Package 'mvtmeta'

October 13, 2022

Type Package

Title Multivariate Meta-Analysis

Version 1.1

Date 2020-02-11

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Description Functions to run fixed effects or random effects multivariate meta-analysis.

License GPL-3

Imports gtools

NeedsCompilation no

Repository CRAN

Date/Publication 2020-02-11 19:50:03 UTC

R topics documented:

`mvtmeta-package` *Multivariate meta-analysis*

Description

This package contains functions to run fixed effects or random effects multivariate meta-analysis.

Details

Package:	mvtmeta
Type:	Package
Version:	1.1
Date:	2020-02-11
License:	GPL-3

Use the function mvrmeta_fe to run the fixed effects multivariate meta-analysis. Use the function mvrmeta_re to run the random effects multivariate meta-analysis.

Author(s)

Han Chen

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References

Chen, H., Manning, A.K. and Dupuis J. (2012) A method of moments estimator for random effect multivariate meta-analysis. Biometrics 68, 1278-1284.

Examples

```
y <- matrix(c(0.3161, 7.4015, 0.4278,
              -0.3201, 6.9426, -0.9816,
              0.6983, 4.6680, -0.2415,
              3.2736, 4.3080, 0.2052,
              -0.1599, 5.6398, -0.6782,
              -0.6989, 6.3158, -0.7918,
              -3.6094, 9.3429, -2.8711,
              0.2172,6.4078,-0.6093), 3, 8)
cov <- array(c(2.3568, -1.2105, 0.8524, -1.2105, 9.7029,
                       -6.1753, 0.8524, -6.1753, 4.4114,
               0.2529, 0.1498, -0.1019, 0.1498, 0.7016,
                       -0.4167, -0.1019, -0.4167, 0.2743,
               0.1444, -0.0652, 0.0433, -0.0652, 0.6481,
                       -0.3899, 0.0433, -0.3899, 0.2608,
               3.8428, -4.5587, 3.2892, -4.5587, 10.3517,
                       -6.6684, 3.2892, -6.6684, 4.8268,
               0.1161, -0.0992, 0.0645, -0.0992, 0.4363,
                       -0.2610, 0.0645, -0.2610, 0.1733,
               0.1603, 0.0242, -0.0129, 0.0242, 0.7697,
                       -0.4686, -0.0129, -0.4686, 0.3180,
               3.2054, -1.1984, 0.8437, -1.1984, 17.8889,
                       -10.7697, 0.8437, -10.7697, 7.2101,
               0.0278, 0.0136, -0.0091, 0.0136, 0.1184,
                       -0.0716, -0.0091, -0.0716, 0.0482), c(3, 3, 8))
fe <- mvtmeta_fe(y, cov)
re <- mvtmeta_re(y, cov)
```

`mvtmeta_fe` *Fixed effects multivariate meta-analysis.*

Description

This function computes the effect estimates and their covariance matrix for fixed effects multivariate meta-analysis, which is an extension of the inverse-variance fixed effects meta-analysis in the univariate case.

Usage

```
mvtmeta_fe(y, cov)
```

Arguments

`y`	A matrix. Each column represents observed effect estimates in each study.
`cov`	An array with the first two dimensions equal to the number of effects, and the third dimension equal to the number of studies. Each stratum is a symmetric, positive definite matrix representing corresponding covariance matrix from each study.

Details

This function is an multivariate extension of the inverse-variance fixed effects meta-analysis. It computes the summary effect estimates and their covariance matrix using observed study-specific effect estimates and covariance matrices. Please make sure that the orders of effects and studies in `y` and `cov` match.
Please note that fixed effects meta-analysis may provide invalid results when heterogeneity is present.

Value

`beta`	Summary effect estimates from meta-analysis.
`cov`	The covariance matrix for the summary effect estimates.

Author(s)

Han Chen

References

Chen, H., Manning, A.K. and Dupuis J. (2012) A method of moments estimator for random effect multivariate meta-analysis. Biometrics 68, 1278-1284.

See Also

`mvtmeta_re`

Examples

```
y <- matrix(c(0.3161, 7.4015, 0.4278,
              -0.3201, 6.9426, -0.9816,
              0.6983, 4.6680, -0.2415,
              3.2736, 4.3080, 0.2052,
              -0.1599, 5.6398, -0.6782,
              -0.6989, 6.3158, -0.7918,
              -3.6094, 9.3429, -2.8711,
              0.2172,6.4078,-0.6093), 3, 8)
cov <- array(c(2.3568, -1.2105, 0.8524, -1.2105, 9.7029,
                       -6.1753, 0.8524, -6.1753, 4.4114,
               0.2529, 0.1498, -0.1019, 0.1498, 0.7016,
                       -0.4167, -0.1019, -0.4167, 0.2743,
               0.1444, -0.0652, 0.0433, -0.0652, 0.6481,
                       -0.3899, 0.0433, -0.3899, 0.2608,
               3.8428, -4.5587, 3.2892, -4.5587, 10.3517,
                       -6.6684, 3.2892, -6.6684, 4.8268,
               0.1161, -0.0992, 0.0645, -0.0992, 0.4363,
                       -0.2610, 0.0645, -0.2610, 0.1733,
               0.1603, 0.0242, -0.0129, 0.0242, 0.7697,
                       -0.4686, -0.0129, -0.4686, 0.3180,
               3.2054, -1.1984, 0.8437, -1.1984, 17.8889,
                       -10.7697, 0.8437, -10.7697, 7.2101,
               0.0278, 0.0136, -0.0091, 0.0136, 0.1184,
                       -0.0716, -0.0091, -0.0716, 0.0482), c(3, 3, 8))
fe <- mvtmeta_fe(y, cov)
fe
```

`mvtmeta_re` *Random effects multivariate meta-analysis.*

Description

This function computes the effect estimates, their covariance matrix and between-study covariance matrix for random effects multivariate meta-analysis.

Usage

```
mvtmeta_re(y, cov)
```

Arguments

`y`	A matrix. Each column represents observed effect estimates in each study.
`cov`	An array with the first two dimensions equal to the number of effects, and the third dimension equal to the number of studies. Each stratum is a symmetric, positive definite matrix representing corresponding covariance matrix from each study.

Details

This function performs random effects multivariate meta-analysis. It computes the between-study covariance matrix as a method of moments estimate (Chen et al., 2012), which is a multivariate extension of DerSimonian and Laird's estimator in the univariate case. The computation does not require permutation.
If the between-study covariance matrix is not positive semi-definite (usually due to low heterogeneity or small number of studies), it is automatically fixed to be a positive semi-definite estimate by eigendecomposition and setting negative eigenvalues to 0.
This function then computes the summary effect estimates and their covariance matrix based on the random effects multivariate meta-analysis method and the positive semi-definite between-study covariance matrix estimate.

Value

`beta`	Summary effect estimates from meta-analysis.
`cov`	The covariance matrix for the summary effect estimates.
`between`	The between-study covariance matrix estimate.
`negeigen`	Number of negative eigenvalues of the original between-study covariance matrix estimate.

Author(s)

Han Chen

References

Chen, H., Manning, A.K. and Dupuis J. (2012) A method of moments estimator for random effect multivariate meta-analysis. Biometrics 68, 1278-1284.

See Also

`mvtmeta_fe`

Examples

```
y <- matrix(c(0.3161, 7.4015, 0.4278,
              -0.3201, 6.9426, -0.9816,
              0.6983, 4.6680, -0.2415,
              3.2736, 4.3080, 0.2052,
              -0.1599, 5.6398, -0.6782,
              -0.6989, 6.3158, -0.7918,
              -3.6094, 9.3429, -2.8711,
              0.2172,6.4078,-0.6093), 3, 8)
cov <- array(c(2.3568, -1.2105, 0.8524, -1.2105, 9.7029,
                        -6.1753, 0.8524, -6.1753, 4.4114,
               0.2529, 0.1498, -0.1019, 0.1498, 0.7016,
                        -0.4167, -0.1019, -0.4167, 0.2743,
               0.1444, -0.0652, 0.0433, -0.0652, 0.6481,
                        -0.3899, 0.0433, -0.3899, 0.2608,
```

```
                3.8428, -4.5587, 3.2892, -4.5587, 10.3517,
                        -6.6684, 3.2892, -6.6684, 4.8268,
                0.1161, -0.0992, 0.0645, -0.0992, 0.4363,
                        -0.2610, 0.0645, -0.2610, 0.1733,
                0.1603, 0.0242, -0.0129, 0.0242, 0.7697,
                        -0.4686, -0.0129, -0.4686, 0.3180,
                3.2054, -1.1984, 0.8437, -1.1984, 17.8889,
                        -10.7697, 0.8437, -10.7697, 7.2101,
                0.0278, 0.0136, -0.0091, 0.0136, 0.1184,
                        -0.0716, -0.0091, -0.0716, 0.0482), c(3, 3, 8))
re <- mvtmeta_re(y, cov)
re
```

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