Package ‘MantelCorr’

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Title Compute Mantel Cluster Correlations
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Author Brian Steinmeyer and William Shannon
Description Computes Mantel cluster correlations from a (p x n) numeric data matrix (e.g. microarray gene-expression data).
Maintainer Brian Steinmeyer <steinmeb@ilya.wustl.edu>
Depends R (>= 2.10)
Imports stats
License GPL (>= 2)
biocViews Clustering
NeedsCompilation no

R topics documented:

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ClusterGeneList Generate Genes from a Cluster List

Description

‘ClusterGeneList’ produces a list of both significant and nonsignificant genes from each respective cluster type

Usage

ClusterGeneList(clus, clustlist.sig, x.data)
ClusterGeneList

Arguments

- `clus`: 'clusters' object returned by `GetClusters`
- `clustlist.sig`: 'SignificantClusters' object returned by `ClusterList`
- `x.data`: original (p x n) numeric data matrix (e.g., gene-expression data)

Value

A list with components:

- `SignificantClusterGenes`: significant cluster genes returned from `ClusterList`
- `NonSignificantClusterGenes`: nonsignificant cluster genes returned from `ClusterList`

Note

Argument `x.data` should have an ID gene variable, 'probes', attached as a 'dimnames' attribute

Author(s)

Brian Steinmeyer

See Also

'GetClusters' 'ClusterList'

Examples

```r
# simulate a p x n microarray expression dataset, where p = genes and n = samples
data.sep <- rbind(matrix(rnorm(1000), ncol=50), matrix(rnorm(1000, mean=5), ncol=50))
noise <- matrix(runif(40000), ncol=1000)
data <- t(cbind(data.sep, noise))
data <- data[1:200, ]
# data has p = 1,050 genes and n = 40 samples

clusters.result <- GetClusters(data, 100, 100)
dist.matrices <- DistMatrices(data, clusters.result$clusters)
mantel.corrs <- MantelCorrs(dist.matrices$Dfull, dist.matrices$Dsubsets)
permutation.result <- PermutationTest(dist.matrices$Dfull, dist.matrices$Dsubsets, 100, 40, 0.05)

# generate both significant and non-significant gene clusters
cluster.list <- ClusterList(permutation.result, clusters.result$cluster.sizes, mantel.corrs)

# significant and non-significant cluster genes (expression values)
cluster.genes <- ClusterGeneList(clusters.result$clusters, cluster.list$SignificantClusters, data)
```
ClusterList

Description

'ClusterList' generates a list of both significant and nonsignificant clusters, with cluster number, Mantel cluster correlation and size.

Usage

ClusterList(p.val, clus.size, mantel.cors)

Arguments

p.val  permutation p-value returned from 'PermutationTest'
clus.size  vector of k cluster sizes returned from 'GetCluster'
mantel.cors  original, unpermuted k Mantel correlations returned from 'MantelCorrs'

Value

A list with components:

SignificantClusters  clusters with significant Mantel correlation, equal to or larger than the permutation p-value returned by 'PermutationTest'

NonSignificantClusters  clusters with nonsignificant Mantel correlation, smaller than the permutation p-value returned by 'PermutationTest'

Author(s)

Brian Steinmeyer

See Also

'PermutationTest'

Examples

# simulate a p x n microarray expression dataset, where p = genes and n = samples
data.sep <- rbind(matrix(rnorm(1000), ncol=50), matrix(rnorm(1000, mean=5), ncol=50))
noise <- matrix(runif(40000), ncol=1000)
data <- t(cbind(data.sep, noise))
data <- data[1:200, ]
# data has p = 1,050 genes and n = 40 samples

clusters.result <- GetClusters(data, 100, 100)
dist.matrices <- DistMatrices(data, clusters.result$clusters)
mantel.cors <- MantelCorrs(dist.matrices$Dfull, dist.matrices$Dsubsets)
permutation.result <- PermutationTest(dist.matrices$Dfull, dist.matrices$Dsubsets, 100, 40, 0.05)

# generate both significant and non-significant gene clusters
cluster.list <- ClusterList(permutation.result, clusters.result$cluster.sizes, mantel.corrs)

DistMatrices

Compute Dissimilarity Matrices

Description
'DistMatrices' uses 'dist' to compute dissimilarity matrices for 'data' and each cluster k from 'GetClusters'

Usage
DistMatrices(x.data, cluster.assignment)

Arguments
x.data original 'data' matrix
cluster.assignment cluster assignment vector, "clusters", returned by 'GetClusters'

Value
returns a list with two components:

Dsubsets dissimilarity matrices for each cluster k
Dfull dissimilarity matrix for the original 'data'

Note
'GetClusters' should be executed prior to 'DistMatrices'

Author(s)
Brian Steinmeyer

See Also
'GetClusters'

Examples

# simulate a p x n microarray expression dataset, where p = genes and n = samples
data.sep <- rbind(matrix(rnorm(1000), ncol=50), matrix(rnorm(1000, mean=5), ncol=50))
noise <- matrix(runif(40000), ncol=1000)
data <- t(cbind(data.sep, noise))
data <- data[1:200, ]
# data has p = 1,050 genes and n = 40 samples
clusters.result <- GetClusters(data, 100, 100)
dissimilarity.matrices <- DistMatrices(data, clusters.result$clusters)
GetClusters

Over-Partition a (p x n) Data Matrix using 'kmeans'

Description

'GetClusters' uses an overly large k with the 'kmeans' function to over-partition p variables (rows = genes) from n objects (cols = samples) from a given data matrix 'x.data'

Usage

GetClusters(x.data, num.k, num.iters)

Arguments

x.data p x n data matrix of numeric values
num.k number of k partitions desired
num.iters number of iterations - recommend >= 100

Value

'GetClusters' returns a list with the following components:

clusters cluster assignment from 'kmeans'
cluster.sizes size of each cluster k from 'kmeans'

Note

The input data matrix, x.data, must be numeric (e.g., gene-expression values). We recommend using 'num.k' = one-half the number of genes and 'num.iters' greater than 50

Author(s)

Brian Steinmeyer

See Also

'kmeans'

Examples

# simulate a p x n microarray expression dataset, where p = genes and n = samples
data.sep <- rbind(matrix(rnorm(1000), ncol=50), matrix(rnorm(1000, mean=5), ncol=50))
nnoise <- matrix(runif(40000), ncol=1000)
data <- t(cbind(data.sep, noise))
data <- data[1:200, ]
# data has p = 1,050 genes and n = 40 samples
clusters.result <- GetClusters(data, 100, 100)
Description

Samples were taken with Affymetrix Hgu6800 chips and expression levels measured on 7,129 genes (probes). The samples consist of 27 acute lymphoblastic leukemia (ALL) and 11 acute myeloid leukemia (AML) patients. The data values are raw (e.g. no standardization or gene filtering applied).

Usage

data(GolubTrain)

Format

A data frame of 7129 observations (genes) with the following 38 variables (samples):

X1  ALL
X2  ALL
X3  ALL
X4  ALL
X5  ALL
X6  ALL
X7  ALL
X8  ALL
X9  ALL
X10 ALL
X11 ALL
X12 ALL
X13 ALL
X14 ALL
X15 ALL
X16 ALL
X17 ALL
X18 ALL
X19 ALL
X20 ALL
X21 ALL
X22 ALL
X23 ALL
X24 ALL
X25 ALL
X26 ALL
MantelCorrs

X27  ALL
X28  AML
X29  AML
X30  AML
X31  AML
X32  AML
X33  AML
X34  AML
X35  AML
X36  AML
X37  AML
X38  AML

Source
http://www.broad.mit.edu/cgi-bin/cancer/datasets.cgi

References

Examples
data(GolubTrain)

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Description
'MantelCorrs' computes the Mantel correlation between two dissimilarity matrices

Usage
MantelCorrs(Dfull, Dsubsets)

Arguments

<table>
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<tr>
<th>Argument</th>
<th>Description</th>
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<tbody>
<tr>
<td>Dfull</td>
<td>distance matrix returned by 'DistMatrices' using original 'data'</td>
</tr>
<tr>
<td>Dsubsets</td>
<td>list of distance matrices from each k cluster or partition returned by 'DistMatrices'</td>
</tr>
</tbody>
</table>

Value
A list with k components
where component i
    Mantel correlation for cluster i, i = 1,...,k
Warning
The function is meant to be executed AFTER 'GetClusters' and 'DistMatrices' (see example).

Note
the value 'k' corresponds to the parameter 'num.k' in 'GetClusters'.

Author(s)
Brian Steinmeyer

References

See Also
'GetClusters' 'DistMatrices' 'kmeans'

Examples

# simulate a p x n microarray expression dataset, where p = genes and n = samples
data.sep <- rbind(matrix(rnorm(1000), ncol=50), matrix(rnorm(1000, mean=5), ncol=50))
noise <- matrix(runif(40000), ncol=1000)
data <- t(cbind(data.sep, noise))
data <- data[1:200, ]
# data has p = 1,050 genes and n = 40 samples

clusters.result <- GetClusters(data, 100, 100)
dist.matrices <- DistMatrices(data, clusters.result$clusters)
mantel.corrs <- MantelCorrs(dist.matrices$Dfull, dist.matrices$Dsubsets)

PermutationTest

Permutation Test for Dissimilarity Matrices

Description
'PermutationTest' computes and returns an empirical p-value from a null distribution generated by permuting 'Dfull' a total of 'num.per' times.

Usage
PermutationTest(Dfull, Dsubsets, num.per, num.chips, alpha)

Arguments

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<tr>
<td>Dfull</td>
<td>dissimilarity matrix from the original (p x n) microarray expression data</td>
</tr>
<tr>
<td>Dsubsets</td>
<td>dissimilarity matrices from each k disjoint clusters returned by 'GetClusters'</td>
</tr>
<tr>
<td>num.per</td>
<td>number of permutations</td>
</tr>
<tr>
<td>num.chips</td>
<td>number of samples, 'n' from the original (p x n) data matrix</td>
</tr>
<tr>
<td>alpha</td>
<td>desired level of significance</td>
</tr>
</tbody>
</table>
Details

For each permutation, k Mantel correlations are computed by correlating the permuted 'Dfull' with each dissimilarity matrix 'Dsubsets' from the 'k' clusters returned by 'GetClusters'. The absolute value of the maximum Mantel cluster correlation is retained at each permutation. These 'num.per' maximum correlations are then used to generate a null distribution for distance metric independence, with the p-value taken from the (1 - 'alpha') percentile of this permutation distribution.

Value

returns the permuted p-value for the 'alpha' selected level of significance

Warning

(p x n) data matrix should be numeric (e.g. gene-expression levels)

Note

The function is meant to be executed AFTER 'GetClusters', 'DistMatrices' and 'MantelCorrs' (see example)

Author(s)

Brian Steinmeyer

See Also

'GetClusters' 'DistMatrices' 'MantelCorrs'

Examples

```
# simulate a p x n microarray expression dataset, where p = genes and n = samples
data.sep <- rbind(matrix(rnorm(1000), ncol=50), matrix(rnorm(1000, mean=5), ncol=50))
noise <- matrix(runif(40000), ncol=1000)
data <- t(cbind(data.sep, noise))
data <- data[1:200,]
# data has p = 1,050 genes and n = 40 samples

clusters.result <- GetClusters(data, 100, 100)
dist.matrices <- DistMatrices(data, clusters.result$clusters)
mantel.corrs <- MantelCorrs(dist.matrices$Dfull, dist.matrices$Dsubsets)
permutation.result <- PermutationTest(dist.matrices$Dfull, dist.matrices$Dsubsets, 100, 40, 0.05)
```
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