studies using the constant coefficient (fixed-effect) meta-analysis model. The weighted average estimate will be biased regardless of number of studies or sample size per study and the actual confidence interval coverage probability can be much smaller than the specified confidence level when the true effect sizes are not identical across studies.

Usage

```
meta.ave.gen.cc(alpha, est, se, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`est`	vector of parameter estimates
`se`	vector of standard errors
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

- Hedges LV, Olkin I (1985). *Statistical methods for meta-analysis*. Academic Press, New York. ISBN 01-233-63802.
- Borenstein M, Hedges LV, Higgins JP, Rothstein HR (2009). *Introduction to meta-analysis*. Wiley, New York.

Examples

```
est <- c(.022, .751, .421, .287, .052, .146, .562, .904)
se <- c(.124, .464, .102, .592, .864, .241, .252, .318)
meta.ave.gen.cc(.05, est, se, bystudy = TRUE)

# Should return:
#             Estimate         SE          LL        UL
# Average    0.3127916 0.06854394  0.17844794 0.4471352
# Study 1    0.0220000 0.12400000 -0.22103553 0.2650355
# Study 2    0.7510000 0.46400000 -0.15842329 1.6604233
# Study 3    0.4210000 0.10200000  0.22108367 0.6209163
# Study 4    0.2870000 0.59200000 -0.87329868 1.4472987
# Study 5    0.0520000 0.86400000 -1.64140888 1.7454089
# Study 6    0.1460000 0.24100000 -0.32635132 0.6183513
# Study 7    0.5620000 0.25200000  0.06808908 1.0559109
# Study 8    0.9040000 0.31800000  0.28073145 1.5272685
```

---

meta.ave.gen.rc — *Confidence interval for an average effect size using a random coefficient model*

Description

Computes the estimate, standard error, and confidence interval for a a weighted average effect from multiple studies using the random coefficient (random-effects) meta-analysis model. An estimate of effect-sze heterogeneity (tau-squared) is also computed. The random coefficient model assumes that the studies in the meta-analysis are a random sample from some definable superpopulation of studies. This assumption is very difficult to justify. The weighted average estimate will be biased regardless of number of studies or sample size per study and the actual confidence interval coverage probability can much smaller than the specified confidence level if the effect sizes are correlated with the weights. This method also assume that the true effects sizes in the superpopulation of studies have a normal distribution. A large number of studies, each with a large sample size, is required to assess the superpopulation normality assumption and to accurately estimate tau-squared. The traditional confidence interval for the population tau-squared is hypersensitive to very minor and difficult to detect violations of the superpopulation normality assumption.

Usage

```
meta.ave.gen.rc(alpha, est, se, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`est`	vector of parameter estimates
`se`	vector of standard errors
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

- Hedges LV, Olkin I (1985). *Statistical methods for meta-analysis*. Academic Press, New York. ISBN 01-233-63802.
- Borenstein M, Hedges LV, Higgins JP, Rothstein HR (2009). *Introduction to meta-analysis*. Wiley, New York.

Examples

```
est <- c(.022, .751, .421, .287, .052, .146, .562, .904)
se <- c(.124, .464, .102, .592, .864, .241, .252, .318)
meta.ave.gen.rc(.05, est, se, bystudy = TRUE)

# Should return:
#                Estimate        SE          LL        UL
# Tau-squared 0.03772628 0.0518109  0.00000000 0.1392738
# Average     0.35394806 0.1155239  0.12752528 0.5803708
# Study 1     0.02200000 0.1240000 -0.22103553 0.2650355
# Study 2     0.75100000 0.4640000 -0.15842329 1.6604233
# Study 3     0.42100000 0.1020000  0.22108367 0.6209163
# Study 4     0.28700000 0.5920000 -0.87329868 1.4472987
# Study 5     0.05200000 0.8640000 -1.64140888 1.7454089
# Study 6     0.14600000 0.2410000 -0.32635132 0.6183513
# Study 7     0.56200000 0.2520000  0.06808908 1.0559109
# Study 8     0.90400000 0.3180000  0.28073145 1.5272685
```

---

meta.ave.mean.ps — *Confidence interval for an average mean difference from paired-samples studies*

Description

Computes the estimate, standard error, and confidence interval for an average mean difference from two or more paired-samples studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence interval for the average effect size. Equal variances within or across studies is not assumed.

Usage

```
meta.ave.mean.ps(alpha, m1, m2, sd1, sd2, cor, n, bystudy = TRUE)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for measurement 1
m2	vector of estimated means for measurement 2
sd1	vector of estimated SDs for measurement 1
sd2	vector of estimated SDs for measurement 2
cor	vector of estimated correlations for paired measurements
n	vector of sample sizes
bystudy	logical to also return each study estimate (TRUE) or not

Value

A matrix. First row is the overall average estimate. If bystudy is TRUE also returns 1 row per study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
m1 <- c(53, 60, 53, 57)
m2 <- c(55, 62, 58, 61)
sd1 <- c(4.1, 4.2, 4.5, 4.0)
sd2 <- c(4.2, 4.7, 4.9, 4.8)
cor <- c(.7, .7, .8, .85)
n <- c(30, 50, 30, 70)
meta.ave.mean.ps(.05, m1, m2, sd1, sd2, cor, n, bystudy = TRUE)

# Should return:
#         Estimate        SE        LL         UL      df
# Average    -3.25 0.2471557 -3.739691 -2.7603091 112.347
# Study 1    -2.00 0.5871400 -3.200836 -0.7991639  29.000
# Study 2    -2.00 0.4918130 -2.988335 -1.0116648  49.000
# Study 3    -5.00 0.5471136 -6.118973 -3.8810270  29.000
```

```
# Study 4   -4.00 0.3023716 -4.603215 -3.3967852  69.000
```

---

meta.ave.mean2 *Confidence interval for an average mean difference from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for an average mean difference from two or more 2-group studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence intervals. Equal variances within or across studies is not assumed.

Usage

```
meta.ave.mean2(alpha, m1, m2, sd1, sd2, n1, n2, bystudy = TRUE)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for group 1
m2	vector of estimated means for group 2
sd1	vector of estimated SDs for group 1
sd2	vector of estimated SDs for group 2
n1	vector of group 1 sample sizes
n2	vector of group 2 sample sizes
bystudy	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
m1 <- c(7.4, 6.9)
m2 <- c(6.3, 5.7)
sd1 <- c(1.72, 1.53)
sd2 <- c(2.35, 2.04)
n1 <- c(40, 60)
n2 <- c(40, 60)
meta.ave.mean2(.05, m1, m2, sd1, sd2, n1, n2, bystudy = TRUE)

# Should return:
#          Estimate        SE        LL       UL        df
# Average     1.15 0.2830183 0.5904369 1.709563 139.41053
# Study 1     1.10 0.4604590 0.1819748 2.018025  71.46729
# Study 2     1.20 0.3292036 0.5475574 1.852443 109.42136
```

`meta.ave.meanratio.ps` *Confidence interval for an average mean ratio from paired-samples studies*

Description

Computes the estimate, standard error, and confidence interval for an geometric average mean ratio from two or more paired-samples studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence interval for the average effect size. Equal variances within or across studies is not assumed.

Usage

```
meta.ave.meanratio.ps(alpha, m1, m2, sd1, sd2, cor, n, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for measurement 1
`m2`	vector of estimated means for measurement 2
`sd1`	vector of estimated SDs for measurement 1
`sd2`	vector of estimated SDs for measurement 2
`cor`	vector of estimated correlations for paired measurements
`n`	vector of sample sizes
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval
- df - degrees of freedom

Examples

```
m1 <- c(53, 60, 53, 57)
m2 <- c(55, 62, 58, 61)
sd1 <- c(4.1, 4.2, 4.5, 4.0)
sd2 <- c(4.2, 4.7, 4.9, 4.8)
cor <- c(.7, .7, .8, .85)
n <- c(30, 50, 30, 70)
meta.ave.meanratio.ps(.05, m1, m2, sd1, sd2, cor, n, bystudy = TRUE)

# Should return:
#             Estimate          SE          LL          UL
# Average -0.05695120 0.004350863 -0.06558008 -0.04832231
# Study 1 -0.03704127 0.010871086 -0.05927514 -0.01480740
# Study 2 -0.03278982 0.008021952 -0.04891054 -0.01666911
# Study 3 -0.09015110 0.009779919 -0.11015328 -0.07014892
# Study 4 -0.06782260 0.004970015 -0.07773750 -0.05790769
#         exp(Estimate)   exp(LL)   exp(UL)       df
# Average     0.9446402 0.9365240 0.9528266 103.0256
# Study 1     0.9636364 0.9424474 0.9853017  29.0000
# Study 2     0.9677419 0.9522663 0.9834691  49.0000
# Study 3     0.9137931 0.8956968 0.9322550  29.0000
# Study 4     0.9344262 0.9252073 0.9437371  69.0000
```

---

meta.ave.meanratio2 *Confidence interval for an average mean ratio from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for an geometric average mean ratio from two or more 2-group studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence intervals. Equal variances within or across studies is not assumed.

Usage

```
meta.ave.meanratio2(alpha, m1, m2, sd1, sd2, n1, n2, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

A matrix. First row is the overall average estimate. If bystudy is TRUE also returns 1 row per study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval
- df - degrees of freedom

References

Bonett DG, Price RM (2020). "Confidence intervals for ratios of means and medians." *Journal of Educational and Behavioral Statistics*, **45**(6), 750–770. ISSN 1076-9986, doi: 10.3102/1076998620934125, https://journals.sagepub.com/doi/10.3102/1076998620934125.

Examples

```
m1 <- c(7.4, 6.9)
m2 <- c(6.3, 5.7)
sd1 <- c(1.7, 1.5)
sd2 <- c(2.3, 2.0)
n1 <- c(40, 20)
n2 <- c(40, 20)
meta.ave.meanratio2(.05, m1, m2, sd1, sd2, n1, n2, bystudy = TRUE)

# Should return:
#          Estimate         SE          LL        UL   exp(Estimate)
```

```
# Average 0.1759928 0.05738065 0.061437186 0.2905484       1.192429
# Study 1 0.1609304 0.06820167 0.024749712 0.2971110       1.174603
# Study 2 0.1910552 0.09229675 0.002986265 0.3791242       1.210526
#          exp(LL)  exp(UL)       df
# Average 1.063364 1.337161 66.26499
# Study 1 1.025059 1.345965 65.69929
# Study 2 1.002991 1.461004 31.71341
```

`meta.ave.odds` *Confidence interval for average odds ratio from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for a geometric average odds ratio from two or more studies.

Usage

```
meta.ave.odds(alpha, f1, f2, n1, n2, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f1`	vector of group 1 event counts
`f2`	vector of group 2 event counts
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval

References

Bonett DG, Price RM (2015). "Varying coefficient meta-analysis methods for odds ratios and risk ratios." *Psychological Methods*, **20**(3), 394–406. ISSN 1939-1463, doi: 10.1037/met0000032, https://doi.apa.org/getdoi.cfm?doi=10.1037/met0000032.

Examples

```
n1 <- c(204, 201, 932, 130, 77)
n2 <- c(106, 103, 415, 132, 83)
f1 <- c(24, 40, 93, 14, 5)
f2 <- c(12, 9, 28, 3, 1)
meta.ave.odds(.05, f1, f2, n1, n2, bystudy = TRUE)

# Should return:
#            Estimate        SE          LL        UL
# Average 0.86211102 0.2512852  0.36960107 1.3546210
# Study 1 0.02581353 0.3700520 -0.69947512 0.7511022
# Study 2 0.91410487 0.3830515  0.16333766 1.6648721
# Study 3 0.41496672 0.2226089 -0.02133877 0.8512722
# Study 4 1.52717529 0.6090858  0.33338907 2.7209615
# Study 5 1.42849472 0.9350931 -0.40425414 3.2612436
#         exp(Estimate)   exp(LL)   exp(UL)
# Average      2.368155 1.4471572  3.875292
# Study 1      1.026150 0.4968460  2.119335
# Study 2      2.494541 1.1774342  5.284997
# Study 3      1.514320 0.9788873  2.342625
# Study 4      4.605150 1.3956902 15.194925
# Study 5      4.172414 0.6674745 26.081952
```

---

meta.ave.path *Confidence interval for an average slope coefficient in a general linear model or a path model.*

Description

Computes the estimate, standard error, and confidence interval for an average slope coefficient in a general linear model (ANOVA, ANCOVA, multiple regression) or a path model from two or more studies.

Usage

```
meta.ave.path(alpha, n, slope, se, s, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`slope`	vector of slope estimates
`se`	vector of slope standard errors
`s`	number of predictors of the response variable
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
n <- c(75, 85, 250, 160)
slope <- c(1.57, 1.38, 1.08, 1.25)
se <- c(.658, .724, .307, .493)
meta.ave.path(.05, n, slope, se, 2, bystudy = TRUE)

#  Should return:
#         Estimate        SE          LL       UL       df
#  Average     1.32 0.2844334  0.75994528 1.880055 263.1837
#  Study 1     1.57 0.6580000  0.25830097 2.881699  72.0000
#  Study 2     1.38 0.7240000 -0.06026664 2.820267  82.0000
#  Study 3     1.08 0.3070000  0.47532827 1.684672 247.0000
#  Study 4     1.25 0.4930000  0.27623174 2.223768 157.0000
```

---

meta.ave.pbcor — *Confidence interval for an average point-biserial correlation*

Description

Computes the estimate, standard error, and confidence interval for an average point-biserial correlation from two or more studies. Two types of point-biserial correlations can be meta-analyzed. One type uses an unweighted variance and is appropriate in 2-group experimental designs. The other type uses a weighted variance and is appropriate in 2-group nonexperimental designs with simple random sampling within each group. This function requires all point-biserial correlations to be of the same type. Use the meta.ave.gen function to meta-analyze any combination of biserial correlation types.

Usage

```
meta.ave.pbcor(alpha, m1, m2, sd1, sd2, n1, n2, type, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`type`	• set to 1 for weighted variance • set to 2 for unweighted variance
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2020). "Point-biserial correlation: Interval estimation, hypothesis testing, meta-analysis, and sample size determination." *British Journal of Mathematical and Statistical Psychology*, **73**(S1), 113–144. ISSN 0007-1102, doi: 10.1111/bmsp.12189, https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12189.

Examples

```
m1 <- c(21.9, 23.1, 19.8)
m2 <- c(16.1, 17.4, 15.0)
sd1 <- c(3.82, 3.95, 3.67)
sd2 <- c(3.21, 3.30, 3.02)
n1 <- c(40, 30, 24)
n2 <- c(40, 28, 25)
meta.ave.pbcor(.05, m1, m2, sd1, sd2, n1, n2, 2, bystudy = TRUE)

# Should return:
#          Estimate         SE        LL        UL
# Average 0.6159094 0.04363432 0.5230976 0.6942842
# Study 1 0.6349786 0.06316796 0.4842098 0.7370220
```

```
# Study 2 0.6160553 0.07776700 0.4255342 0.7380898
# Study 3 0.5966942 0.08424778 0.3903883 0.7283966
```

---

meta.ave.plot *Forest plot for average effect sizes*

Description

Generates a forest plot to visualize effect sizes estimates and overall averages from the meta.ave functions in vcmeta. If the column exp(Estimate) is present, this function plots the exponentiated effect size and CI found in columns exp(Estimate), exp(LL), and exp(UL). Otherwise, this function plots the effect size and CI found in the columns Estimate, LL, and UL.

Usage

```
meta.ave.plot(
  result,
  reference_line = NULL,
  diamond_height = 0.2,
  ggtheme = ggplot2::theme_classic()
)
```

Arguments

result	• a result matrix from any of the replicate functions in vcmeta
reference_line	Optional x-value for a reference line. Only applies if focuse is 'Difference' or 'Both'. Defaults to NULL, in which case a reference line is not drawn.
diamond_height	• Optional height of the diamond representing average effect size. Only applies if focus is 'Average' or 'Both'. Defaults to 0.2
ggtheme	• optional ggplot2 theme object; defaults to theme_classic()

Value

Returns a ggplot object. If stored, can be further customized via the ggplot API

Examples

```
# Plot results from meta.ave.mean2
m1 <- c(7.4, 6.9)
m2 <- c(6.3, 5.7)
sd1 <- c(1.72, 1.53)
sd2 <- c(2.35, 2.04)
n1 <- c(40, 60)
n2 <- c(40, 60)
result <- meta.ave.mean2(.05, m1, m2, sd1, sd2, n1, n2, bystudy = TRUE)
meta.ave.plot(result, reference_line = 0)
```

```
# Plot results from meta.ave.meanratio2
# Note that this plots the exponentiated effect size and CI
m1 <- c(53, 60, 53, 57)
m2 <- c(55, 62, 58, 61)
sd1 <- c(4.1, 4.2, 4.5, 4.0)
sd2 <- c(4.2, 4.7, 4.9, 4.8)
cor <- c(.7, .7, .8, .85)
n <- c(30, 50, 30, 70)
result <- meta.ave.meanratio.ps(.05, m1, m2, sd1, sd2, cor, n, bystudy = TRUE)
myplot <- meta.ave.plot(result, reference_line = 1)
myplot

# Change x-scale to log2
library(ggplot2)
myplot <- myplot + scale_x_continuous(
  trans = 'log2',
  limits = c(0.75, 1.25),
  name = "Estimated Ratio of Means, Log2 Scale"
)
myplot
```

`meta.ave.prop.ps` *Confidence interval for an average proportion difference in paired-samples studies*

Description

Computes the estimate, standard error, and confidence interval for an average proportion difference from two or more studies.

Usage

```
meta.ave.prop.ps(alpha, f11, f12, f21, f22, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f11`	vector of frequencies in cell 1,1
`f12`	vector of frequencies in cell 1,2
`f21`	vector of frequencies in cell 2,1
`f22`	vector of frequencies in cell 2,2
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG, Price RM (2014). "Meta-analysis methods for risk differences." *British Journal of Mathematical and Statistical Psychology*, **67**(3), 371–387. ISSN 00071102, doi: 10.1111/bmsp.12024, https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12024.

Examples

```
f11 <- c(17, 28, 19)
f12 <- c(43, 56, 49)
f21 <- c(3, 5, 5)
f22 <- c(37, 54, 39)
meta.ave.prop.ps(.05, f11, f12, f21, f22, bystudy = TRUE)

# Should return:
#          Estimate         SE        LL        UL
# Average 0.3809573 0.03000016 0.3221581 0.4397565
# Study 1 0.3921569 0.05573055 0.2829270 0.5013867
# Study 2 0.3517241 0.04629537 0.2609869 0.4424614
# Study 3 0.3859649 0.05479300 0.2785726 0.4933572
```

`meta.ave.prop2` *Confidence interval for an average proportion difference in 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for an average proportion difference from two or more studies.

Usage

```
meta.ave.prop2(alpha, f1, f2, n1, n2, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f1`	vector of group 1 event counts
`f2`	vector of group 2 event counts
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG, Price RM (2014). "Meta-analysis methods for risk differences." *British Journal of Mathematical and Statistical Psychology*, **67**(3), 371–387. ISSN 00071102, doi: 10.1111/bmsp.12024, `https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12024`.

Examples

```
n1 <- c(204, 201, 932, 130, 77)
n2 <- c(106, 103, 415, 132, 83)
f1 <- c(24, 40, 93, 14, 5)
f2 <- c(12, 9, 28, 3, 1)
meta.ave.prop2(.05, f1, f2, n1, n2, bystudy = TRUE)

# Should return:
#              Estimate         SE            LL         UL
# Average 0.0567907589 0.01441216  2.854345e-02 0.08503807
# Study 1 0.0009888529 0.03870413 -7.486985e-02 0.07684756
# Study 2 0.1067323481 0.04018243  2.797623e-02 0.18548847
# Study 3 0.0310980338 0.01587717 -2.064379e-05 0.06221671
# Study 4 0.0837856174 0.03129171  2.245499e-02 0.14511624
# Study 5 0.0524199553 0.03403926 -1.429577e-02 0.11913568
```

`meta.ave.propratio2` *Confidence interval for an average proportion ratio from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for a geometric average proportion ratio from two or more studies.

Usage

```
meta.ave.propratio2(alpha, f1, f2, n1, n2, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f1`	vector of group 1 event counts
`f2`	vector of group 2 event counts
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval

References

Price RM, Bonett DG (2008). "Confidence intervals for a ratio of two independent binomial proportions." *Statistics in Medicine*, **27**(26), 5497–5508. ISSN 02776715, doi: 10.1002/sim.3376, `https://onlinelibrary.wiley.com/doi/10.1002/sim.3376`.

Examples

```
n1 <- c(204, 201, 932, 130, 77)
n2 <- c(106, 103, 415, 132, 83)
f1 <- c(24, 40, 93, 14, 5)
f2 <- c(12, 9, 28, 3, 1)
meta.ave.propratio2(.05, f1, f2, n1, n2, bystudy = TRUE)

#  Should return:
#          Estimate        SE          LL        UL
# Average 0.84705608 0.2528742  0.35143178 1.3426804
# Study 1 0.03604257 0.3297404 -0.61023681 0.6823220
# Study 2 0.81008932 0.3442007  0.13546839 1.4847103
# Study 3 0.38746839 0.2065227 -0.01730864 0.7922454
# Study 4 1.49316811 0.6023296  0.31262374 2.6737125
# Study 5 1.50851199 0.9828420 -0.41782290 3.4348469
#     exp(Estimate)   exp(LL)   exp(UL)
# Average  2.332769 1.4211008  3.829294
# Study 1  1.036700 0.5432222  1.978466
# Study 2  2.248109 1.1450730  4.413686
# Study 3  1.473246 0.9828403  2.208350
# Study 4  4.451175 1.3670071 14.493677
# Study 5  4.520000 0.6584788 31.026662
```

---

meta.ave.semipart — *Confidence interval for an average semipartial correlation*

Description

Computes the estimate, standard error, and confidence interval for an average semipartial correlation from two or more studies.

Usage

```
meta.ave.semipart(alpha, n, cor, r2, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`cor`	vector of estimated semipartial correlations
`r2`	vector of squared multiple correlations for full model
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
n <- c(128, 97, 210, 217)
cor <- c(.35, .41, .44, .39)
r2 <- c(.29, .33, .36, .39)
meta.ave.semipart(.05, n, cor, r2, bystudy = TRUE)

# Should return:
#         Estimate         SE        LL        UL
# Average   0.3975 0.03221240 0.3325507 0.4586965
# Study 1   0.3500 0.07175200 0.2023485 0.4820930
# Study 2   0.4100 0.07886080 0.2447442 0.5521076
# Study 3   0.4400 0.05146694 0.3338366 0.5351410
# Study 4   0.3900 0.05085271 0.2860431 0.4848830
```

---

meta.ave.slope *Confidence interval for an average slope coefficient*

Description

Computes the estimate, standard error, and confidence interval for an average slope coefficient in a simple linear regression model from two or more studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence interval.

Usage

```
meta.ave.slope(alpha, n, cor, sdy, sdx, bystudy = TRUE)
```

Arguments

alpha	alpha level for 1-alpha confidence
n	vector of sample sizes
cor	vector of estimated correlations
sdy	vector of estimated SDs of y
sdx	vector of estimated SDs of x
bystudy	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

Examples

```
n <- c(45, 85, 50, 60)
cor <- c(.24, .35, .16, .20)
sdy <- c(12.2, 14.1, 11.7, 15.9)
sdx <- c(1.34, 1.87, 2.02, 2.37)
meta.ave.slope(.05, n, cor, sdy, sdx, bystudy = TRUE)

# Should return:
#          Estimate        SE         LL       UL       df
# Average 1.7731542 0.4755417  0.8335021 2.712806 149.4777
# Study 1 2.1850746 1.3084468 -0.4536599 4.823809  43.0000
# Study 2 2.6390374 0.7262491  1.1945573 4.083518  83.0000
# Study 3 0.9267327 0.8146126 -0.7111558 2.564621  48.0000
# Study 4 1.3417722 0.8456799 -0.3510401 3.034584  58.0000
```

`meta.ave.spear` *Confidence interval for an average Spearman correlation*

Description

Computes the estimate, standard error, and confidence interval for an average Spearman correlation from two or more studies. The Spearman correlation is preferred to the Pearson correlation if the relation between the two quantitative variables is monotonic rather than linear or if the bivariate normality assumption is not plausible.

Usage

```
meta.ave.spear(alpha, n, cor, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`cor`	vector of estimated Spearman correlations
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2008). "Meta-analytic interval estimation for bivariate correlations." *Psychological Methods*, **13**(3), 173–181. ISSN 1939-1463, doi: 10.1037/a0012868, `https://doi.apa.org/getdoi.cfm?doi=10.1037/a0012868`.

Examples

```
n <- c(150, 200, 300, 200, 350)
cor <- c(.14, .29, .16, .21, .23)
meta.ave.spear(.05, n, cor, bystudy = TRUE)

# Should return:
#          Estimate         SE          LL        UL
# Average     0.206 0.02944265  0.14763960 0.2629309
# Study 1     0.140 0.08031750 -0.02151639 0.2943944
# Study 2     0.290 0.06492643  0.15476515 0.4145671
# Study 3     0.160 0.05635101  0.04689807 0.2690514
# Study 4     0.210 0.06776195  0.07187439 0.3402225
# Study 5     0.230 0.05069710  0.12690280 0.3281809
```

`meta.ave.stdmean.ps` *Confidence interval for an average standardized mean difference from paired-samples studies*

Description

Computes the estimate, standard error, and confidence interval for an average standardized mean difference from two or more paired-samples studies. Unweighted variances and single group variance are options for the standardizer. Equal variances within or across studies is not assumed.

Usage

```
meta.ave.stdmean.ps(alpha, m1, m2, sd1, sd2, cor, n, stdzr, bystudy = TRUE)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for measurement 1
m2	vector of estimated means for measurement 2
sd1	vector of estimated SDs for measurement 1
sd2	vector of estimated SDs for measurement 2
cor	vector of estimated correlations for paired measurements
n	vector of sample sizes
stdzr	• set to 0 for square root unweighted average variance standardizer • set to 1 for group 1 SD standardizer • set to 2 for group 2 SD standardizer
bystudy	logical to also return each study estimate (TRUE) or not

Value

A matrix. First row is the overall average estimate. If bystudy is TRUE also returns 1 row per study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
m1 <- c(23.9, 24.1)
m2 <- c(25.1, 26.9)
sd1 <- c(1.76, 1.58)
sd2 <- c(2.01, 1.76)
cor <- c(.78, .84)
n <- c(25, 30)
meta.ave.stdmean.ps(.05, m1, m2, sd1, sd2, cor, n, 1, bystudy = TRUE)

# Should return:
#            Estimate        SE        LL         UL
# Average -1.1931045 0.1568034 -1.500433 -0.8857755
# Study 1 -0.6818182 0.1773785 -1.029474 -0.3341628
# Study 2 -1.7721519 0.2586234 -2.279044 -1.2652594
```

meta.ave.stdmean2 *Confidence interval for an average standardized mean difference from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for an average standardized mean difference from two or more 2-group studies. Unweighted variances, weighted variances, and single group variance are options for the standardizer. Equal variances within or across studies is not assumed.

Usage

```
meta.ave.stdmean2(alpha, m1, m2, sd1, sd2, n1, n2, stdzr, bystudy = TRUE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`stdzr`	• set to 0 for square root unweighted average variance standardizer • set to 1 for group 1 SD standardizer • set to 2 for group 2 SD standardizer • set to 3 for square root weighted average variance standardizer
`bystudy`	logical to also return each study estimate (TRUE) or not

Value

A matrix. First row is the overall average estimate. If bystudy is TRUE also returns 1 row per study. The matrix has the following columns:

- Estimate - the estimated effect size
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, `https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619`.

Examples

```
m1 <- c(21.9, 23.1, 19.8)
m2 <- c(16.1, 17.4, 15.0)
sd1 <- c(3.82, 3.95, 3.67)
sd2 <- c(3.21, 3.30, 3.02)
n1 <- c(40, 30, 24)
n2 <- c(40, 28, 25)
meta.ave.stdmean2(.05, m1, m2, sd1, sd2, n1, n2, 0, bystudy = TRUE)

# Should return:
#          Estimate        SE        LL       UL
# Average 1.526146 0.1734341 1.1862217 1.866071
# Study 1 1.643894 0.2629049 1.1286100 2.159178
# Study 2 1.566132 0.3056278 0.9671126 2.165152
# Study 3 1.428252 0.3289179 0.7835848 2.072919
```

---

meta.ave.var *Confidence interval for an average variance*

Description

Computes the estimate and confidence interval for an average variance from two or more studies.

Usage

```
meta.ave.var(alpha, var, n, bystudy = TRUE)
```

Arguments

alpha	alpha level for 1-alpha confidence
var	vector of sample variances
n	vector of sample sizes
bystudy	logical to also return each study estimate (TRUE) or not

Value

Returns a matrix. The first row is the average estimate across all studies. If bystudy is true, there is 1 additional row for each study. The matrix has the following columns:

- Estimate - the estimated variance
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
var <- c(26.63, 22.45, 34.12)
n <- c(40, 30, 50)
meta.ave.var(.05, var, n, bystudy = TRUE)

# Should return:
#           Estimate        LL        UL
# Average 27.73333 21.45679 35.84589
# Study 1 26.63000 17.86939 43.90614
# Study 2 22.45000 14.23923 40.57127
# Study 3 34.12000 23.80835 52.98319
```

`meta.chitest` *Computes a chi-square test of effect-size homogeneity*

Description

Computes a chi-square test of effect size homogeneity and p-value using effect-size estimates and their standard errors from two or more studies. This test should not be used to justify the use of a constant coeffient (fixed-effect) meta-analysis. This test can be used to justify the estimation of an average effect size in a varying coefficient model.

Usage

```
meta.chitest(est, se)
```

Arguments

`est`	vector of effect-size estimates
`se`	vector of effect-size standard errors

Value

Returns a one-row matrix:

- Q - chi-square test statitic
- df - degrees of freedom
- p - p-value

References

Borenstein M, Hedges LV, Higgins JP, Rothstein HR (2009). *Introduction to meta-analysis*. Wiley, New York.

Examples

```
est <- c(.297, .324, .281, .149)
se <- c(.082, .051, .047, .094)
meta.chitest(est, se)

# Should return:
#         Q df         p
#  2.706526  3 0.4391195
```

---

meta.lc.agree — *Confidence interval for a linear contrast of G-index coefficients*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of G-index of agreement coefficients from two or more studies. This function assumes that two raters each provide a dichotomous rating for a sample of objects.

Usage

```
meta.lc.agree(alpha, f11, f12, f21, f22, v)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f11`	vector of frequencies in cell 1,1
`f12`	vector of frequencies in cell 1,2
`f21`	vector of frequencies in cell 2,1
`f22`	vector of frequencies in cell 2,2
`v`	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
f11 <- c(17, 28, 19)
f12 <- c(43, 56, 49)
f21 <- c(3, 5, 5)
f22 <- c(37, 54, 39)
v <- c(.5, .5, -1)
meta.lc.agree(.05, f11, f12, f21, f22, v)

# Should return:
#            Estimate        SE         LL        UL
# Contrast 0.07692783 0.1138407 -0.1461958 0.3000515
```

---

meta.lc.gen *Confidence interval for a linear contrast of effect sizes*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of any type of effect size from two or more studies.

Usage

```
meta.lc.gen(alpha, est, se, v)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`est`	vector of parameter estimates
`se`	vector of standard errors
`v`	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
est <- c(.55, .59, .44, .48, .26, .19)
se <- c(.054, .098, .029, .084, .104, .065)
v <- c(.5, .5, -.25, -.25, -.25, -.25)
meta.lc.gen(.05, est, se, v)

# Should return:
#          Estimate         SE        LL        UL
# Contrast   0.2275 0.06755461 0.0950954 0.3599046
```

---

meta.lc.mean.ps *Confidence interval for a linear contrast of mean differences from paired-samples studies*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of paired-samples mean differences from two or more studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence interval. Equal variances within or across studies is not assumed.

Usage

```
meta.lc.mean.ps(alpha, m1, m2, sd1, sd2, cor, n, v)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for group 1
m2	vector of estimated means for group 2
sd1	vector of estimated SDs for group 1
sd2	vector of estimated SDs for group 2
cor	vector of estimated correlations for paired measurements
n	vector of sample sizes
v	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
m1 <- c(53, 60, 53, 57)
m2 <- c(55, 62, 58, 61)
sd1 <- c(4.1, 4.2, 4.5, 4.0)
sd2 <- c(4.2, 4.7, 4.9, 4.8)
cor <- c(.7, .7, .8, .85)
n <- c(30, 50, 30, 70)
v <- c(.5, .5, -.5, -.5)
meta.lc.mean.ps(.05, m1, m2, sd1, sd2, cor, n, v)

# Should return:
#          Estimate        SE       LL       UL      df
# Contrast      2.5 0.4943114 1.520618 3.479382 112.347
```

---

meta.lc.mean1 — *Confidence interval a for a linear contrast of means*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of means from two or more studies. This function will use either an unequal variance (recommended) or an equal variance method. A Satterthwaite adjustment to the degrees of freedom is used with the unequal variance method.

Usage

```
meta.lc.mean1(alpha, m, sd, n, v, eqvar = FALSE)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m`	vector of estimated means
`sd`	vector of estimated standard deviations
`n`	vector of sample sizes
`v`	vector of contrast coefficients
`eqvar`	• FALSE for unequal variance method • TRUE for equal variance method

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Snedecor GW, Cochran WG (1980). *Statistical methods*, 7th edition. ISU University Pres, Ames, Iowa.

Examples

```
m <- c(33.5, 37.9, 38.0, 44.1)
sd <- c(3.84, 3.84, 3.65, 4.98)
n <- c(10, 10, 10, 10)
v <- c(.5, .5, -.5, -.5)
meta.lc.mean1(.05, m, sd, n, v, eqvar = FALSE)

# Should return:
#          Estimate       SE        LL        UL       df
# Contrast    -5.35 1.300136 -7.993583 -2.706417 33.52169
```

`meta.lc.mean2` *Confidence interval for a linear contrast of mean differences from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of 2-group mean differences from two or more studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence interval. Equal variances within or across studies is not assumed.

Usage

```
meta.lc.mean2(alpha, m1, m2, sd1, sd2, n1, n2, v)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for group 1
m2	vector of estimated means for group 2
sd1	vector of estimated SDs for group 1
sd2	vector of estimated SDs for group 2
n1	vector of group 1 sample sizes
n2	vector of group 2 sample sizes
v	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of the linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
m1 <- c(45.1, 39.2, 36.3, 34.5)
m2 <- c(30.0, 35.1, 35.3, 36.2)
sd1 <- c(10.7, 10.5, 9.4, 11.5)
sd2 <- c(12.3, 12.0, 10.4, 9.6)
n1 <- c(40, 20, 50, 25)
n2 <- c(40, 20, 48, 26)
v <- c(.5, .5, -.5, -.5)
meta.lc.mean2(.05, m1, m2, sd1, sd2, n1, n2, v)

# Should return:
#          Estimate       SE       LL       UL       df
# Contrast     9.95 2.837787 4.343938 15.55606 153.8362
```

`meta.lc.meanratio.ps` *Confidence interval for a log-linear contrast of mean ratios from paired-samples studies*

Description

Computes the estimate, standard error, and confidence interval for a log-linear contrast of paired-sample mean ratios from two or more studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence interval. Equal variances within or across studies is not assumed.

Usage

```
meta.lc.meanratio.ps(alpha, m1, m2, sd1, sd2, cor, n, v)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`cor`	vector of estimated correlations for paired measurements
`n`	vector of sample sizes
`v`	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of log-linear contrast
- SE - standard error of log-linear contrast
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - exponentiated estimate of log-linear function
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval
- df - degrees of freedom

References

Bonett DG, Price RM (2020). "Confidence intervals for ratios of means and medians." *Journal of Educational and Behavioral Statistics*, **45**(6), 750–770. ISSN 1076-9986, doi: 10.3102/1076998620934125, `https://journals.sagepub.com/doi/10.3102/1076998620934125`.

Examples

```
m1 <- c(53, 60, 53, 57)
m2 <- c(55, 62, 58, 61)
sd1 <- c(4.1, 4.2, 4.5, 4.0)
sd2 <- c(4.2, 4.7, 4.9, 4.8)
cor <- c(.7, .7, .8, .85)
n <- c(30, 50, 30, 70)
v <- c(.5, .5, -.5, -.5)
meta.lc.meanratio.ps(.05, m1, m2, sd1, sd2, cor, n, v)

# Should return:
#           Estimate          SE         LL         UL exp(Estimate)
# Contrast 0.0440713 0.008701725 0.02681353 0.06132907      1.045057
#           exp(LL)  exp(UL)       df
# Contrast 1.027176 1.063249 103.0256
```

`meta.lc.meanratio2` *Confidence interval for a log-linear contrast of mean ratios from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for a log-linear contrast of 2-group mean ratio from two or more studies. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence interval. Equal variances within or across studies is not assumed.

Usage

```
meta.lc.meanratio2(alpha, m1, m2, sd1, sd2, n1, n2, v)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for group 1
m2	vector of estimated means for group 2
sd1	vector of estimated SDs for group 1
sd2	vector of estimated SDs for group 2
n1	vector of group 1 sample sizes
n2	vector of group 2 sample sizes
v	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of log-linear contrast
- SE - standard error of log-linear contrast
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval
- df - degrees of freedom

References

Bonett DG, Price RM (2020). “Confidence intervals for ratios of means and medians.” *Journal of Educational and Behavioral Statistics*, **45**(6), 750–770. ISSN 1076-9986, doi: 10.3102/1076998620934125, https://journals.sagepub.com/doi/10.3102/1076998620934125.

Examples

```
m1 <- c(45.1, 39.2, 36.3, 34.5)
m2 <- c(30.0, 35.1, 35.3, 36.2)
sd1 <- c(10.7, 10.5, 9.4, 11.5)
sd2 <- c(12.3, 12.0, 10.4, 9.6)
n1 <- c(40, 20, 50, 25)
n2 <- c(40, 20, 48, 26)
v <- c(.5, .5, -.5, -.5)
meta.lc.meanratio2(.05, m1, m2, sd1, sd2, n1, n2, v)

# Should return:
#           Estimate         SE        LL        UL  exp(Estimate)
# Contrast 0.2691627 0.07959269 0.1119191 0.4264064      1.308868
#            exp(LL)  exp(UL)       df
# Contrast 1.118422 1.531743 152.8665
```

---

meta.lc.odds — *Confidence interval for a log-linear contrast of odds ratios*

Description

Computes the estimate, standard error, and confidence interval for an exponentiated log-linear contrast of odds ratios from two or more studies.

Usage

```
meta.lc.odds(alpha, f1, f2, n1, n2, v)
```

Arguments

alpha	alpha level for 1-alpha confidence
f1	vector of group 1 event counts
f2	vector of group 2 event counts
n1	vector of group 1 sample sizes
n2	vector of group 2 sample sizes
v	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of log-linear contrast
- SE - standard error of log-linear contrast
- exp(Estimate) - the exponentiated contrast
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval

References

Bonett DG, Price RM (2015). "Varying coefficient meta-analysis methods for odds ratios and risk ratios." *Psychological Methods*, **20**(3), 394–406. ISSN 1939-1463, doi: 10.1037/met0000032, https://doi.apa.org/getdoi.cfm?doi=10.1037/met0000032.

Examples

```
n1 <- c(50, 150, 150)
f1 <- c(16, 50, 25)
n2 <- c(50, 150, 150)
f2 <- c(7, 15, 20)
v <- c(1, -1, 0)
meta.lc.odds(.05, f1, f2, n1, n2, v)

# Should return:
#             Estimate        SE  exp(Estimate)   exp(LL)  exp(UL)
# Contrast -0.4596883 0.5895438      0.6314805 0.1988563 2.005305
```

`meta.lc.prop.ps` *Confidence interval for a linear contrast of proportion differences in paired-samples studies*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of paired-samples group proportion differences from two or more studies.

Usage

```
meta.lc.prop.ps(alpha, f11, f12, f21, f22, v)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f11`	vector of frequencies in cell 1,1
`f12`	vector of frequencies in cell 1,2
`f21`	vector of frequencies in cell 2,1
`f22`	vector of frequencies in cell 2,2
`v`	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG, Price RM (2014). "Meta-analysis methods for risk differences." *British Journal of Mathematical and Statistical Psychology*, **67**(3), 371–387. ISSN 00071102, doi: 10.1111/bmsp.12024, `https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12024`.

Examples

```
f11 <- c(17, 28, 19)
f12 <- c(43, 56, 49)
f21 <- c(3, 5, 5)
f22 <- c(37, 54, 39)
v <- c(.5, .5, -1)
meta.lc.prop.ps(.05, f11, f12, f21, f22, v)
```

```
# Should return:
#              Estimate         SE         LL       UL
#  Contrast -0.01436285 0.06511285 -0.1419817 0.113256
```

---

meta.lc.prop1 *Confidence interval for a linear contrast of proportions.*

Description

Computes the estimate, standard error, and an adjusted Wald confidence interval for a linear contrast of proportions from two or more studies.

Usage

```
meta.lc.prop1(alpha, f, n, v)
```

Arguments

alpha	alpha level for 1-alpha confidence
f	vector of frequency counts
n	vector of sample sizes
v	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate -estimate of linear contrast
- SE - standard error
- LL - lower limit of the adjusted Wald confidence interval
- UL - upper limit of the adjusted Wald confidence interval

References

Price RM, Bonett DG (2004). "An improved confidence interval for a linear function of binomial proportions." *Computational Statistics and Data Analysis*, **45**(3), 449–456. ISSN 01679473, doi: 10.1016/S01679473(03)000070.

Examples

```
f <- c(26, 24, 38)
n <- c(60, 60, 60)
v <- c(-.5, -.5, 1)
meta.lc.prop1(.05, f, n, v)

# Should return:
#           Estimate         SE         LL        UL
# Contrast 0.2119565 0.07602892 0.06294259 0.3609705
```

`meta.lc.prop2` *Confidence interval for a linear contrast of proportion differences in 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of 2-group proportion differences from two or more studies.

Usage

```
meta.lc.prop2(alpha, f1, f2, n1, n2, v)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f1`	vector of group 1 event counts
`f2`	vector of group 2 event counts
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`v`	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of the linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG, Price RM (2014). "Meta-analysis methods for risk differences." *British Journal of Mathematical and Statistical Psychology*, **67**(3), 371–387. ISSN 00071102, doi: 10.1111/bmsp.12024, https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12024.

Examples

```
n1 <- c(50, 150, 150)
n2 <- c(50, 150, 150)
f1 <- c(16, 50, 25)
f2 <- c(7, 15, 20)
v <- c(1, -1, 0)
meta.lc.prop2(.05, f1, f2, n1, n2, v)

# Should return:
#              Estimate         SE         LL        UL
# Contrast -0.05466931 0.09401019 -0.2389259 0.1295873
```

`meta.lc.propratio2` *Confidence interval for a log-linear contrast of proportion ratios from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for an exponentiated log-linear contrast of 2-group proportion ratios from two or more studies.

Usage

```
meta.lc.propratio2(alpha, f1, f2, n1, n2, v)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f1`	vector of group 1 event counts
`f2`	vector of group 2 event counts
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`v`	vector of contrast coefficients

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of log-linear contrast
- SE - standard error of log-linear contrast
- exp(Estimate) - the exponentiated contrast
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval

References

Price RM, Bonett DG (2008). "Confidence intervals for a ratio of two independent binomial proportions." *Statistics in Medicine*, **27**(26), 5497–5508. ISSN 02776715, doi: 10.1002/sim.3376, `https://onlinelibrary.wiley.com/doi/10.1002/sim.3376`.

Examples

```
n1 <- c(50, 150, 150)
f1 <- c(16, 50, 25)
n2 <- c(50, 150, 150)
f2 <- c(7, 15, 20)
v <- c(1, -1, 0)
meta.lc.propratio2(.05, f1, f2, n1, n2, v)

# Should return:
#            Estimate        SE  exp(Estimate)   exp(LL)  exp(UL)
# Contrast -0.3853396 0.4828218      0.6802196 0.2640405 1.752378
```

`meta.lc.stdmean.ps` *Confidence interval for a linear contrast of standardized mean differences from paired-samples studies*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of paired-samples standardized mean differences from two or more studies. Equal variances within or across studies is not assumed.

Usage

```
meta.lc.stdmean.ps(alpha, m1, m2, sd1, sd2, cor, n, v, stdzr)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`cor`	vector of estimated correlations for paired measurements
`n`	vector of sample sizes
`v`	vector of contrast coefficients
`stdzr`	• set to 0 for square root unweighted average variance standardizer • set to 1 for group 1 SD standardizer • set to 2 for group 2 SD standardizer

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
m1 <- c(53, 60, 53, 57)
m2 <- c(55, 62, 58, 61)
sd1 <- c(4.1, 4.2, 4.5, 4.0)
sd2 <- c(4.2, 4.7, 4.9, 4.8)
cor <- c(.7, .7, .8, .85)
n <- c(30, 50, 30, 70)
v <- c(.5, .5, -.5, -.5)
meta.lc.stdmean.ps(.05, m1, m2, sd1, sd2, cor, n, v, 0)

# Should return:
#             Estimate        SE        LL        UL
# Contrast  0.5127577 0.1392232 0.2398851 0.7856302
```

meta.lc.stdmean2 *Confidence interval for a linear contrast of standardized mean differences from 2-group studies*

Description

Computes the estimate, standard error, and confidence interval for a linear contrast of 2-group standardized mean differences from two or more studies. Equal variances within or across studies is not assumed. Use the square root average variance standardizer (stdzr = 0) for 2-group experimental designs. Use the square root weighted variance standardizer (stdzr = 3) for 2-group nonexperimental designs with simple random sampling. The stdzr = 1 and stdzr = 2 options can be used with either 2-group experimental or nonexperimental designs.

Usage

```
meta.lc.stdmean2(alpha, m1, m2, sd1, sd2, n1, n2, v, stdzr)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`v`	vector of contrast coefficients
`stdzr`	• set to 0 for square root unweighted average variance standardizer • set to 1 for group 1 SD standardizer • set to 2 for group 2 SD standardizer • set to 3 for square root weighted average variance standardizer

Value

Returns 1-row matrix with the estimate for the contrast. The matrix has the following columns:

- Estimate - estimate of linear contrast
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
m1 <- c(45.1, 39.2, 36.3, 34.5)
m2 <- c(30.0, 35.1, 35.3, 36.2)
sd1 <- c(10.7, 10.5, 9.4, 11.5)
sd2 <- c(12.3, 12.0, 10.4, 9.6)
n1 <- c(40, 20, 50, 25)
n2 <- c(40, 20, 48, 26)
v <- c(.5, .5, -.5, -.5)
meta.lc.stdmean2(.05, m1, m2, sd1, sd2, n1, n2, v, 0)

# Should return:
#           Estimate        SE        LL       UL
# Contrast 0.8557914 0.2709192 0.3247995 1.386783
```

`meta.lm.agree` *Meta-regression analysis for G agreement indices*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a G-index of agreement. The estimates are OLS estimates with standard errors that accomodate residual heteroscedasticity.

Usage

```
meta.lm.agree(alpha, f11, f12, f21, f22, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f11`	vector of frequencies in cell 1,1
`f12`	vector of frequencies in cell 1,2
`f21`	vector of frequencies in cell 2,1
`f22`	vector of frequencies in cell 2,2
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
f11 <- c(40, 20, 25, 30)
f12 <- c(3, 2, 2, 1)
f21 <- c(7, 6, 8, 6)
f22 <- c(26, 25, 13, 25)
x1 <- c(1, 1, 4, 6)
x2 <- c(1, 1, 0, 0)
X <- matrix(cbind(x1, x2), 4, 2)
meta.lm.agree(.05, f11, f12, f21, f22, X)

# Should return:
#     Estimate         SE         z     p          LL        UL
# b0 0.1904762 0.38772858 0.4912617 0.623 -0.56945786 0.9504102
# b1 0.0952381 0.07141957 1.3335013 0.182 -0.04474169 0.2352179
# b2 0.4205147 0.32383556 1.2985438 0.194 -0.21419136 1.0552207
```

---

meta.lm.cor *Meta-regression analysis for Pearson or partial correlations*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a Fisher-transformed Pearson or partial correlation. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity. The correlations are Fisher-transformed and hence the parameter estimates do not have a simple interpretation. However, the hypothesis test results can be used to decide if a population slope is either positive or negative.

Usage

```
meta.lm.cor(alpha, n, cor, s, X)
```

Arguments

alpha	alpha level for 1-alpha confidence
n	vector of sample sizes
cor	vector of estimated Pearson or partial correlations
s	number of control variables
X	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - Standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
n <- c(55, 190, 65, 35)
cor <- c(.40, .65, .60, .45)
q <- 0
x1 <- c(18, 25, 23, 19)
X <- matrix(x1, 4, 1)
meta.lm.cor(.05, n, cor, q, X)

# Should return:
#      Estimate         SE         z     p          LL         UL
# b0 -0.47832153 0.48631509 -0.983563 0.325 -1.431481595 0.47483852
# b1  0.05047154 0.02128496  2.371231 0.018  0.008753794 0.09218929
```

---

meta.lm.cor.gen *Meta-regression analysis for correlations*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a Fisher-transformed correlation. The correlations can be of different types (e.g., Pearson, partial, Spearman). The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity. This function uses estimated correlations and their standard errors as input. The correlations are Fisher-transformed and hence the parameter estimates do not have a simple interpretation. However, the hypothesis test results can be used to decide if a population slope is either positive or negative.

Usage

```
meta.lm.cor.gen(alpha, cor, se, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`cor`	vector of estimated correlations
`se`	number of control variables
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
cor <- c(.40, .65, .60, .45)
se <- c(.182, .114, .098, .132)
x1 <- c(18, 25, 23, 19)
X <- matrix(x1, 4, 1)
meta.lm.cor.gen(.05, cor, se, X)

# Should return:
#      Estimate         SE          z     p
# b0 -0.47832153 0.63427931 -0.7541181 0.451
# b1  0.05047154 0.02879859  1.7525699 0.080
```

`meta.lm.cronbach` *Meta-regression analysis for Cronbach reliabilities*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a log-complement Cronbach reliablity. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity. The exponentiated slope estimate for a predictor variable describes a multiplicative change in variable.

Usage

```
meta.lm.cronbach(alpha, n, rel, r, X)
```

Arguments

alpha	alpha level for 1-alpha confidence
n	vector of sample sizes
rel	vector of estimated reliabilities
r	number of measurements (e.g., items)
X	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - exponentiated OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the exponentiated confidence interval
- UL - upper limit of the exponentiated confidence interval

References

Bonett DG (2010). "Varying coefficient meta-analytic methods for alpha reliability." *Psychological Methods*, **15**(4), 368–385. ISSN 1939-1463, doi: 10.1037/a0020142, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0020142.

Examples

```
n <- c(583, 470, 546, 680)
rel <- c(.91, .89, .90, .89)
x1 <- c(1, 0, 0, 0)
X <- matrix(x1, 4, 1)
meta.lm.cronbach(.05, n, rel, 10, X)

# Should return:
#      Estimate         SE          z     p         LL          UL
# b0 -2.2408328 0.03675883 -60.960391 0.000 -2.3128788 -2.16878684
# b1 -0.1689006 0.07204625  -2.344336 0.019 -0.3101087 -0.02769259
```

meta.lm.gen *Meta-regression analysis for any type of effect size*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is any type of effect size. The estimates are OLS estimates with standard errors that accomodate residual heteroscedasticity.

Usage

```
meta.lm.gen(alpha, est, se, X)
```

Arguments

alpha	alpha level for 1-alpha confidence
est	vector of parameter estimates
se	vector of standard errors
X	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
est <- c(4.1, 4.7, 4.9, 5.7, 6.6, 7.3)
se <- c(1.2, 1.5, 1.3, 1.8, 2.0, 2.6)
x1 <- c(10, 20, 30, 40, 50, 60)
x2 <- c(1, 1, 1, 0, 0, 0)
X <- matrix(cbind(x1, x2), 6, 2)
meta.lm.gen(.05, est, se, X)

# Should return:
#      Estimate         SE           z     p         LL         UL
# b0  3.5333333 4.37468253  0.80767766 0.419 -5.0408869 12.1075535
# b1  0.0600000 0.09058835  0.66233679 0.508 -0.1175499  0.2375499
# b2 -0.1666667 2.81139793 -0.05928249 0.953 -5.6769054  5.3435720
```

meta.lm.mean.ps *Meta-regression analysis for paired-samples mean differences*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a paired-samples mean difference. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity.

Usage

```
meta.lm.mean.ps(alpha, m1, m2, sd1, sd2, cor, n, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`cor`	vector of estimated correlations
`n`	vector of sample sizes
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- t - t-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, `https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619`.

Examples

```
n <- c(65, 30, 29, 45, 50)
cor <- c(.87, .92, .85, .90, .88)
m1 <- c(20.1, 20.5, 19.3, 21.5, 19.4)
m2 <- c(10.4, 10.2, 8.5, 10.3, 7.8)
sd1 <- c(9.3, 9.9, 10.1, 10.5, 9.8)
sd2 <- c(7.8, 8.0, 8.4, 8.1, 8.7)
x1 <- c(2, 3, 3, 4, 4)
X <- matrix(x1, 5, 1)
meta.lm.mean.ps(.05, m1, m2, sd1, sd2, cor, n, X)

# Should return:
#    Estimate        SE        t     p        LL        UL  df
# b0     8.00 1.2491990 6.404104 0.000 5.5378833 10.462117 217
# b1     0.85 0.3796019 2.239188 0.026 0.1018213  1.598179 217
```

`meta.lm.mean1` *Meta-regression analysis for 1-group means*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a mean from one group. The estimates are OLS estimates with standard errors that accomodate residual heteroscedasticity.

Usage

```
meta.lm.mean1(alpha, m, sd, n, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m`	vector of estimated means
`sd`	vector of estimated standard deviations
`n`	vector of sample sizes
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- t - t-value

- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

Examples

```
n <- c(25, 15, 30, 25, 40)
m <- c(20.1, 20.5, 19.3, 21.5, 19.4)
sd <- c(10.4, 10.2, 8.5, 10.3, 7.8)
x1 <- c(1, 1, 0, 0, 0)
x2 <- c( 12, 13, 11, 13, 15)
X <- matrix(cbind(x1, x2), 5, 2)
meta.lm.mean1(.05, m, sd, n, X)

# Should return:
#       Estimate        SE          t     p         LL        UL  df
# b0 19.45490196 6.7873381 2.86635227 0.005  6.0288763 32.880928 132
# b1  0.25686275 1.9834765 0.12950128 0.897 -3.6666499  4.180375 132
# b2  0.04705882 0.5064693 0.09291544 0.926 -0.9547876  1.048905 132
```

`meta.lm.mean2` *Meta-regression analysis for 2-group mean differences*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a 2-group mean difference. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity.

Usage

```
meta.lm.mean2(alpha, m1, m2, sd1, sd2, n1, n2, X)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for group 1
m2	vector of estimated means for group 2
sd1	vector of estimated SDs for group 1
sd2	vector of estimated SDs for group 2
n1	vector of group 1 sample sizes
n2	vector of group 2 sample sizes
X	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- t - t-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
n1 <- c(65, 30, 29, 45, 50)
n2 <- c(67, 32, 31, 20, 52)
m1 <- c(31.1, 32.3, 31.9, 29.7, 33.0)
m2 <- c(34.1, 33.2, 30.6, 28.7, 26.5)
sd1 <- c(7.1, 8.1, 7.8, 6.8, 7.6)
sd2 <- c(7.8, 7.3, 7.5, 7.2, 6.8)
x1 <- c(4, 6, 7, 7, 8)
x2 <- c(1, 0, 0, 0, 1)
X <- matrix(cbind(x1, x2), 5, 2)
meta.lm.mean2(.05, m1, m2, sd1, sd2, n1, n2, X)

# Should return:
#    Estimate        SE         t     p         LL        UL  df
# b0   -15.20 3.4097610 -4.457791 0.000 -21.902415 -8.497585 418
# b1     2.35 0.4821523  4.873979 0.000   1.402255  3.297745 418
# b2     2.85 1.5358109  1.855697 0.064  -0.168875  5.868875 418
```

---

meta.lm.meanratio.ps *Meta-regression analysis for paired-samples log mean ratios*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a paired-samples log mean ratio. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity.

Usage

```
meta.lm.meanratio.ps(alpha, m1, m2, sd1, sd2, cor, n, X)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for group 1
m2	vector of estimated means for group 2
sd1	vector of estimated SDs for group 1
sd2	vector of estimated SDs for group 2
cor	vector of estimated correlations
n	vector of sample sizes
X	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval

Examples

```
n <- c(65, 30, 29, 45, 50)
cor <- c(.87, .92, .85, .90, .88)
m1 <- c(20.1, 20.5, 19.3, 21.5, 19.4)
m2 <- c(10.4, 10.2, 8.5, 10.3, 7.8)
sd1 <- c(9.3, 9.9, 10.1, 10.5, 9.8)
sd2 <- c(7.8, 8.0, 8.4, 8.1, 8.7)
x1 <- c(2, 3, 3, 4, 4)
X <- matrix(x1, 5, 1)
meta.lm.meanratio.ps(.05, m1, m2, sd1, sd2, cor, n, X)

# Should return:
#      Estimate         SE           LL        UL        z     p
# b0 0.50957008 0.13000068  0.254773424 0.7643667 3.919749 0.000
# b1 0.07976238 0.04133414 -0.001251047 0.1607758 1.929697 0.054
#     exp(Estimate)   exp(LL)  exp(UL)
```

```
# b0       1.664575 1.2901693 2.147634
# b1       1.083030 0.9987497 1.174422
```

`meta.lm.meanratio2` *Meta-regression analysis for 2-group log mean ratios*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a 2-group log mean ratio. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity.

Usage

```
meta.lm.meanratio2(alpha, m1, m2, sd1, sd2, n1, n2, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval

Examples

```
n1 <- c(65, 30, 29, 45, 50)
n2 <- c(67, 32, 31, 20, 52)
m1 <- c(31.1, 32.3, 31.9, 29.7, 33.0)
m2 <- c(34.1, 33.2, 30.6, 28.7, 26.5)
sd1 <- c(7.1, 8.1, 7.8, 6.8, 7.6)
sd2 <- c(7.8, 7.3, 7.5, 7.2, 6.8)
x1 <- c(4, 6, 7, 7, 8)
X <- matrix(x1, 5, 1)
meta.lm.meanratio2(.05, m1, m2, sd1, sd2, n1, n2, X)

# Should return:
#       Estimate         SE          LL          UL         z p
# b0 -0.40208954 0.09321976 -0.58479692 -0.21938216 -4.313351 0
# b1  0.06831545 0.01484125  0.03922712  0.09740377  4.603078 0
#    exp(Estimate)  exp(LL)   exp(UL)
# b0     0.6689208 0.557219 0.8030148
# b1     1.0707030 1.040007 1.1023054
```

---

meta.lm.odds *Meta-regression analysis for odds ratios*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a log odds ratio. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity. The exponentiated slope estimate for a predictor variable describes a multiplicative change in the odds ratio associated with a 1-unit increase in that predictor variable.

Usage

```
meta.lm.odds(alpha, f1, f2, n1, n2, X)
```

Arguments

alpha	alpha level for 1-alpha confidence
f1	vector of group 1 event counts
f2	vector of group 2 event counts
n1	vector of group 1 sample sizes
n2	vector of group 2 sample sizes
X	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval

References

Bonett DG, Price RM (2015). "Varying coefficient meta-analysis methods for odds ratios and risk ratios." *Psychological Methods*, **20**(3), 394–406. ISSN 1939-1463, doi: 10.1037/met0000032, https://doi.apa.org/getdoi.cfm?doi=10.1037/met0000032.

Examples

```
n1 <- c(204, 201, 932, 130, 77)
n2 <- c(106, 103, 415, 132, 83)
f1 <- c(24, 40, 93, 14, 5)
f2 <- c(12, 9, 28, 3, 1)
x1 <- c(4, 4, 5, 3, 26)
x2 <- c(1, 1, 1, 0, 0)
X <- matrix(cbind(x1, x2), 5, 2)
meta.lm.odds(.05, f1, f2, n1, n2, X)

# Should return:
#        Estimate         SE           z     p         LL         UL
# b0  1.541895013 0.69815801  2.20851868 0.027  0.1735305 2.91025958
# b1 -0.004417932 0.04840623 -0.09126784 0.927 -0.0992924 0.09045653
# b2 -1.071122269 0.60582695 -1.76803337 0.077 -2.2585213 0.11627674
#    exp(Estimate)   exp(LL)   exp(UL)
# b0     4.6734381 1.1894969 18.361564
# b1     0.9955918 0.9054779  1.094674
# b2     0.3426238 0.1045049  1.123307
```

`meta.lm.prop.ps` *Meta-regression analysis for paired-samples proportion differences*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a paired-samples proportion difference. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity.

Usage

```
meta.lm.prop.ps(alpha, f11, f12, f21, f22, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f11`	vector of frequencies in cell 1,1
`f12`	vector of frequencies in cell 1,2
`f21`	vector of frequencies in cell 2,1
`f22`	vector of frequencies in cell 2,2
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG, Price RM (2014). “Meta-analysis methods for risk differences.” *British Journal of Mathematical and Statistical Psychology*, **67**(3), 371–387. ISSN 00071102, doi: 10.1111/bmsp.12024, `https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12024`.

Examples

```
f11 <- c(40, 20, 25, 30)
f12 <- c(3, 2, 2, 1)
f21 <- c(7, 6, 8, 6)
f22 <- c(26, 25, 13, 25)
x1 <- c(1, 1, 4, 6)
x2 <- c(1, 1, 0, 0)
X <- matrix(cbind(x1, x2), 4, 2)
meta.lm.prop.ps(.05, f11, f12, f21, f22, X)

# Should return:
#       Estimate         SE          z     p          LL         UL
# b0 -0.21113402 0.21119823 -0.9996960 0.317 -0.62507494 0.20280690
# b1  0.02185567 0.03861947  0.5659236 0.571 -0.05383711 0.09754845
# b2  0.12575138 0.17655623  0.7122455 0.476 -0.22029248 0.47179524
```

---

meta.lm.prop1 — *Meta-regression analysis for 1-group proportions*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a proportion from one group. The estimates are OLS estimates with standard errors that accomodate residual heteroscedasticity.

Usage

```
meta.lm.prop1(alpha, f, n, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f`	vector of sample frequency counts
`n`	vector of sample sizes
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
f <- c(38, 26, 24, 15, 45, 38)
n <- c(80, 60, 70, 50, 180, 200)
x1 <- c(10, 15, 18, 22, 24, 30)
X <- matrix(x1, 6, 1)
meta.lm.prop1(.05, f, n, X)

# Should return:
#       Estimate         SE         z p          LL           UL
# b0  0.63262816 0.06845707  9.241239 0  0.49845477  0.766801546
# b1 -0.01510565 0.00290210 -5.205076 0 -0.02079367 -0.009417641
```

---

meta.lm.prop2 — *Meta-regression analysis for 2-group proportion differences*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a 2-group proportion difference. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity.

Usage

```
meta.lm.prop2(alpha, f1, f2, n1, n2, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f1`	vector of group 1 event counts
`f2`	vector of group 2 event counts
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG, Price RM (2014). "Meta-analysis methods for risk differences." *British Journal of Mathematical and Statistical Psychology*, **67**(3), 371–387. ISSN 00071102, doi: 10.1111/bmsp.12024, https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12024.

Examples

```
f1 <- c(24, 40, 93, 14, 5)
f2 <- c(12, 9, 28, 3, 1)
n1 <- c(204, 201, 932, 130, 77)
n2 <- c(106, 103, 415, 132, 83)
x1 <- c(4, 4, 5, 3, 26)
x2 <- c(1, 1, 1, 0, 0)
X <- matrix(cbind(x1, x2), 5, 2)
meta.lm.prop2(.05, f1, f2, n1, n2, X)

# Should return:
#        Estimate          SE          z     p          LL          UL
# b0  0.089756283 0.034538077  2.5987632 0.009  0.02206290 0.157449671
# b1 -0.001447968 0.001893097 -0.7648672 0.444 -0.00515837 0.002262434
# b2 -0.034670988 0.034125708 -1.0159786 0.310 -0.10155615 0.032214170
```

`meta.lm.propratio2` *Meta-regression analysis for proportion ratios*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a log proportion ratio. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity. The exponentiated slope estimate for a predictor variable describes a multiplicative change in the proportion ratio associated with a 1-unit increase in that predictor variable.

Usage

```
meta.lm.propratio2(alpha, f1, f2, n1, n2, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f1`	vector of group 1 event counts
`f2`	vector of group 2 event counts
`n1`	vector of group 1 sample sizes
`n2`	vector of group 2 sample sizes
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- exp(Estimate) - the exponentiated estimate
- exp(LL) - lower limit of the exponentiated confidence interval
- exp(UL) - upper limit of the exponentiated confidence interval

References

Price RM, Bonett DG (2008). "Confidence intervals for a ratio of two independent binomial proportions." *Statistics in Medicine*, **27**(26), 5497–5508. ISSN 02776715, doi: 10.1002/sim.3376, https://onlinelibrary.wiley.com/doi/10.1002/sim.3376.

Examples

```
n1 <- c(204, 201, 932, 130, 77)
n2 <- c(106, 103, 415, 132, 83)
f1 <- c(24, 40, 93, 14, 5)
f2 <- c(12, 9, 28, 3, 1)
x1 <- c(4, 4, 5, 3, 26)
x2 <- c(1, 1, 1, 0, 0)
X <- matrix(cbind(x1, x2), 5, 2)
meta.lm.propratio2(.05, f1, f2, n1, n2, X)

# Should return:
#        Estimate         SE           z     p          LL         UL
# b0  1.4924887636 0.69172794  2.15762393 0.031  0.13672691 2.84825062
# b1  0.0005759509 0.04999884  0.01151928 0.991 -0.09741998 0.09857188
# b2 -1.0837844594 0.59448206 -1.82307345 0.068 -2.24894789 0.08137897
#     exp(Estimate)   exp(LL)   exp(UL)
# b0      4.4481522 1.1465150 17.257565
# b1      1.0005761 0.9071749  1.103594
# b2      0.3383128 0.1055102  1.084782
```

`meta.lm.semipart` *Meta-regression analysis for semipartial correlations*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a Fisher- transformed semipartial correlation. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity. The correlations are Fisher-transformed and hence the parameter estimates do not have a simple interpretation. However, the hypothesis test results can be used to decide if a population slope is either positive or negativ

Usage

```
meta.lm.semipart(alpha, n, cor, r2, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`cor`	vector of estimated semipartial correlations
`r2`	vector of estimated squared multiple correlations for full model
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
n <- c(128, 97, 210, 217)
cor <- c(.35, .41, .44, .39)
r2 <- c(.29, .33, .36, .39)
x1 <- c(18, 25, 23, 19)
X <- matrix(x1, 4, 1)
meta.lm.semipart(.05, n, cor, r2, X)

# Should return:
```

```
#      Estimate        SE         z     p          LL         UL
# b0 0.19695988 0.3061757 0.6432905 0.520 -0.40313339 0.79705315
# b1 0.01055584 0.0145696 0.7245114 0.469 -0.01800004 0.03911172
```

`meta.lm.spear` *Meta-regression analysis for Spearman correlations*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a Fisher-transformed Spearman correlation. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity. The correlations are Fisher-transformed and hence the parameter estimates do not have a simple interpretation. However, the hypothesis test results can be used to decide if a population slope is either positive or negative.

Usage

```
meta.lm.spear(alpha, n, cor, X)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`cor`	vector of estimated Spearman correlations
`X`	matrix of predictor values

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
n <- c(150, 200, 300, 200, 350)
cor <- c(.14, .29, .16, .21, .23)
x1 <- c(18, 25, 23, 19, 24)
X <- matrix(x1, 5, 1)
meta.lm.spear(.05, n, cor, X)

# Should return:
#       Estimate         SE          z     p           LL         UL
# b0 -0.08920088 0.26686388 -0.3342561 0.738 -0.612244475 0.43384271
# b1  0.01370866 0.01190212  1.1517825 0.249 -0.009619077 0.03703639
```

---

meta.lm.stdmean.ps — *Meta-regression analysis for paired-samples standardized mean differences*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a paired-samples standardized mean difference. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity.

Usage

```
meta.lm.stdmean.ps(alpha, m1, m2, sd1, sd2, cor, n, X, stdzr)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m1`	vector of estimated means for group 1
`m2`	vector of estimated means for group 2
`sd1`	vector of estimated SDs for group 1
`sd2`	vector of estimated SDs for group 2
`cor`	vector of estimated correlations
`n`	vector of sample sizes
`X`	matrix of predictor values
`stdzr`	• set to 0 for square root unweighted average variance standardizer • set to 1 for group 1 SD standardizer • set to 2 for group 2 SD standardizer

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- t - t-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
n <- c(65, 30, 29, 45, 50)
cor <- c(.87, .92, .85, .90, .88)
m1 <- c(20.1, 20.5, 19.3, 21.5, 19.4)
m2 <- c(10.4, 10.2, 8.5, 10.3, 7.8)
sd1 <- c(9.3, 9.9, 10.1, 10.5, 9.8)
sd2 <- c(7.8, 8.0, 8.4, 8.1, 8.7)
x1 <- c(2, 3, 3, 4, 4)
X <- matrix(x1, 5, 1)
meta.lm.stdmean.ps(.05, m1, m2, sd1, sd2, cor, n, X, 0)

# Should return:
#      Estimate         SE         z     p         LL        UL
# b0 1.01740253 0.25361725 4.0115667 0.000  0.5203218 1.5144832
# b1 0.04977943 0.07755455 0.6418635 0.521 -0.1022247 0.2017836
```

`meta.lm.stdmean2` *Meta-regression analysis for 2-group standardized mean differences*

Description

This function estimates the intercept and slope coefficients in a meta-regression model where the dependent variable is a 2-group standardized mean difference. The estimates are OLS estimates with standard errors that accommodate residual heteroscedasticity.

Usage

```
meta.lm.stdmean2(alpha, m1, m2, sd1, sd2, n1, n2, X, stdzr)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for group 1
m2	vector of estimated means for group 2
sd1	vector of estimated SDs for group 1
sd2	vector of estimated SDs for group 2
n1	vector of group 1 sample sizes
n2	vector of group 2 sample sizes
X	matrix of predictor values
stdzr	• set to 0 for square root unweighted average variance standardizer • set to 1 for group 1 SD standardizer • set to 2 for group 2 SD standardizer • set to 3 for square root weighted average variance standardizer

Value

Returns a matrix. The first row is for the intercept with one additional row per predictor. The matrix has the following columns:

- Estimate - OLS estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
n1 <- c(65, 30, 29, 45, 50)
n2 <- c(67, 32, 31, 20, 52)
m1 <- c(31.1, 32.3, 31.9, 29.7, 33.0)
m2 <- c(34.1, 33.2, 30.6, 28.7, 26.5)
sd1 <- c(7.1, 8.1, 7.8, 6.8, 7.6)
sd2 <- c(7.8, 7.3, 7.5, 7.2, 6.8)
x1 <- c(4, 6, 7, 7, 8)
```

```
X <- matrix(x1, 5, 1)
meta.lm.stdmean2(.05, m1, m2, sd1, sd2, n1, n2, X, 0)

# Should return:
#      Estimate        SE         z p         LL         UL
# b0 -1.6988257 0.4108035 -4.135373 0 -2.5039857 -0.8936657
# b1  0.2871641 0.0649815  4.419167 0  0.1598027  0.4145255
```

`meta.sub.cor` *Confidence interval for a difference in average Pearson or partial correlations for two sets of studies*

Description

Computes the estimate, standard error, and confidence interval for a difference in average Pearson or partial correlations for two mutually exclusive sets of studies. Each set can have one or more studies. All of the correlations must be either Pearson correlations or partial correlations.

Usage

```
meta.sub.cor(alpha, n, cor, s, group)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`cor`	vector of estimated Pearson correlations
`s`	number of control variables (set to 0 for Pearson)
`group`	vector of group indicators: • 1 for set A • 2 for set B • 0 to ignore

Value

Returns a matrix with three rows:

- Row 1 - estimate for Set A
- Row 2 - estimate for Set B
- Row 3 - estimate for difference, Set A - Set B

The columns are:

- Estimate - estimate of average correlation or difference
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2008). "Meta-analytic interval estimation for bivariate correlations." *Psychological Methods*, **13**(3), 173–181. ISSN 1939-1463, doi: 10.1037/a0012868, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0012868.

Examples

```
n <- c(55, 190, 65, 35)
cor <- c(.40, .65, .60, .45)
group <- c(1, 1, 2, 0)
meta.sub.cor(.05, n, cor, 0, group)

# Should return:
#                Estimate         SE         LL        UL
# Set A:            0.525 0.06195298  0.3932082 0.6356531
# Set B:            0.600 0.08128008  0.4171458 0.7361686
# Set A - Set B:   -0.075 0.10219894 -0.2645019 0.1387283
```

`meta.sub.cronbach` *Confidence interval for a difference in average Cronbach reliabilities for two sets of studies*

Description

Computes the estimate, standard error, and confidence interval for a difference in average Cronbach reliability coefficients for two mutually exclusive sets of studies. Each set can have one or more studies. The number of measurements used to compute the sample reliablity coefficient is assumed to be the same for all studies.

Usage

```
meta.sub.cronbach(alpha, n, rel, r, group)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`rel`	vector of estimated Cronbach reliabilities
`r`	number of measurements (e.g., items)
`group`	vector of group indicators: • 1 for set A • 2 for set B • 0 to ignore

Value

Returns a matrix with three rows:

- Row 1 - estimate for Set A
- Row 2 - estimate for Set B
- Row 3 - estimate for difference, Set A - Set B

The columns are:

- Estimate - estimate of average correlation or difference
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2010). "Varying coefficient meta-analytic methods for alpha reliability." *Psychological Methods*, **15**(4), 368–385. ISSN 1939-1463, doi: 10.1037/a0020142, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0020142.

Examples

```
n <- c(120, 170, 150, 135)
rel <- c(.89, .87, .73, .71)
group <- c(1, 1, 2, 2)
r <- 10
meta.sub.cronbach(.05, n, rel, r, group)

# Should return:
#                Estimate         SE        LL        UL
# Set A:             0.88 0.01068845 0.8581268 0.8999386
# Set B:             0.72 0.02515130 0.6684484 0.7668524
# Set A - Set B:     0.16 0.02732821 0.1082933 0.2152731
```

---

meta.sub.pbcor *Confidence interval for a difference in average point-biserial correlations for two sets of studies*

Description

Computes the estimate, standard error, and confidence interval for a difference in average point-biserial correlations for two mutually exclusive sets of studies. Each set can have one or more studies. Two types of point-biserial correlations can be analyzed. One type uses an unweighted variance and is approrpaite for 2-group experimental designs. The other type uses a weighted variance and is appropriate for 2-group nonexperimental designs with simple random sampling. Equal variances within or across studies is not assumed.

Usage

```
meta.sub.pbcor(alpha, m1, m2, sd1, sd2, n1, n2, type, group)
```

Arguments

alpha	alpha level for 1-alpha confidence
m1	vector of estimated means for group 1
m2	vector of estimated means for group 2
sd1	vector of estimated SDs for group 1
sd2	vector of estimated SDs for group 2
n1	vector of group 1 sample sizes
n2	vector of group 2 sample sizes
type	• set to 1 for weighted variance • set to 2 for unweighted variance
group	vector of group indicators: • 1 for set A • 2 for set B • 0 to ignore

Value

Returns a matrix with three rows:

- Row 1 - estimate for Set A
- Row 2 - estimate for Set B
- Row 3 - estimate for difference, Set A - Set B

The columns are:

- Estimate - estimate of average correlation or difference
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2020). "Point-biserial correlation: Interval estimation, hypothesis testing, meta-analysis, and sample size determination." *British Journal of Mathematical and Statistical Psychology*, **73**(S1), 113–144. ISSN 0007-1102, doi: 10.1111/bmsp.12189, https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12189.

Examples

```
m1 <- c(45.1, 39.2, 36.3, 34.5)
m2 <- c(30.0, 35.1, 35.3, 36.2)
sd1 <- c(10.7, 10.5, 9.4, 11.5)
sd2 <- c(12.3, 12.0, 10.4, 9.6)
n1 <- c(40, 20, 50, 25)
n2 <- c(40, 20, 48, 26)
group <- c(1, 1, 2, 2)
meta.sub.pbcor(.05,  m1, m2, sd1, sd2, n1, n2, 2, group)

# Should return:
#                   Estimate         SE         LL        UL
# Set A:          0.36338772 0.08552728  0.1854777 0.5182304
# Set B:         -0.01480511 0.08741322 -0.1840491 0.1552914
# Set A - Set B:  0.37819284 0.12229467  0.1320530 0.6075828
```

`meta.sub.semipart` *Confidence interval for a difference in average semipartial correlations for two sets of studies*

Description

Computes the estimate, standard error, and confidence interval for a difference in average semipartial correlations for two sets of mutually exclusive studies. Each set can have one or more studies.

Usage

```
meta.sub.semipart(alpha, n, cor, r2, group)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`cor`	vector of estimated semi-partial correlations
`r2`	vector of squared multiple correlations for a model that includes the IV and all control variables
`group`	vector of group indicators: • 1 for set A • 2 for set B • 0 to ignore

Value

Returns a matrix with three rows:

- Row 1 - estimate for Set A
- Row 2 - estimate for Set B
- Row 3 - estimate for difference, Set A - Set B

The columns are:

- Estimate - estimate of average correlation or difference
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

Examples

```
n <- c(55, 190, 65, 35)
cor <- c(.40, .65, .60, .45)
r2 <- c(.25, .41, .43, .39)
group <- c(1, 1, 2, 0)
meta.sub.semipart(.05, n, cor, r2, group)

# Should return:
#                Estimate         SE         LL        UL
# Set A:            0.525 0.05955276  0.3986844 0.6317669
# Set B:            0.600 0.07931155  0.4221127 0.7333949
# Set A - Set B:   -0.075 0.09918091 -0.2587113 0.1324682
```

`meta.sub.spear` *Confidence interval for a difference in average Spearman correlations for two sets of studies*

Description

Computes the estimate, standard error, and confidence interval for a difference in average Spearman correlations for two mutually exclusive sets of studies. Each set can have one or more studies.

Usage

```
meta.sub.spear(alpha, n, cor, group)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`n`	vector of sample sizes
`cor`	vector of estimated Spearman correlations
`group`	vector of group indicators: • 1 for set A • 2 for set B • 0 to ignore

Value

Returns a matrix with three rows:

- Row 1 - estimate for Set A
- Row 2 - estimate for Set B
- Row 3 - estimate for difference, Set A - Set B

The columns are:

- Estimate - estimate of average correlation or difference
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett, D.G. (2008). Meta-analytic interval estimation for bivariate correlations. *Psychological Methods*, 13, 173-189.

Examples

```
n <- c(55, 190, 65, 35)
cor <- c(.40, .65, .60, .45)
group <- c(1, 1, 2, 0)
meta.sub.spear(.05, n, cor, group)

# Should return:
#                Estimate         SE         LL        UL
# Set A:            0.525 0.06483629  0.3865928 0.6402793
# Set B:            0.600 0.08829277  0.3992493 0.7458512
# Set A - Set B:   -0.075 0.10954158 -0.2760700 0.1564955
```

`replicate.cor` *Compares Pearson or partial correlations in original and follow-up studies*

Description

This function can be used to compare and combine Pearson or partial correlations from the original study and the follow-up study. The confidence level for the difference is 1 – 2alpha.

Usage

```
replicate.cor(alpha, cor1, n1, cor2, n2, s)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`cor1`	estimated Pearson correlation between y and x in original study
`n1`	sample size in original study
`cor2`	estimated Pearson correlation between y and x in follow-up study
`n2`	sample size in follow-up study
`s`	number of control variables in each study (0 for Pearson)

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the original study
- Row 2 summarizes the follow-up study
- Row 3 estimates the difference between studies
- Row 4 estimates the average effect size between the two studies

The columns are:

- Estimate - Pearson or partial correlation estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2021). "Design and analysis of replication studies." *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, https://journals.sagepub.com/doi/10.1177/1094428120911088.

Examples

```
replicate.cor(.05, .598, 80, .324, 200, 0)

# Should return:
#                      Estimate         SE        z            p        LL        UL
#  Original:              0.598 0.11396058 6.589418 4.708045e-09 0.4355043 0.7227538
#  Follow-up:             0.324 0.07124705 4.819037 2.865955e-06 0.1939787 0.4428347
#  Original - Follow-up:  0.274 0.09708614 2.633335 8.455096e-03 0.1065496 0.4265016
#  Average:               0.461 0.04854307 7.634998 2.264855e-14 0.3725367 0.5411607
```

---

replicate.gen *Compares effect sizes in the original and follow-up studies*

Description

This function can be used to compare and combine any effect size (e.g.,odds ratio, proportion ratio, proportion difference, slope coefficient, etc.) using the effect size estimate and its standard error from the original study and the follow-up study. The same results can be obtained using the meta.lc.gen function with appropriate contrast coefficients. The confidence level for the difference is $1 - 2alpha$.

Usage

```
replicate.gen(alpha, est1, se1, est2, se2)
```

Arguments

alpha	alpha level for 1-alpha confidence
est1	estimated effect size in original study
se1	effect size standard error in original study
est2	estimated effect size in follow-up study
se2	effect size standard error in follow-up study

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the original study
- Row 2 summarizes the follow-up study
- Row 3 estimates the difference between studies
- Row 4 estimates the average effect size between the two studies

Columns are:

- Estimate - effect size estimate

- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2021). "Design and analysis of replication studies." *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, https://journals.sagepub.com/doi/10.1177/1094428120911088.

Examples

```
replicate.gen(.05, .782, .210, .650, .154)

# Should return:
#                        Estimate        SE         z            p         LL        UL
#  Original:                0.782 0.2100000 3.7238095 1.962390e-04  0.3704076 1.1935924
#  Follow-up:               0.650 0.1540000 4.2207792 2.434593e-05  0.3481655 0.9518345
#  Original - Follow-up:    0.132 0.2604151 0.5068831 6.122368e-01 -0.2963446 0.5603446
#  Average:                 0.716 0.1302075 5.4989141 3.821373e-08  0.4607979 0.9712021
```

---

replicate.mean.ps — *Compares paired-samples mean differences in original and follow-up studies*

Description

This function computes confidence intervals for a paired-samples mean difference from an original study and a follow-up study. Confidence intervals for the difference and average effect size also are computed. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence intervals for the difference and average. The same results can be obtained using the meta.lc.mean.ps function with appropriate contrast coefficients. The confidence level for the difference is 1 – 2alpha.

Usage

```
replicate.mean.ps(
  alpha,
  m11,
  m12,
  sd11,
  sd12,
  cor1,
  n1,
```

```
  m21,
  m22,
  sd21,
  sd22,
  cor2,
  n2
)
```

Arguments

alpha	alpha level for 1-alpha confidence
m11	estimated mean for group 1 in original study
m12	estimated mean for group 2 in original study
sd11	estimated SD for group 1 in original study
sd12	estimated SD for group 2 in original study
cor1	estimated correlation of paired observations in orginal study
n1	sample size in original study
m21	estimated mean for group 1 in follow-up study
m22	estimated mean for group 2 in follow-up study
sd21	estimated SD for group 1 in follow-up study
sd22	estimated SD for group 2 in follow-up study
cor2	estimated correlation of paired observations in follow-up study
n2	sample size in follow-up study

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the original study
- Row 2 summarizes the follow-up study
- Row 3 estimates the difference between studies
- Row 4 estimates the average effect size between the two studies

The columns are:

- Estimate - effect size estimate
- SE - standard error
- df - degrees of freedom
- t - t-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2021). “Design and analysis of replication studies.” *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, `https://journals.sagepub.com/doi/10.1177/1094428120911088`.

Examples

```
replicate.mean.ps(.05, 86.22, 70.93, 14.89, 12.32, .765, 20,
                     84.81, 77.24, 15.68, 16.95, .702, 75)

#  Should return:
#                    Estimate       SE        t           p
# Original:             15.29 2.154344 7.097288 9.457592e-07
# Follow-up:             7.57 1.460664 5.182575 1.831197e-06
# Original - Follow-up:  7.72 2.602832 2.966000 5.166213e-03
# Average:              11.43 1.301416 8.782740 1.010232e-10
#                            LL       UL       df
# Original:            10.780906 19.79909 19.00000
# Follow-up:            4.659564 10.48044 74.00000
# Original - Follow-up:  3.332885 12.10712 38.40002
# Average:              8.796322 14.06368 38.40002
```

`replicate.mean2` *Compares 2-group mean differences in original and follow-up studies*

Description

This function computes confidence intervals for a 2-group mean difference from an original study and a follow-up study. Confidence intervals for the difference and average effect size also are computed. A Satterthwaite adjustment to the degrees of freedom is used to improve the accuracy of the confidence intervals. The same results can be obtained using the meta.lc.mean2 function with appropriate contrast coefficients. The confidence level for the difference is 1 – 2alpha.

Usage

```
replicate.mean2(
  alpha,
  m11,
  m12,
  sd11,
  sd12,
  n11,
  n12,
  m21,
  m22,
  sd21,
```

```
  sd22,
  n21,
  n22
)
```

Arguments

alpha	alpha level for 1-alpha confidence
m11	estimated mean for group 1 in original study
m12	estimated mean for group 2 in original study
sd11	estimated SD for group 1 in original study
sd12	estimated SD for group 2 in original study
n11	sample size for group 1 in original study
n12	sample size for group 2 in original study
m21	estimated mean for group 1 in follow-up study
m22	estimated mean for group 2 in follow-up study
sd21	estimated SD for group 1 in follow-up study
sd22	estimated SD for group 2 in follow-up study
n21	sample size for group 1 in follow-up study
n22	sample size for group 2 in follow-up study

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the original study
- Row 2 summarizes the follow-up study
- Row 3 estimates the difference between studies
- Row 4 estimates the average effect size between the two studies

The columns are:

- Estimate - effect size estimate
- SE - standard error
- t - t-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Bonett DG (2021). "Design and analysis of replication studies." *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, https://journals.sagepub.com/doi/10.1177/1094428120911088.

Examples

```
replicate.mean2(.05, 21.9, 16.1, 3.82, 3.21, 40, 40,
                   25.2, 19.1, 3.98, 3.79, 75, 75)

# Should return:
#                       Estimate        SE          t            p
# Original:                 5.80 0.7889312  7.3517180 1.927969e-10
# Follow-up:                6.10 0.6346075  9.6122408 0.000000e+00
# Original - Follow-up:    -0.30 1.0124916 -0.2962988 7.673654e-01
# Average:                  5.95 0.5062458 11.7531843 0.000000e+00
#                                 LL       UL        df
# Original:                 4.228624 7.371376  75.75255
# Follow-up:                4.845913 7.354087 147.64728
# Original - Follow-up:    -1.974571 1.374571 169.16137
# Average:                  4.950627 6.949373 169.16137
```

---

replicate.oddsratio   *Compares 2-group proportion differences in original and follow-up studies*

Description

This function computes confidence intervals for an odds ratio from an original study and a follow-up study. Confidence intervals for the ratio and average oods ratio size also are computed. The confidence level for the difference is 1 – 2alpha.

Usage

```
replicate.oddsratio(alpha, est1, se1, est2, se2)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`est1`	estimate of log odds ratio 1 in original study
`se1`	standard error of log odds ration in original study
`est2`	estimate of log odds ratio in follow-up study
`se2`	standard error of log odds ratio in follow-up study

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the Original study
- Row 2 summarizes the Follow-up study
- Row 3 estimates the difference between studies

- Row 4 estimates the average effect size of the two studies

The columns are:

- Estimate - effect size estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - exponentiated lower limit of the confidence interval
- UL - exponentiated upper limit of the confidence interval

References

Bonett DG (2021). "Design and analysis of replication studies." *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, https://journals.sagepub.com/doi/10.1177/1094428120911088.

Examples

```
replicate.oddsratio(.05, 1.39, .302, 1.48, .206)

# Should return:
#                          Estimate        SE          z            p
# Original:              1.39000000 0.3020000  4.6026490 4.171509e-06
# Follow-up:             1.48000000 0.2060000  7.1844660 6.747936e-13
# Original - Follow-up: -0.06273834 0.3655681 -0.1716188 8.637372e-01
# Average:               0.36067292 0.1827840  1.9732190 4.847061e-02
#                         exp(LL)  exp(UL)
# Original:              2.2212961 7.256583
# Follow-up:             2.9336501 6.578144
# Original - Follow-up: 0.5147653 1.713551
# Average:               1.0024257 2.052222
```

---

replicate.plot — *Plot to compare estimates from an original and follow-up study*

Description

Generates a basic plot using ggplot2 to visualize the estimates from and original and follow-up study

Usage

```
replicate.plot(
  result,
  focus = c("Both", "Difference", "Average"),
  reference_line = NULL,
  diamond_height = 0.2,
  difference_axis_ticks = 5,
  ggtheme = ggplot2::theme_classic()
)
```

Arguments

`result`
- a result matrix from any of the replicate functions in vcmeta

`focus`
- Optional specification of the focus of the plot; defaults to 'Both'
- Both - a bit busy; plots each estimate, differencence, and average
- Difference - plot each estimate and difference between them
- Average - plot each estimate and the average effect size

`reference_line`
Optional x-value for a reference line. Only applies if focuse is 'Difference' or 'Both'. Defaults to NULL, in which case a reference line is not drawn.

`diamond_height`
- Optional height of the diamond representing average effect size. Only applies if focus is 'Average' or 'Both'. Defaults to 0.2

`difference_axis_ticks`
- Optional requested number of ticks on the difference axis. Only applies if focus is 'Difference' or 'Both'. Defaults to 5.

`ggtheme`
- optional ggplot2 theme object; defaults to theme_classic()

Value

Returns a ggplot object. If stored, can be further customized via the ggplot API

Examples

```
# Compare Damisch et al., 2010 to Calin-Jageman & Caldwell 2014
# Damisch et al., 2010, Exp 1, German participants made 10 mini-golf putts
#  Half were told they had a 'lucky' golf ball; half were not
#  Found a large but uncertain improvement in shots made in the luck condition
# Calin-Jageman & Caldwell, 2014, Exp 1, was a pre-registered replication with
#  input from Damisch, though with English-speaking participants
#
# Here we compare the effect sizes, in original units,for the two studies
# Use the replicate.mean2 function because the design is 2-group between-subs

library(ggplot2)
damisch_v_calinjageman_raw <- replicate.mean2(
  alpha = 0.05,
  m11 = 6.42,
  m12 = 4.75,
```

```
  sd11 = 1.88,
  sd12 = 2.15,
  n11 = 14,
  n12 = 14,
  m21 = 4.73,
  m22 = 4.62,
  sd21 = 1.958,
  sd22 = 2.12,
  n21 = 66,
  n22 = 58
)

# View the comparison:
damisch_v_calinjageman_raw


# Now plot the comparison, focusing on the difference
replicate.plot(damisch_v_calinjageman_raw, focus = "Difference")

# Plot the comparison, focusing on the average
replicate.plot(damisch_v_calinjageman_raw,
  focus = "Average",
  reference_line = 0,
  diamond_height = 0.1
)


# Kind of busy, but plot the comparison with both difference and average
# In this case, store the plot for manipulation
myplot <- replicate.plot(
  damisch_v_calinjageman_raw,
  focus = "Both",
  reference_line = 0
)

# View the stored plot
myplot

# Change x-labels and study labels
myplot <- myplot + xlab("Difference in Putts Made, Lucky - Control")
myplot <- myplot + scale_y_discrete(
    labels = c(
      "Average",
      "Difference",
      "Calin-Jageman & Caldwell, 2014",
      "Damisch et al., 2010"
      )
  )

# View the updated plot
myplot
```

`replicate.prop2` *Compares 2-group proportion differences in original and follow-up studies*

Description

This function computes confidence intervals for a 2-group proportion difference from an original study and a follow-up study. Confidence intervals for the difference and average effect size also are computed. The same results can be obtained using the meta.lc.prop2 function with appropriate contrast coefficients. The confidence level for the difference is 1 – 2alpha.

Usage

```
replicate.prop2(alpha, f11, f12, n11, n12, f21, f22, n21, n22)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`f11`	sample count for group 1 in original study
`f12`	sample count for group 2 in original study
`n11`	sample size for group 1 in original study
`n12`	sample size for group 2 in original study
`f21`	sample count for group 1 in follow-up study
`f22`	sample count for group 2 in follow-up study
`n21`	sample size for group 1 in follow-up study
`n22`	sample size for group 2 in follow-up study

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the Original study
- Row 2 summarizes the Follow-up study
- Row 3 estimates the difference between studies
- Row 4 estimates the average effect size of the two studies

The columns are:

- Estimate - effect size estimate
- SE - standard error
- z - z-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2021). "Design and analysis of replication studies." *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, https://journals.sagepub.com/doi/10.1177/1094428120911088.

Examples

```
replicate.prop2(.05, 21, 16, 40, 40, 19, 13, 60, 60)

# Should return:
#                         Estimate         SE         z         p
# Original:             0.11904762 0.10805233 1.1017590 0.2705665
# Follow-up:            0.09677419 0.07965047 1.2149858 0.2243715
# Original - Follow-up: 0.02359056 0.13542107 0.1742016 0.8617070
# Average:              0.11015594 0.06771053 1.6268656 0.1037656
#                               LL        UL
# Original:             -0.09273105 0.3308263
# Follow-up:            -0.05933787 0.2528863
# Original - Follow-up: -0.19915727 0.2463384
# Average:              -0.02255427 0.2428661
```

---

replicate.slope — *Computes confidence intervals for a slope in original and follow-up studies*

Description

Computes confidence intervals for a slope in original and follow-up studies, the difference in slopes, and the average of the slopes (equal error variances between studies is not assumed). The confidence interval for the difference uses a 1 - 2alpha confidence level. Use the replicate.gen function for slopes in other types of models (e.g., binary logistic, ordinal logistic, SEM).

Usage

```
replicate.slope(alpha, b1, se1, n1, b2, se2, n2, s)
```

Arguments

alpha	alpha level for 1-alpha or 1 - 2alpha confidence
b1	sample slope in original study
se1	standard error of slope in original study
n1	sample size in original study
b2	sample slope in follow-up study
se2	standard error of slope in follow-up study
n2	sample size in follow-up study
s	number of predictor variables in model

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the Original study
- Row 2 summarizes the Follow-up study
- Row 3 estimates the difference between studies
- Row 4 estimates the average effect size of the two studies

The columns are:

- Estimate - effect size estimate
- SE - standard error
- t - t-value
- p - p-value
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval
- df - degrees of freedom

References

Bonett DG (2021). "Design and analysis of replication studies." *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, https://journals.sagepub.com/doi/10.1177/1094428120911088.

Examples

```
replicate.slope(.05, 23.4, 5.16, 50, 18.5, 4.48, 90, 4)

# Should return:
#                       Estimate       SE         t            p
# Original:                23.40 5.160000 4.5348837 4.250869e-05
# Follow-up:               18.50 4.480000 4.1294643 8.465891e-05
# Original - Follow-up:     4.90 6.833447 0.7170612 4.749075e-01
# Average:                 20.95 3.416724 6.1316052 1.504129e-08
#                              LL       UL       df
# Original:             13.007227 33.79277  45.0000
# Follow-up:             9.592560 27.40744  85.0000
# Original - Follow-up: -6.438743 16.23874 106.4035
# Average:              14.176310 27.72369 106.4035
```

`replicate.stdmean.ps` *Compares paired-samples standardized mean differences in original and follow-up studies*

Description

This function computes confidence intervals for a paired-samples standardized mean difference from an original study and a follow-up study. Confidence intervals for the difference and average effect size also are computed. The same results can be obtained using the meta.lc.stdmean.ps function with appropriate contrast coefficients. The confidence level for the difference is 1 – 2alpha.

Usage

```
replicate.stdmean.ps(
  alpha,
  m11,
  m12,
  sd11,
  sd12,
  cor1,
  n1,
  m21,
  m22,
  sd21,
  sd22,
  cor2,
  n2
)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m11`	estimated mean for group 1 in original study
`m12`	estimated mean for group 2 in original study
`sd11`	estimated SD for group 1 in original study
`sd12`	estimated SD for group 2 in original study
`cor1`	estimated correlation of paired observations in orginal study
`n1`	estimated size in original study
`m21`	estimated mean for group 1 in follow-up study
`m22`	estimated mean for group 2 in follow-up study
`sd21`	estimated SD for group 1 in follow-up study
`sd22`	estimated SD for group 2 in follow-up study
`cor2`	estimated correlation of paired observations in follow-up study
`n2`	sample size in follow-up study

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the original study
- Row 2 summarizes the follow-up study
- Row 3 estimates the difference between studies
- Row 4 estimates the average effect size between the two studies

The columns are:

- Estimate - effect size estimate
- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2021). "Design and analysis of replication studies." *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, https://journals.sagepub.com/doi/10.1177/1094428120911088.

Examples

```
replicate.stdmean.ps(alpha = .05,
  m11 = 86.22, m12 = 70.93, sd11 = 14.89, sd12 = 12.32, cor1 = .765, n1 = 20,
  m21 = 84.81, m22 = 77.24, sd21 = 15.68, sd22 = 16.95, cor2 = .702, n2 = 75
)

# Should return:
#                          Estimate         SE        LL        UL
#  Orginal:               1.0890300 0.22915553 0.6697353 1.5680085
#  Follow-up:             0.4604958 0.09590506 0.2756687 0.6516096
#  Original - Follow-up:  0.6552328 0.24841505 0.2466264 1.0638392
#  Average:               0.7747629 0.12420752 0.5313206 1.0182052
```

`replicate.stdmean2` *Compares 2-group standardized mean differences in original and follow-up studies*

Description

This function computes confidence intervals for a 2-group standardized mean difference from an original study and a follow-up study. Confidence intervals for the difference and average effect size also are computed. The same results can be obtained using the meta.lc.stdmean2 function with appopriate contrast coefficients. The confidence level for the difference is 1 – 2alpha.

Usage

```
replicate.stdmean2(
  alpha,
  m11,
  m12,
  sd11,
  sd12,
  n11,
  n12,
  m21,
  m22,
  sd21,
  sd22,
  n21,
  n22
)
```

Arguments

`alpha`	alpha level for 1-alpha confidence
`m11`	estimated mean for group 1 in original study
`m12`	estimated mean for group 2 in original study
`sd11`	estimated SD for group 1 in original study
`sd12`	estimated SD for group 2 in original study
`n11`	sample size for group 1 in original study
`n12`	sample size for group 2 in original study
`m21`	estimated mean for group 1 in follow-up study
`m22`	estimated mean for group 2 in follow-up study
`sd21`	estimated SD for group 1 in follow-up study
`sd22`	estimated SD for group 2 in follow-up study
`n21`	sample size for group 1 in follow-up study
`n22`	sample size for group 2 in follow-up study

Value

A 4-row matrix. The rows are:

- Row 1 summarizes the original study
- Row 2 summarizes the follow-up study
- Row 3 estimates the difference between studies
- Row 4 estimates the average effect size between the two studies

The columns are:

- Estimate - effect size estimate

- SE - standard error
- LL - lower limit of the confidence interval
- UL - upper limit of the confidence interval

References

Bonett DG (2021). "Design and analysis of replication studies." *Organizational Research Methods*, **24**(3), 513–529. ISSN 1094-4281, doi: 10.1177/1094428120911088, https://journals.sagepub.com/doi/10.1177/1094428120911088.

Examples

```
replicate.stdmean2(.05, 21.9, 16.1, 3.82, 3.21, 40, 40,
                        25.2, 19.1, 3.98, 3.79, 75, 75)

# Should return:
#                          Estimate        SE         LL        UL
#  Original:             1.62803662 0.2594668  1.1353486 2.1524396
#  Follow-up:            1.56170447 0.1870576  1.2030461 1.9362986
#  Original - Follow-up: 0.07422178 0.3198649 -0.4519092 0.6003527
#  Average:              1.59487055 0.1599325  1.2814087 1.9083324
```

`se.cor` *Computes the standard error for a Pearson or partial correlation*

Description

This function can be used to compute the standard error of a Pearson or partial correlation using the estimatede correlation, sample size, and number of control variables. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in applications where a combination of different types of correlations are used in the

Usage

```
se.cor(cor, s, n)
```

Arguments

`cor`	estimated Pearson or partial correlation
`s`	number of control variables (0 for Pearson)
`n`	sample size

Value

Returns a one-row matrix:

- Estimate - estimate of Pearson or partial correlation
- SE - standard error

References

Bonett DG (2008). "Meta-analytic interval estimation for bivariate correlations." *Psychological Methods*, **13**(3), 173–181. ISSN 1939-1463, doi: 10.1037/a0012868, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0012868.

Examples

```
se.cor(.40, 0, 55)

# Should return:
#              Estimate       SE
# Correlation:      0.4 0.116487
```

---

se.mean.ps *Computes the standard error for a paired-samples mean difference*

Description

This function can be used to compute the standard error of a paired-samples mean difference using the two estimated means, and sample size. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, #' meta.lc.gen, and meta.lm.gen functions in applications where compatible mean differences from a combination of 2-group and paired-samples experiments are used in the meta-analysis.

Usage

```
se.mean.ps(m1, m2, sd1, sd2, cor, n)
```

Arguments

m1	estimated mean for measurement 1
m2	estimated mean for measurement 2
sd1	estimated standard deviation for measurement 1
sd2	estimated standard deviation for measurement 2
cor	estimated correlation for measurements 1 and 2
n	sample size

Value

Returns a one-row matrix:

- Estimate - estimate of mean difference
- SE - standard error

References

Snedecor GW, Cochran WG (1980). *Statistical methods*, 7th edition. ISU University Pres, Ames, Iowa.

Examples

```
se.mean.ps(23.9, 25.1, 1.76, 2.01, .78, 25)

# Should return:
#                   Estimate        SE
# Mean difference:     -1.2 0.2544833
```

`se.mean2` *Computes the standard error for a 2-group mean difference*

Description

This function can be used to compute the standard error of a 2-group mean difference using the two estimated means, estimated standard deviations, and sample sizes. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in applications where compatible mean differences from a combination of 2-group and paired-samples experiments are used in the meta-analysis.

Usage

```
se.mean2(m1, m2, sd1, sd2, n1, n2)
```

Arguments

`m1`	estimated mean for group 1
`m2`	estimated mean for group 2
`sd1`	estimated standard deviation for group 1
`sd2`	estimated standard deviation for group 2
`n1`	group 1 sample size
`n2`	group 2 sample size

Value

Returns a one-row matrix:

- Estimate - estimate of mean difference
- SE - standard error

References

Snedecor GW, Cochran WG (1980). *Statistical methods*, 7th edition. ISU University Pres, Ames, Iowa.

Examples

```
se.mean2(21.9, 16.1, 3.82, 3.21, 40, 40)

#                    Estimate        SE
# Mean difference:      5.8 0.7889312
```

---

se.meanratio.ps   *Computes the standard error for a paired-samples log mean ratio*

Description

This function can be used to compute the standard error of a paired-samples mean ratio using the estimated eans, estimated size. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in application where compatible mean ratios from a combination of 2-group and paired-samples experiments are used in the meta-analysis.

Usage

```
se.meanratio.ps(m1, m2, sd1, sd2, cor, n)
```

Arguments

m1	estimated mean for measurement 1
m2	estimated mean for measurement 2
sd1	estimated standard deviation for measurement 1
sd2	estimated standard deviation for measurement 2
cor	estimated correlation for measurements 1 and 2
n	sample size

Value

Returns a one-row matrix:

- Estimate - estimate of log mean ratio
- SE - standard error

References

Bonett DG, Price RM (2020). "Confidence intervals for ratios of means and medians." *Journal of Educational and Behavioral Statistics*, **45**(6), 750–770. ISSN 1076-9986, doi: 10.3102/1076998620934125, https://journals.sagepub.com/doi/10.3102/1076998620934125.

Examples

```
se.meanratio.ps(21.9, 16.1, 3.82, 3.21, .748, 40)

# Should return:
#                  Estimate         SE
# Log mean ratio: 0.3076674 0.02130161
```

`se.meanratio2` *Computes the standard error for a 2-group log mean ratio*

Description

This function can be used to compute the standard error of a 2-group mean ratio using the two estimated means, estimated standard deviations, and sample sizes. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and link[vcmeta]meta.lm.gen functions in application where compatible mean ratios from a combination of 2-group and paired-samples experiments are used in the meta-analysis.

Usage

```
se.meanratio2(m1, m2, sd1, sd2, n1, n2)
```

Arguments

m1	estimated mean for group 1
m2	estimated mean for group 2
sd1	estimated standard deviation for group 1
sd2	estimated standard deviation for group 2
n1	group 1 sample size
n2	group 2 sample size

Value

Returns a one-row matrix:

- Estimate - estimate of log mean ratio
- SE - standard error

References

Bonett DG, Price RM (2020). "Confidence intervals for ratios of means and medians." *Journal of Educational and Behavioral Statistics*, **45**(6), 750–770. ISSN 1076-9986, doi: 10.3102/1076998620934125, https://journals.sagepub.com/doi/10.3102/1076998620934125.

Examples

```
se.meanratio2(21.9, 16.1, 3.82, 3.21, 40, 40)

# Should return:
#                  Estimate       SE
# Log mean ratio: 0.3076674 0.041886
```

---

se.odds — *Computes the standard error for a log odds ratio*

Description

This function computes a log odds ratio and its standard error using the frequency counts and sample sizes in a 2-group design. These frequency counts and sample sizes can be obtained from a 2x2 contingency table. This function is useful in a meta-analysis of odds ratios where some studies report the sample odds ratio and its standard error and other studies only report the frequency counts or a 2x2 contingency table. The log odds ratio and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions.

Usage

```
se.odds(f1, n1, f2, n2)
```

Arguments

f1	number of participants who have the outcome of interest in group 1
n1	group 1 sample size
f2	number of participants who have the outcome of interest in group 2
n2	group 2 sample size

Value

Returns a one-row matrix:

- Estimate - estimate of log odds ratio
- SE - standard error

References

Bonett DG, Price RM (2015). "Varying coefficient meta-analysis methods for odds ratios and risk ratios." *Psychological Methods*, **20**(3), 394–406. ISSN 1939-1463, doi: 10.1037/met0000032, https://doi.apa.org/getdoi.cfm?doi=10.1037/met0000032.

Examples

```
se.odds(36, 50, 21, 50)

# Should return:
#                  Estimate        SE
# Log odds ratio: 1.239501 0.4204435
```

---

se.pbcor *Computes the standard error for a point-biserial correlation*

Description

The function computes a point-biserial correlation and its standard error for two types of point-biserial correlations in 2-group designs using the estimated means, estimated standard deviations, and samples sizes. One type of point-biserial correlation uses an unweighted average of variances and is appropriate for 2-group experimental designs. The other type of point-biserial correlation uses a weighted average of variances and is appropriate for 2-group nonexperimental designs with simple random sampling. This function is useful in a meta-analysis of compatible point-biserial correlations where some studies used a 2-group experimental design and other studies used a 2-group nonexperimental design. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions.

Usage

```
se.pbcor(m1, m2, sd1, sd2, n1, n2, type)
```

Arguments

m1	estimated mean for group 1
m2	estimated mean for group 2
sd1	estimated standard deviation for group 1
sd2	estimated standard deviation for group 2

`n1`	group 1 sample size
`n2`	group 2 sample size
`type`	• set to 1 for weighted variance average • set to 2 for unweighted variance average

Value

Returns a one-row matrix:

- Estimate - estimate of point-biserial correlation
- SE - standard error

References

Bonett DG (2020). "Point-biserial correlation: Interval estimation, hypothesis testing, meta-analysis, and sample size determination." *British Journal of Mathematical and Statistical Psychology*, **73**(S1), 113–144. ISSN 0007-1102, doi: 10.1111/bmsp.12189, https://onlinelibrary.wiley.com/doi/10.1111/bmsp.12189.

Examples

```
se.pbcor(21.9, 16.1, 3.82, 3.21, 40, 40, 1)

#  Should return:
#                              Estimate         SE
#  Point-biserial correlation: 0.6349786 0.05981325
```

`se.prop.ps` *Computes the Bonett-Price estimate and standard error for a paired-samples proportion difference*

Description

This function can be used to compute the standard error of a paired-samples proportion difference using the frequency counts from a 2 x 2 contingency table. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in applications where compatible proportion differences from a combination of 2-group and paired-samples studies are used in the meta-analysis.

Usage

```
se.prop.ps(f00, f01, f10, f11)
```

Arguments

`f00`	number of participants with y = 0 and x = 0
`f01`	number of participants with y = 0 and x = 1
`f10`	number of participants with y = 1 and x = 0
`f11`	number of participants with y = 1 and x = 1

Value

Returns a one-row matrix:

- Estimate - estimate of proportion difference
- SE - standard error

References

Agresti A, Caffo B (2000). "Simple and Effective Confidence Intervals for Proportions and Differences of Proportions Result from Adding Two Successes and Two Failures." *The American Statistician*, **54**(4), 280-288. doi: 10.1080/00031305.2000.10474560, `https://www.tandfonline.com/doi/abs/10.1080/00031305.2000.10474560`.

Examples

```
se.prop.ps(16, 64, 5, 15)

# Should return:
#                           Estimate         SE
# Proportion difference: 0.5784314 0.05953213
```

---

se.prop2 — *Computes the Agresti-Caffo estimate and standard error for a 2-group proportion difference*

Description

This function can be used to compute the standard error of a 2-group proportion difference using the two sample proportions and sample sizes. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in applications where compatible proportion differences from a combination of 2-group and paired-samples studies are used in the meta-analysis.

Usage

```
se.prop2(f1, f2, n1, n2)
```

Arguments

f1	number of participants in group 1 who have the outcome
f2	number of participants in group 2 who have the outcome
n1	group 1 sample size
n2	group 2 sample size

Value

Returns a one-row matrix:

- Estimate - estimate of proportion difference
- SE - standard error

References

Agresti A, Caffo B (2000). "Simple and Effective Confidence Intervals for Proportions and Differences of Proportions Result from Adding Two Successes and Two Failures." *The American Statistician*, **54**(4), 280-288. doi: 10.1080/00031305.2000.10474560, https://www.tandfonline.com/doi/abs/10.1080/00031305.2000.10474560.

Examples

```
se.prop2(31, 16, 40, 40)

# Should return:
#                           Estimate        SE
# Proportion difference: 0.3571429 0.1002777
```

---

se.semipartial — *Computes the standard error for a semipartial correlation*

Description

This function can be used to compute the standard error of a semipartial correlation using the estimated correlation, sample size, and squared multiple correlation for the full model. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in applications where a combination of different types of correlations are used in the meta-analysis.

Usage

```
se.semipartial(cor, r2, n)
```

Arguments

`cor`	estimated semipartial correlation
`r2`	estimated squared multiple correlation for full model
`n`	sample size

Value

Returns a one-row matrix:

- Estimate - estimate of semipartial correlation
- SE - standard error

Examples

```
se.semipartial(.40, .25, 60)

# Should return:
#                          Estimate        SE
# Semipartial correlation:      0.4 0.1063262
```

---

se.slope *Computes a slope and standard error*

Description

This function can be used to compute a slope and its standard error for a simple linear regression model using the estimated Pearson correlation and the estimated standard deviations of response and predictor variables. This function is useful in a meta-analysis of slopes of a simple linear regression model where some studies report the Pearson correlation but not the slope.

Usage

```
se.slope(cor, sdy, sdx, n)
```

Arguments

`cor`	estimated Pearson correlation
`sdy`	estimated standard deviation of the response variable
`sdx`	estimated standard deviation of the predictor variable
`n`	sample size

Value

Returns a one-row matrix:

- Estimate - estimate of slope
- SE - standard error

References

Snedecor GW, Cochran WG (1980). *Statistical methods*, 7th edition. ISU University Pres, Ames, Iowa.

Examples

```
se.slope(.392, 4.54, 2.89, 60)

# Should return:
#         Estimate        SE
# Slope: 0.6158062 0.1897647
```

---

se.spear — *Computes the standard error for a Spearman correlation*

Description

This function can be used to compute the standard error of a Spearman correlation using the estimated correlation and sample size. The standard error from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in applications where a combination of different types of correlations are used in the meta-analysis.

Usage

```
se.spear(cor, n)
```

Arguments

`cor`	estimated Spearman correlation
`n`	sample size

Value

Returns a one-row matrix:

- Estimate - estimate of Spearman correlation
- SE - standard error

References

Bonett DG, Wright TA (2000). "Sample size requirements for estimating Pearson, Kendall and Spearman correlations." *Psychometrika*, **65**(1), 23–28. ISSN 0033-3123, doi: 10.1007/BF02294183, https://link.springer.com/article/10.1007/BF02294183.

Examples

```
se.spear(.40, 55)

# Should return:
#                        Estimate        SE
# Spearman correlation:       0.4 0.1210569
```

---

se.stdmean.ps   *Computes the standard error for a paired-samples standardized mean difference*

Description

The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in applications where compatible standardized mean differences from a combination of 2-group and paired-samples experiments are used in the meta-analysis.

Usage

```
se.stdmean.ps(m1, m2, sd1, sd2, cor, n, stdzr)
```

Arguments

`m1`	sample mean for measurement 1
`m2`	sample mean for measurement 2
`sd1`	sample standard deviation for measurement 1
`sd2`	sample standard deviation for measurement 2
`cor`	sample correlation for measurements 1 and 2
`n`	sample size
`stdzr`	• set to 0 for square root average variance standardizer • set to 1 for group 1 SD standardizer • set to 2 for group 2 SD standardizer

Value

Returns a one-row matrix:

- Estimate - estimate of standardized mean difference
- SE - standard error

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
se.stdmean.ps(23.9, 25.1, 1.76, 2.01, .78, 25, 0)

# Should return:
#                                  Estimate        SE
# Standardizedd mean difference: -0.6352097 0.1602852
```

---

se.stdmean2 — *Computes the standard error for a 2-group standardized mean difference*

Description

Use the square root average variance standardizer (stdzr = 0) for 2-group experimental designs. Use the square root weighted variance standardizer (stdzr = 3) for 2-group nonexperimental designs with simple random sampling. The single-group standardizers (stdzr = 1 and stdzr = 2) can be used with either 2-group experimental or nonexperimental designs. The effect size estimate and standard error output from this function can be used as input in the meta.ave.gen, meta.lc.gen, and meta.lm.gen functions in applications where compatible standardized mean differences from a combination of 2-group and paired-samples experiments are used in the meta-analysis.

Usage

```
se.stdmean2(m1, m2, sd1, sd2, n1, n2, stdzr)
```

Arguments

m1	sample mean for group 1
m2	sample mean for group 2
sd1	sample standard deviation for group 1
sd2	sample standard deviation for group 2
n1	group 1 sample size

n2 group 2 sample size

stdzr
- set to 0 for square root average variance standardizer
- set to 1 for group 1 SD standardizer
- set to 2 for group 2 SD standardizer
- set to 3 for square root weighted variance standardizer

Value

Returns a one-row matrix:

- Estimate - estimate of standardized mean difference
- SE - standard error

References

Bonett DG (2009). "Meta-analytic interval estimation for standardized and unstandardized mean differences." *Psychological Methods*, **14**(3), 225–238. ISSN 1939-1463, doi: 10.1037/a0016619, https://doi.apa.org/getdoi.cfm?doi=10.1037/a0016619.

Examples

```
se.stdmean2(21.9, 16.1, 3.82, 3.21, 40, 40, 0)

# Should return:
#                               Estimate        SE
# Standardized mean difference: 1.643894 0.2629049
```

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