# Package ‘covEB’

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**Type** Package  
**Title** Empirical Bayes estimate of block diagonal covariance matrices  
**Version** 1.0.0  
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**Author** C. Pacini  
**Maintainer** C. Pacini <claripacini@gmail.com>  

**Description**  
Using bayesian methods to estimate correlation matrices assuming that they can be written and estimated as block diagonal matrices. These block diagonal matrices are determined using shrinkage parameters that values below this parameter to zero.

**License** GPL-3  
**Depends** R (>= 3.3), mvtnorm, igraph, gsl, Biobase, stats  
**Suggests** curatedBladderData  
**biocViews** Bayesian, Microarray, RNASeq, Preprocessing, Software, GeneExpression, StatisticalMethod  
**NeedsCompilation** no

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**Description**  
Using bayesian methods to estimate correlation matrices assuming that they can be written and estimated as block diagonal matrices. These block diagonal matrices are determined using shrinkage parameters that values below this parameter to zero.
Details

The DESCRIPTION file:
The function for this package is `covEB` that calculates an empirical Bayes estimate of a given covariance matrix assuming that it has a block diagonal structure.

Author(s)
C. Pacini

Maintainer: C. Pacini <clarepacini@gmail.com>

Description
Assuming a block diagonal structure of the correlation matrix, the function calculates and empirical Bayes estimate of the original covariance matrix. The aim is to reduce false discovery rates by pooling information on the levels of correlations between elements in the same blocks. The blocks can have different levels of true correlation between them. The algorithm searches the space of possible correlation values and estimates the final correlation by an average of all non zero estimates.

Usage
`covEB(Covmat, delta = 0.1, shift = 0.05, cutoff = NULL, startlambda = 0.5, n)`
Arguments

Covmat  A sample covariance matrix. Must be positive semi-definite, is converted to a correlation matrix in the algorithm.
delta This parameter gives the size of the range of correlation values that are considered in one iteration. The larger the value the more the values will be pooled to the overall correlation of the full matrix. Default 0.1
shift The shift parameter determines how much the lower bound of the range of correlation values is moved by through each iteration. The larger the value the fewer iterations. Default 0.05.
cutoff Optional - If the average correlations for a given block are below this value then the prior for this block is set to be the independence prior.
startlambda This determines a lower noise level for the correlations, for example, it defaults to 0.5. This means that all correlation values below 0.5 will be set to zero (assumed to be noise).
n The number of samples (replicates) used to calculate Covmat

Value

Returns the estimated correlation matrix.

Author(s)

C. Pacini

References


Examples

\[
\begin{align*}
sigma & \leftarrow \text{matrix}(c(4,2,2,3), \text{nrow}=2) \\
x & \leftarrow \text{rmvn}(n=500, \text{mean}=c(1,2), \text{sigma}=\sigma) \\
samplecov & \leftarrow \text{cov}(x) \\
test & \leftarrow \text{covEB}(\text{samplecov}, \delta=0.05, \text{shift}=0.025, \text{startlambda}=0.4, n=500)
\end{align*}
\]

EBsingle  Empirical Bayes estimate of block diagonal correlation matrix

Description

Assuming a block diagonal structure of the correlation matrix, the function calculates and empirical Bayes estimate of the original covariance matrix. The algorithm assumes a single block diagonal prior with one shrinkage threshold determining significance of correlations.
**Usage**

EBsingle(Covmat, startlambda = 0.5, n, happrox=FALSE)

**Arguments**

- **Covmat**: A sample covariance matrix. Must be positive semi-definite, is converted to a correlation matrix in the algorithm.
- **startlambda**: This determines a lower noise level for the correlations, for example, it defaults to 0.5. This means that all correlation values below 0.5 will be set to zero (assumed to be noise).
- **n**: The number of samples (replicates) used to calculate Covmat
- **happrox**: Logical indicating whether or not to use a hypergeometric distribution estimation of the correlations. The alternative is to take the sample average of the correlations. FALSE by default.

**Value**

Returns the estimated correlation matrix.

**Author(s)**

C. Pacini

**References**


**Examples**

```r
sigma <- matrix(c(4,2,2,3), ncol=2)
x <- rmvnorm(n=500, mean=c(1,2), sigma=sigma)
samplecov<-cov(x)
test<-EBsingle(samplecov,startlambda=0.4,n=500)
```
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