

Package ‘mvtmeta’

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Type Package

Title Multivariate Meta-Analysis

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Author Han Chen

Maintainer Han Chen <Han.Chen.2@uth.tmc.edu>

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

License GPL-3

Imports gtools

NeedsCompilation no

Repository CRAN

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mvtmeta-package	<i>Multivariate meta-analysis</i>
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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 `mvtmeta_fe` to run the fixed effects multivariate meta-analysis. Use the function `mvtmeta_re` to run the random effects multivariate meta-analysis.

Author(s)

Han Chen

Maintainer: Han Chen <hanchen@bu.edu>

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

<code>y</code>	A matrix. Each column represents observed effect estimates in each study.
<code>cov</code>	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

<code>beta</code>	Summary effect estimates from meta-analysis.
<code>cov</code>	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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