Package ‘SAGx’

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Title Statistical Analysis of the GeneChip
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Description A package for retrieval, preparation and analysis of data from the Affymetrix GeneChip. In particular the issue of identifying differentially expressed genes is addressed.
License GPL-3
LazyLoad yes
URL http://home.swipnet.se/pibroberg/expression_hemsida1.html
biocViews Microarray, OneChannel, Preprocessing, DataImport, DifferentialExpression, Clustering, MultipleComparison, GeneExpression, GeneSetEnrichment, Pathways, Regression, KEGG
NeedsCompilation yes

R topics documented:
clin2mim ........................................... 2
cluster.q ........................................... 3
estimatep0 ........................................ 4
fetchSignal ........................................ 4
firstpass .......................................... 5
fom ................................................. 6
fp.fn ................................................. 7
Fstat ............................................... 8
gap .................................................. 9
GSEA.mean.t ...................................... 10
JT.test ............................................. 11
list.experiments .................................. 13
list.intersection.p ............................... 13
mat2TeX .......................................... 14
### Description

Given a clinical variable, it produces a script file for WinMIM by calculating means and covariances and for the N most highly correlated probes (in absolute value). Here N is an input parameter, but a recommended value 10. WinMIM can find a relevant graphical model for the dependencies between the probes and the clinical variable.

### Usage

```r
clin2mim(variable="FEV1.ACTUAL", data=dbs, clindat=clinical, probes=probes, N=10, out="mimscr.txt")
```

### Arguments

- **variable**: Clinical variable to be examined
- **data**: The input data set, with subject id in first column.
- **clindat**: The input clinical data, with subject id in first column
- **probes**: The name of the probes in the order of data
- **N**: The number of highly correlated probes to be studied
- **out**: The MIM script file

### Value

The correlation matrix
**Note**

David Edwards’ program WinMIM can be found on StatLib ([http://lib.stat.cmu.edu/graphmod/](http://lib.stat.cmu.edu/graphmod/)). In MIM issue input `mimscript.txt` and the calculations to find a model will start. When finished go to the Graphics menu and click on Independence Graph. The resulting graph can be exported both to WMF and LaTeX.

**Author(s)**

Per Broberg

**References**

Whittaker, Joe (1990) *Graphical Models in Multivariate Analysis*. Wiley

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**cluster.q**

**Clustering Goodness measured by Q2**

**Description**

Calculates a goodness of clustering measure based prediction sum squares.

**Usage**

```r
cluster.q(data,cluster)
```

**Arguments**

- `data` The data matrix  
- `cluster` a vector describing the cluster memberships

**Value**

The clustering mean Q2

**Author(s)**

Per Broberg

**References**

estimatep0  Estimate proportion unchanged genes

Description
The function uses the vector of p-values to estimate p0.

Usage
estimatep0(ps = pp, B = 500, range = seq(0, 0.95, by = 0.05))

Arguments
- **ps**  the vector of p-values, e.g. from firstpass
- **B**  the number of Bootstrap samples
- **range**  the values considered

Value
the value of p0, the proportion unchanged genes

Author(s)
Per Broberg

References

fetchSignal  Fetch data from the GATC database

Description
Fetch FILENAME, PROBESET, SIGNAL and ABS_CALL from the GATC database

Usage
fetchSignal(experiment = "AZ33 ALI", channel, chip = "HG_U95Av2")

Arguments
- **experiment**  The name of the experiment corresponding to an individual chip
- **channel**  The channel to the database
- **chip**  the chip type

Value
dataframe with columns
firstpass

Author(s)
Ported to R by Per Broberg. Original Oracle code by Petter Hallgren, with input from Petra Johansson.

Examples

## Not run:
# Do not run example 1. Fetch Probeset, Signal, ABS_CALL and CHIP for one sample.
library(RODBC)
(channel<-odbcConnect("DSN",uid="USERID",pwd="PASSWORD"))
ali.data <-fetchSignal(experiment="AZ33 ALI", channel, chip="hg_u95a")
colnames(ali.data)
#[1] "FILENAME" "PROBESET" "SIGNAL" "ABS_CALL" "CHIP"

# Do not run example 2
t1 <- paste("select q1.name as name from experiment q1, physical_chip q2, chip_design q3"
   "where q1.physical_chip_id=q2.id and q3.id=q2.design_id and ")
t2 <- paste("upper(q1.name) like ' 
   t3 <- paste("Ids <- sqlQuery(channel,paste(t1,t2,t3) )
   # fetch Signal from GATC corresponding to the U95A chip for all samples in experiment. #
   tmp <- apply(Ids,1,toupper)
   probes <- data.frame(fetchSignal(experiment=tmp[1],channel, chip="hg_u95a")[,"PROBESET"])
   test <- matrix(nrow=nrow(as.data.frame(probes)),ncol=nrow(Ids))
   for(i in 1:nrow(as.data.frame(tmp))){
      test[,i] <- fetchSignal(experiment=tmp[i],channel, chip="hg_u95a")[,"SIGNAL"]
   }
   codes <- data.frame(apply(Ids,1,code<-function(x) substr(x,1,5)))
   colnames(test) <- as.character(t(codes))
   test <- test[,order(colnames(test))]

## End(Not run)

firstpass  First pass description of GeneChip data

Description

Does a first-pass analysis for a comparative experiment. This includes the calculation of means and confidence intervals for the groups, and finally a Kruskal-Wallis p-value for the null hypothesis of no difference

Usage

firstpass(data = D, probes = probes , g, log = FALSE, present = NULL, labels = NULL, output.data = FALSE)

Arguments

data  A data frame with one array in each column
probes a vector containing the names of the probes in the same order as rows in D
  g  A vector with the groups for the arrays, eg. TREATMENT and CONTROL
present  A dataframe with the Present calls, 3 = P, 2 = M, 1 = A.
log if TRUE then data are log transformed through \( t(x) = \log(1+x) \) and geometric means are calculated.

labels a vector of labels given the group means

output.data if T the raw data are included in the output

Details
A speed-up for Wilcoxon based on Kronecker products was put in place with SAGx v.1.4.5. Ties are currently not taken into account in Wilcoxon.

Value
A dataframe with the columns PROBES, followed by group means and sd’s, lower confidence intervals and then, upper confidence interval (confidence level 95%), and finally the input data. If present names a dataframe holding the present calls the proportion present is calculated. Furthermore, if there are two groups the difference in group means is added.

Examples
```r
## Not run:
# not run
g <- c(rep(1,4),rep(2,4)); labs <- c("Mean Diet","Mean Control"); probes <- paste("Probe",1:1000)
firstpass(data = utmat[,1:2], probes = probes[1:2], g, log = FALSE, labels = labs)
# Probesets Mean Diet Mean Control LCL.1 LCL.2 UCL.1 UCL.2 pval
#1 Probe 1 -12.34446036497 -11.9074973055 -12.9047961446666 -12.2832657957485 -11.7840958626327 -11.2158751988625 0.0433081428107922
#2 Probe 2 -7.99773926405627 -8.02799133391929 -8.47704512876227 -8.194751919835 -7.51843339935028 -7.86110714864023 0.772829992684449
## End(Not run)
```

fom

Clustering Figure of Merit

Description
Goodness of clustering measure based on prediction error.

Usage
```r
fom(data, cluster)
```

Arguments
- data: The data matrix
- cluster: a vector describing the cluster memberships

Details
The criterion in the Reference is not correct in the article (i.e. does not follow from the premises), but has been corrected here.
Value

The Figure of Merit measure of the current clustering

Author(s)

Per Broberg

References


---

**Description**

Based on a vector of p-values the proportion false positive (fp) and the proportion false negative are calculated for each entry, assuming that one to be the last to be called significant. The sum of fp and fn is also calculated (errors). Furthermore, an estimate of the proportion unchanged together with the number of the entry with minimum errors.

**Usage**

```r
fp.fn(ps = pvals, B = 100)
```

**Arguments**

- `ps`: a vector of p-values
- `B`: the number of bootstrap loops done by the function `estimatep0` called by `fp.fn`

**Value**

A list with components

- `p0`: the estimated proportion unchanged
- `fp`: the estimated proportion false positives
- `fn`: the estimated proportion false negatives
- `N`: the number of the p-value (significance level) that gives minimum fp + fn

**Author(s)**

Per Broberg
Fstat

Calculation of F statistic by gene given a linear model

Description

Calculates F statistic.

Usage

Fstat(indata = M, formula1 = ~as.factor(g), formula0 = "mean", design1 = NULL, design0 = NULL, B = NULL)

Arguments

indata
The data matrix

formula1
a formula describing the alternative linear model

formula0
a formula describing the null model. Use linear models syntax, except for one-way ANOVA ("mean")

design1
the alternative design matrix. If not NULL it overrides the formula argument

design0
the null design matrix. If not NULL it overrides the formula argument

B
the number of bootstrap replicates

Value

A list with the components

Fstat
the value of the F statistic

fnum
the numerator degrees of freedom

fdenom
the denominator degrees og freedom

design1
the alternative design matrix

design0
the null design matrix

SS1
the sum of squares in the denominator of the F-statistic

SS0
the sum of squares in the numerator of the F-statistic

pvalue
the p-value for testing the alternative vs the null model

Author(s)

Per Broberg

Examples

## Annette Dobson (1990) "An Introduction to Generalized Linear Models".
## Page 9: Plant Weight Data.
ctl <- c(4.17,5.58,5.18,6.11,4.50,4.61,5.17,4.53,5.33,5.14)
trt <- c(4.81,4.17,4.41,3.59,5.87,3.83,6.03,4.89,4.32,4.69)
group <- gl(2,10,20, labels=c("Ctl","Trt"))
weight <- c(ctl, trt)
anova(lm.D9 <- lm(weight ~ group))
# Analysis of Variance Table
# Response: weight
#   Df  Sum Sq  Mean Sq  F value  Pr(>F)
group  1  0.6882  0.6882  1.4191   0.249
Residuals 18  8.7292  0.4850

Fstat(indata = rbind(weight,weight),formula1=~group) # Fstat will need at least two genes to work with#
#$Fstat
# weight weight
#1.419101 1.419101

#$fnum
# [1] 18

#$fdenom
# [1] 1

#$design1
#  (Intercept) groupTrt
#1  1    0
#2  1    0
#3  1    0
#4  1    0
#5  1    0
#6  1    0
#7  1    0
#8  1    0
#9  1    0
#10  1    0
#11  1    1
#12  1    1
#13  1    1
#14  1    1
#15  1    1
#16  1    1
#17  1    1
#18  1    1
#19  1    1
#20  1    1
#attr("assign")
# [1] 0 1

#$design0
# NULL

#$SS1
# weight weight
# 8.72925 8.72925

#$SS0
# weight weight
# 0.688205 0.688205

---

**gap**  
**GAP statistic clustering figure of merit**
Description

Calculates a goodness of clustering measure based on the average dispersion compared to a reference distribution.

Usage

gap(data = swiss, class = g, B = 500, cluster.func = myclus)

Arguments

data The data matrix, with samples (observations) in rows and genes (variables) in columns
class a vector describing the cluster memberships of the rows of data
B the number of bootstrap samples
cluster.func a function taking the arguments data and k (number of clusters) and outputs cluster assignments as list elements cluster (accessed by object$cluster).

Value

The GAP statistic and the standard deviation

Author(s)

Per Broberg

References


Examples

library("MASS")
data(swiss)
c1 <- myclus(data = swiss, k = 3)
gap(swiss, c1$cluster)

GSEA.mean.t

Gene Set Enrichment Analysis using output from samroc

Description

Based on a list of gene sets, e.g. pathways, in terms of Affymtrix identifiers, these sets are ranked with respect to regulation as measured by an effect in a linear model using the SAM statistic. Typical applications include two-group comparisons or simple linear regression to clinical variable or gene expression of a given gene.

Usage

GSEA.mean.t(samroc = samroc.res, probeset = probeset, pway = kegg, type = c("original","absolute", "maxmean"), two.side = FALSE, cutoff = c(10,Inf), rest
**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>samroc</td>
<td>an object of class samroc.result</td>
</tr>
<tr>
<td>probeset</td>
<td>the Affymetrix identifiers</td>
</tr>
<tr>
<td>pway</td>
<td>a list of pathways or gene sets</td>
</tr>
<tr>
<td>type</td>
<td>if &quot;absolute&quot; value of the absolute value of the samroc test statistic is used. If &quot;original&quot; no transformation. &quot;maxmean&quot; not available.</td>
</tr>
<tr>
<td>two.side</td>
<td>if TRUE a two-sided test is performed. Currently only two-sided test when type = &quot;original&quot; and else one-sided</td>
</tr>
<tr>
<td>cutoff</td>
<td>Gene sets with the number of members not falling within the interval given by cutoff are excluded</td>
</tr>
<tr>
<td>restand</td>
<td>if TRUE a 'restandardization' following Efron and Tibshirani (2006) is performed</td>
</tr>
</tbody>
</table>

**Details**

Restandardization based on Efron and Tibshirani (2006) introduced. For normal approximation of the gene set statistic both the mean of the statistic, or the variance (and likewise for the Wilcoxon statistic), are obtained from the permutation distribution included in the samroc.result object. Note that this will account for the dependency between genes.

**Value**

A matrix with columns normal approximation p-values, mean statistic, median statistic, and if type = "original", also Wilcoxon signed ranks statistic based p-value.

**Author(s)**

Per Broberg

**References**


---

**Description**

The test is testing for a monotone trend in terms of the class parameter. The number of times that an individual of a higher class has a higher gene expression forms a basis for the inference.

**Usage**

`JT.test(data, class, labs = NULL, alternative = c("two-sided", "decreasing", "increasing"), ties = FALSE)`
Arguments

data A matrix with genes in rows and subjects in columns
class the column labels, if not an ordered factor it will be redefined to be one.
labs the labels of the categories coded by class
alternative two-sided, decreasing or increasing
ties Adjustment for ties

Details

Assumes that groups are given in increasing order, if the class variable is not an ordered factor, it will be redefined to be one. The p-value is calculated through a normal approximation.

The implementation owes to suggestions posted to R list.

The definition of predictive strength appears in Flandre and O’Quigley.

Value

an object of class JT-test, which extends the class htest, and includes the following slots

statistic the observed JT statistic
parameter the null hypothesis parameter, if other value than 0.
p.value the p-value for the two-sided test of no trend.
method Jonckheere-Terpstra
alternative The relations between the levels: decreasing, increasing or two-sided
data.name the name of the input data
median1 ... mediann the medians for the n groups
trend the rank correlation with category
S1 Predictive strength

Author(s)

Per Broberg, acknowledging input from Christopher Andrews at SUNY Buffalo

References

Flandre, Philippe and O’Quigley, John, Predictive strength of Jonckheere’s test for trend: an application to genotypic scores in HIV infection, Statistics in Medicine, 2007, 26, 24, 4441-4454

Examples

# Enter the data as a vector
A <- as.matrix(c(99,114,116,127,146,111, 125,143,148,157,133,139, 149, 160, 184))
# create the class labels
g <- c(rep(1,5),rep(2,5),rep(3,5))
# The groups have the medians
tapply(A, g, median)
# JT.test indicates that this trend is significant at the 5% level
JT.test(data = A, class = g, labs = c("GRP 1", "GRP 2", "GRP 3"), alternative = "two-sided")
list.experiments

Display all experiment names and id’s in the GATC database

Usage

list.experiments(channel, chip = "HG_U95Av2")

Arguments

channel: the ODBC channel set up through RODBC
chip: the chip type

Details

The GATC database has caused some problems by switching between upper and lower case in an erratic manner. To solve this all names are changed to upper case in the identification of experiments. Thus the function will not distinguish between the experiments ‘A’ and ‘a’, but with any sensible naming strategy, the restriction is without consequence

Value

dataframe with column EXPERIMENT

Examples

# Not run
## Not run: library(Rodbc)
channel <- odbcConnect(DBN, USRID, PWD)
ud <- list.experiments(channel, chip = "hu6800")
colnames(ud)
# [1] "EXPERIMENT"

## End(Not run)

list.intersection.p

p-value for intersection of two gene lists.

Description

Calculates a p-value for observing a number of probe sets common to two lists drawn from the same chip.

Usage

list.intersection.p(N = 14000, N1 = 100, N2 = 200, common = 30)
Arguments

N  The selectable number of probe sets
N1 the number of probe sets on the first list.
N2 the number of probe sets on the second list
common the number of probe sets in common to the two lists.

Value

the p-value giving the probability of observing by chance at least as many in common as was actually observed.

Author(s)

Per Broberg

mat2TeX  Output matrix to LaTeX

Description

The function outputs a matrix to a LaTeX table

Usage

mat2TeX(mat, digits = 4, rowNameTitle = "", file = "", roundNum = NULL, rowNameAlign = "l", matAlign = "r", prtHead = TRUE, prtEnd = TRUE, extraTitle = NULL, rowNameCols = 1, append = FALSE)

Arguments

mat a matrix
digits number of digits
rowNameTitle title above row names
file output file
roundNum integer indicating the precision
rowNameAlign alignment of row names, default is "l"
matAlign alignment of columns, default is "r"
prtHead if TRUE the begin{tabular} line is produced
prtEnd if TRUE the end{tabular} line is produced
extraTitle extra title
rowNameCols the row name column, default is 1
append if TRUE the output is appended to file, default is FALSE

Author(s)

Juerg Kindermann; code found on R list
myclus  A clustering function

Description

Uses a hierarchical clustering to initiate a kmeans clustering.

Usage

myclus(data = swiss, k = 3)

Arguments

data The data matrix
k the number of clusters

Value

a list from function kmeans

Author(s)

From Ripley and Venables

References


Examples

library(MASS)
data(swiss)
cl <- myclus(data = swiss, k = 3)
gap(swiss, cl$cluster)

normalise  Normalise arrays

Description

Normalises arrays against a calculated average array, and calibrated linearly in a cube-root scatter plot.

Usage

normalise(x, linear=TRUE)

Arguments

x The data matrix
linear if linear=TRUE then the matrix elements are raised to the power of 3.
one.probeset.per.gene

Value

normalised version of indata

Author(s)

Per Broberg

References


Description

This function takes a vector of probeset identifiers, a vector of gene identifiers and a vector of present rates, and outputs the probeset id per gene that corresponds to the highest present rate.

Usage

one.probeset.per.gene(probeset = probeset, present = present, symbol = symbol)

Arguments

probeset a vector of probeset id’s
present a vector of present rates
symbol a vector of gene symbols

Details

It is assumed that missing gene symbol is coded as "". Note also that other measurements than present rate may be useful as selection criterion, such some variation measure. The function only assumes that high values are desirable.

Value

A vector of probeset id’s.

Note

Experimental function. Feedback appreciated.

Author(s)

Per Broberg
outlier

Identify outliers in the multivariate distribution

Description

A PCA model is fitted to data and two statistics as measures of extremity are calculated. These are the Hotelling t-square and DMODX, the first is a measure of how far away from the centre of the projection subspace the projection of the observation is. The second one measures how remote from the projection the actual observation is. SVD is done directly on the data matrix. The number of significant dimensions is defined as the number of eigenvalues greater than 1. Typically arrays are in different columns.

Usage

```
o outlier(M)
```

Arguments

M
matrix

Value

Dataframe with columns Hotelling and DMODX

Author(s)

Per Broberg

References


Examples

```r
## Not run:
# not run
ut<-outlier(M)
#[1] "The number of significant dimensions is 19"
colnames(ut)
#[1] "Hotelling" "DMODX"

## End(Not run)
```
**p0.mom**

*Estimate proportion unchanged genes*

**Description**

The function uses the vector of p-values to estimate p0.

**Usage**

```r
p0.mom(ps = pvalues)
```

**Arguments**

- `ps` the vector of p-values, e.g. from firstpass

**Value**

the value of p0, the proportion unchanged genes as a list with components:

- `mgf` estimate from the mgf method
- `PRE` estimate from the PRE method
- `experimental1` 
- `experimental2`

**Author(s)**

Per Broberg

**References**


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**pava**

*Pooling of Adjacent Violators*

**Description**

The PAVA algorithm

**Usage**

```r
pava(x, wt = rep(1, length(x)))
```

**Arguments**

- `x` A numeric sequence
- `wt` observation weights; 1 by default.
The algorithm will turn a non-increasing into a non-decreasing one. `pava` is an internal function used to force monotonicity, e.g. of p1 in function `Zfreq`.

**Value**

A non-decreasing sequence

**Author(s)**

R.F. Raubertas, code from S list

**Examples**

```r
pava(c(1,2,4,3,5))
# [1] 1.0 2.0 3.5 3.5 5.0
```

**Description**

Estimates tail area and local false discovery rate using isotonic regression

**Usage**

```r
pava.fdr(ps = pvalues, p0 = NULL)
```

**Arguments**

- `ps` : the vector of p-values, e.g. from firstpass
- `p0` : an estimate of the proportion unchanged genes

**Details**

If `p0 = NULL` the PRE estimate of `p0` is calculated.

**Value**

A list with components

- `pava.fdr` : estimate of the FDR
- `p0` : estimate of `p0`
- `pava.local.fdr` : estimate of the local fdr

**Author(s)**

Per Broberg
References


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**R2BASE**

*Produces a BASE file*

**Description**

The function produces a BASE file for import to Gene Data Viewer.

**Usage**

```r
R2BASE(context.data = clingen, sample.ids = AZID, expression.data = dats, annotation = annots, out = "u:/temp/temp.base")
```

**Arguments**

- `context.data` e.g. a clinical database
- `sample.ids` Sample Ids, that names the columns of the expression data.
- `expression.data` a matrix with the gene expression data, samples correspond to columns and probesets to rows. It is assumed that probeset identifiers are found in the first column.
- `annotation` annotations of the probesets, i.e. the rows in the expression.data. It is assumed that probeset identifiers are found in the first column.
- `out` the output file including path

**Value**

The file produced complies with an old BASE format. However, none of these formats are documented, as far as I know. So, essentially this function defines a data format that can be read by e.g. Gene Data Viewer.

**Author(s)**

Per Broberg
Description

Given a candidate probe, it produces a script file for WinMIM by calculating means and covariances and for the N most highly correlated probes (in absolute value). Here N is an input parameter, but a recommended value 10. WinMIM can find a relevant graphical model for the dependencies between the probes.

Usage

R2mim(probe="12345_at", N=10, data=inm, out="u:/study/copd/mimscr.txt")

Arguments

- **probe** The name of the candidate probe
- **N** The number of highly correlated probes to be studied
- **data** The input data set
- **out** The MIM script file

Value

The correlation matrix

Note

David Edwards’ program WinMIM can be found on StatLib (http://lib.stat.cmu.edu/graphmod/). In MIM issue input mimscr.txt and the calculations to find a model will start. When finished go to the Graphics menu and click on Independence Graph. The resulting graph can be exported both to WMF and LaTeX.

Author(s)

Per Broberg

References

- Whittaker, Joe (1990) *Graphical Models in Multivariate Analysis*. Wiley
rank.genes

**Rank genes with respect to multiple criteria**

**Description**

It is assumed that genes come in rows and the criteria in columns. Furthermore, high values should be good. After ranking the genes with respect to each criterion, the function does a PCA on the ranks, uses the first PC to obtain the final ranks. In principle it could happen that genes are ranked in the opposite direction to the one intended, but that should be evident from a quick glance at the results.

**Usage**

```r
rank.genes(data = indats)
```

**Arguments**

- `data` A matrix with the criteria in columns.

**Value**

The total ranks of the genes.

**Author(s)**

Per Broberg

rank.trend

**Trend analysis based on ranks**

**Description**

Ranks are used to score genes with respect to degree of agreement to a given trend or pattern, Lehmann (1974) p.294.

**Usage**

```r
rank.trend(data = x, pattern = c(1:ncol(data)), har = FALSE)
```

**Arguments**

- `data` A data frame with one array in each column
- `pattern` A permutation of the integers 1:ncol(data)
- `har` logical parameter indicating whether or not a score based on Hardy’s theorem shall be calculated.

**Details**

The rank scores gives a higher weight to a deviation from trend in more distant obseveations than a deviation between neighbouring observations. The p-values are calculated through a normal approximation.
Value

A list with the components

- **score**
  - the rank score for each gene
- **hardy**
  - if har = TRUE the hardy score, NULL otherwise
- **pvals**
  - the p-values for the null hypothesis of no trend

Author(s)

Per Broberg

References


Examples

```r
# not run
d <- c(123, 334, 578, 762, 755, 890)
rank.trend(data = t(as.matrix(d)), har = TRUE)
# Trend score Hardy score p-value for no trend
# [1,] 2 90 0.01750284
```

---

**rsd.test**

*Compare two groups with respect to their RSD (CV)*

Description

A by row comparison of the Relative Standard Deviation (RSD), as a Coefficient of Variation (CV), is done using a bootstrap

Usage

```r
rsd.test(data1 = x, data2 = y, B = NULL)
```

Arguments

- **data1**
  - A matrix with the samples for group 1 in columns.
- **data2**
  - A matrix with the samples for group 2 in columns.
- **B**
  - the number of bootstrap iterations. If NULL no bootstrap is performed.

Value

A list with the components

- **cv1**
  - A vector of the RSD’s for sample 1
- **cv2**
  - A vector of the RSD’s for sample 2
- **t.stat**
  - the test statistic
- **p.vals**
  - A vector of p-values for the comparison between **cv1** and **cv2**
Author(s)

Per Broberg

References


---

**samroc.result-class**

*Class "samroc.result" for results of the function samrocN*

### Description

The class `samroc.result` is the output of a call to `samrocN` and the input of various other functions.

### Slots

- **d**: Object of class "numeric". Observed test statistic.
- **diff**: Object of class "numeric". Estimate of effect, e.g. difference between group means.
- **se**: Object of class "numeric". Standard error of `diff`.
- **d0**: Object of class "matrix". Permutation test statistics.
- **p0**: Object of class "numeric". The estimated proportion unaffceted genes.
- **s0**: Object of class "numeric". The fudge factor.
- **pvalues**: Object of class "numeric". The p-values.
- **N.list**: Object of class "integer". The optimal top list size among the sizes suggested.
- **errors**: Object of class "numeric". The sum of false postives and false negatives given a list that includes the current gene.
- **formula**: Object of class "formula". The linear model formula used.
- **contrast**: Object of class "numeric". The contrast estimated.
- **annotation**: Object of class "character". Annotation or comments regarding the analysis. By default the date.
- **N.sample**: Object of class "integer". The number of samples.
- **B**: Object of class "integer". The number of premutations.
- **call**: Object of class "character". The call to the function.
- **id**: Object of class "character". The probeset ids.
- **error.df**: Object of class "integer". The error degrees of freedom.
- **design**: Object of class "matrix". The design matrix.

### Methods

- **show** (samroc.result): Summarizes the test result.
- **plot** (samroc.result): Plots the density of the observed test statistic and that of the corresponding null distribution
Author(s)
Per Broberg

See Also
samrocN

---

### Description
Calculation of the regularised t-statistic which minimises the false positive and false negative rates.

### Usage

```r
samrocN(data=M, formula=~as.factor(g), contrast=c(0,1), N = c(50, 100, 200, 300), B=100, perc = 0.6, smooth = FALSE, w = 1, measure = "euclid", p0 = NULL, probeset = NULL)
```

### Arguments
- `data`: The data matrix, or ExpressionSet
- `formula`: a linear model formula
- `contrast`: the contrast to be estimated
- `N`: the size of top lists under consideration
- `B`: the number of bootstrap iterations
- `perc`: the largest eligible percentile of SE to be used as fudge factor
- `smooth`: if TRUE, the std will be estimated as a smooth function of expression level
- `w`: the relative weight of false positives
- `measure`: the goodness criterion
- `p0`: the proportion unchanged probesets; if NULL p0 will be estimated
- `probeset`: probeset ids; if NULL then "probeset 1", "probeset 2", ... are used.

### Details
The test statistic is based on the one in Tusher et al (2001):

\[
d = \frac{\text{diff}}{s_0 + s}
\]

where \(\text{diff}\) is a the estimate of a contrast, \(s_0\) is the regularizing constant and \(s\) the standard error.

At the heart of the method lies an estimate of the false negative and false positive rates. The test is calibrated so that these are minimised. For calculation of \(p\)-values a bootstrap procedure is invoked. Further details are given in Broberg (2003). Note that the definition of \(p\)-values follows that in Davison and Hinkley (1997), in order to avoid \(p\)-values that equal zero.

The \(p\)-values are calculated through permuting the residuals obtained from the null model, assuming that this corresponds to the full model except for the parameter being tested, corresponding to the contrast coefficient not equal to zero. This means that factors not tested are kept fixed. NB This may be adequate for testing a factor with two levels or a regression coefficient (correlation), but it is not adequate for all linear models.
Value

An object of class samroc.result.

Author(s)

Per Broberg

References


---

**samrocNboot**

*Calculate ROC curve based SAM statistic*

**Description**

A c-code version of samrocN. Calculation of the regularised t-statistic which minimises the false positive and false negative rates.

**Usage**

```r
samrocNboot(data=M,formula=~as.factor(g), contrast=c(0,1), N = c(50, 100, 200, 300), B=100, perc = 0.6, smooth=FALSE, w = 1, measure = "euclid", probeset = NULL)
```

**Arguments**

- `data` The data matrix
- `formula` a linear model formula
- `contrast` the contrast to be estimated
- `N` the size of top lists under consideration
- `B` the number of bootstrap iterations
- `perc` the largest eligible percentile of SE to be used as fudge factor
- `smooth` if TRUE, the std will be estimated as a smooth function of expression level
- `w` the relative weight of false positives
- `measure` the goodness criterion
- `probeset` probeset ids; if NULL then "probeset 1", "probeset 2", ... are used.
Details

The test statistic is based on the one in Tusher et al (2001):

\[ d = \frac{\text{diff}}{s_0 + s} \]

where \( \text{diff} \) is an estimate of a contrast, \( s_0 \) is the regularizing constant and \( s \) the standard error.

At the heart of the method lies an estimate of the false negative and false positive rates. The test is calibrated so that these are minimised. For calculation of \( p \)-values a bootstrap procedure is invoked. Further details are given in Broberg (2003).

The \( p \)-values are calculated through permuting the rows of the design matrix. NB This is not adequate for all linear models.

\texttt{samrocNboot} uses C-code to speed up the bootstrap loop.

Value

An object of class \texttt{samroc.result}.

Author(s)

Per Broberg and Freja Vamborg

References


Examples

\begin{verbatim}
library(multtest)
#Loading required package: genefilter
#Loading required package: survival
#Loading required package: splines
#Loading required package: reposTools
data(golub)
# This makes the expression data from Golub et al available
# in the matrix golub, and the sample labels in the vector golub.cl
set.seed(849867)
samroc.res <- samrocNboot(data = golub, formula = ~as.factor(golub.cl))
# The proportion of unchanged genes is estimated at
samroc.res@p0
# The fudge factor equals
samroc.res@s0
# A histogram of p-values
hist(samroc.res@pvalues)
# many genes appear changed
\end{verbatim}
union.of.pways  

Create the union of two pathway lists

Description

This function takes two lists where each component is a vector of probe sets ids and create a new such list that contains all probe sets and pathways from the two lists.

Usage

union.of.pways(x,y)

Arguments

x  
the first list

y  
the second list

Details

The function merge.list in package RCurl forms a basis for this function which adds the ability to add new probe sets to existing pathways.

Value

A list which is the union of the two input lists.

Note

Experimental function. Feedback appreciated.

Author(s)

Per Broberg

Examples

X = list(a=c(1,2),c=c(1,2));Y = list(a=c(3,4),d=c(12,2))
union.of.pways(X,Y)
Description

The function fits a linear model to a microarray data matrix.

Usage

Xprep(indata=M, formula=~as.factor(g), contrast=c(0,1), design=NULL)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>indata</td>
<td>The data matrix</td>
</tr>
<tr>
<td>formula</td>
<td>a linear model formula in the lm format</td>
</tr>
<tr>
<td>contrast</td>
<td>a vector defining the contrast of interest</td>
</tr>
<tr>
<td>design</td>
<td>the design matrix</td>
</tr>
</tbody>
</table>

Value

A list with the entries:

- \( Mbar \): estimate of the contrast
- \( Vest \): the error variance
- \( k \): inverse of the scale factor turning \( Vest \) into a standard error
- \( f \): the degrees of freedom of \( Vest \)
- design: the design matrix

Author(s)

Per Broberg

Description

The function fits a linear model to a microarray data matrix and calculates the residuals.

Usage

Xprep.resid(data=M, formula=~as.factor(g), design=NULL)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>data</td>
<td>The data matrix</td>
</tr>
<tr>
<td>formula</td>
<td>a linear model formula in the lm format</td>
</tr>
<tr>
<td>design</td>
<td>the design matrix</td>
</tr>
</tbody>
</table>
**Value**

A matrix with the residuals

**Author(s)**

Per Broberg
Index

* Topic IO
  - mat2TeX, 14

* Topic database
  - fetchSignal, 4
  - list.experiments, 13

* Topic distribution
  - list.intersection.p, 13

* Topic htest
  - estimatep0, 4
  - fp.fn, 7
  - pava.fdr, 19
  - samrocN, 25
  - samrocNboot, 26

* Topic methods
  - samroc.result-class, 24

* Topic models
  - Fstat, 8
  - R2BASE, 20
  - Xprep, 29
  - Xprep.resid, 29

* Topic multivariate
  - clin2mim, 2
  - cluster.q, 3
  - fom, 6
  - gap, 9
  - GSEA.mean.t, 10
  - myclus, 15
  - normalise, 15
  - one.probeset.per.gene, 16
  - outlier, 17
  - R2mim, 21
  - rank.genes, 22
  - union.of.pways, 28

* Topic nonparametric
  - firstpass, 5
  - JT.test, 11
  - p0.mom, 18
  - rsd.test, 23

* Topic regression
  - pava, 18

* Topic robust
  - rank.trend, 22

- cluster.q, 3
- estimatep0, 4
- fetchSignal, 4
- firstpass, 5
- fom, 6
- fp.fn, 7
- Fstat, 8
- gap, 9
- GSEA.mean.t, 10
- JT.test, 11
- list.experiments, 13
- list.intersection.p, 13
- mat2TeX, 14
- myclus, 15
- normalise, 15
- one.probeset.per.gene, 16
- outlier, 17
- p0.mom, 18
- pava, 18
- pava.fdr, 19
- plot,samroc.result,ANY-method (samroc.result-class), 24
- plot,samroc.result-method (samroc.result-class), 24
- R2BASE, 20
- R2mim, 21
- rank.genes, 22
- rank.trend, 22
- rsd.test, 23
- samroc.result-class, 24
- samrocN, 24, 25, 25
- samrocNboot, 26
- show,samroc.result-method (samroc.result-class), 24
INDEX

union.of.pways, 28
Xprep, 29
Xprep.resid, 29