Package 'a4Base'

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Contents

a4palette . . . 2
addQuantilesColors . . . 3
boxPlot . . . 4
combineTwoExpressionSet . . . 5
computeLogRatio . . . 6
createExpressionSet . . . 8
ExpressionSetWithComputation-class . . . 9
filterVarInt . . . 10
heatmap.expressionSet . . . 11
histPvalue . . . 18
histpvalueplotter . . . 19
lassoReg . . . 20
limmaReg . . . 21
limmaTwoLevels . . . 22
logReg . . . 22
nlcvTT . . . 24
oaColors . . . 25
oaPalette . . . 25
plot1gene . . . 26
plotComb2Samples . . . 27
plotCombination2genes . . . 28
plotCombMultSamples . . . 30
plotLogRatio . . . 31
probabilitiesPlot . . . 35
probe2gene . . . 36
profilesPlot . . . 37
propDEgenes . . . 38
propDEgenes-methods . . . 39
propdegenescalculation . . . 40
replicates . . . 41
spectralMap . . . 41
spectralMap-methods . . . 43
topTable,limma-method . . . 44
tTest . . . 46
volcanoPlot . . . 47
volcanoPlot-methods . . . 48
volcanoplotter . . . 51

Index **53**

`a4palette` *Utility function that defines a color palette for use in a4*

Description

Utility function that defines a color palette for use in a4

Usage

```
a4palette(n, alpha = 1, Janssen = FALSE)
```

Arguments

n	Number of color levels the palette should provid
alpha	alpha transparency level of the colors
Janssen	logical. If TRUE, Janssen Pharmaceutical colors are used (with a maximum of 6 possible colors).

Details

For n = 1, "blue" is returned; for n = 2 c("red", "blue") is returned; for n = 3 c("red", "green", "blue" is returned; for n = 4 c("red", "green", "blue", "purple") is returned and for n > 2, the output of rainbow(n) is returned.

Value

a character vector of colors

Author(s)

Steven Osselaer, Tobias Verbeke

See Also

rainbow palette in palettes

Examples

```
op <- par(mfrow = c(2, 3))
for (nGroups in 1:6)
 pie(rep(1, nGroups), a4palette(nGroups))
par(op)
```

---

addQuantilesColors *Compute quantiles for plotGeneDE function*

Description

Compute quantiles on mean expression level for plotGeneDE function. Colors of bars in the plot could then be allocated using buckets defined by those quantiles.

Usage

```
addQuantilesColors(e, ngroups = 3)
```

Arguments

e	ExpressionSet object to use for computation
ngroups	Number of groups to be created

Details

Number of computed quantiles is equal to (ngroups - 1).

Value

The ExpressionSet object e is returned, with a new column called colorsQuantilesVector in its slot featureData

Author(s)

Eric Lecoutre

See Also

plotLogRatio

Examples

```
if (require(ALL)){
  data(ALL, package = "ALL")
  ALLQ <- addQuantilesColors(ALL)
  fData(ALLQ)
}
```

---

boxPlot *Create a boxplot for a given gene.*

Description

Create a boxplot for a given gene. The boxplot displays the expression values (y-axis) by groupss (x-axis). The raw data are superimposed as dots, jittered for readability of the plot. Optionally, the dots can be colored by another variable.

Usage

```
boxPlot(
  probesetId = NULL,
  geneSymbol = NULL,
  object,
  groups,
  main = NULL,
  colvec = NULL,
  colgroups = NULL,
  probe2gene = TRUE,
  addLegend = TRUE,
  legendPos = "topleft",
  ...
)
```

Arguments

probesetId	The probeset ID. These should be stored in the featureNames of the expressionSet object.
geneSymbol	The gene symbol. These should be stored in the column `Gene Symbol` in the featureData of the expressionSet object.

object	ExpressionSet object for the experiment
groups	String containing the name of the grouping variable. This should be a the name of a column in the pData of the expressionSet object.
main	Main title on top of the graph
colvec	Vector of colors to be used for the groups. If not specified, the default colors of a4palette are used.
colgroups	String containing the name of the variable to color the superimposed dots. This should be a the name of a column in the pData of the expressionSet object
probe2gene	Boolean indicating whether the probeset should be translated to a gene symbol (used for the default title of the plot)
addLegend	Boolean indicating whether a legend for the colors of the dots should be added.
legendPos	Specify where the legend should be placed. Typically either topright, bottomright, topleft (the default) or bottomleft
...	Possibility to add extra plot options. See par

Value

A plot is drawn to the current device and probesetId are returned invisibly.

Author(s)

Willem Talloen

See Also

plot1gene

Examples

```
# simulated data set
esSim <- simulateData()
boxPlot(probesetId = 'Gene.1', object = esSim, groups = 'type', addLegend = FALSE)
# ALL data set
if (require(ALL)){
  data(ALL, package = "ALL")
  ALL <- addGeneInfo(ALL)
  ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
  boxPlot(geneSymbol = 'HLA-DPB1', object = ALL, boxwex = 0.3,
    groups = 'BTtype', colgroups = 'BT', legendPos='topright')
}
```

---

combineTwoExpressionSet

Combine two ExpressionSet objects

Description

Merge two ExpressionSet objects, checking their attributes.

Usage

```
combineTwoExpressionSet(x, y)
```

Arguments

x	An object of class ExpressionSet
y	An object of class ExpressionSet

Details

exprs and pData are merged. Other data (such as MIAME or annotation) are those of x.

Value

An object of class ExpressionSet

Author(s)

Eric Lecoutre

See Also

ExpressionSet

Examples

```
## Not run:
# prepare and combine two ExpressionSet
data(data.H2009); data(phenoData.H2009)
data(data.SKOV3); data(phenoData.SKOV3)
eH2009 <- prepareExpressionSet(exprs = data.H2009, phenoData = phenoData.H2009, changeColumnsNames = TRUE)
eSKOV3  <- prepareExpressionSet(exprs = data.SKOV3, phenoData = phenoData.SKOV3, changeColumnsNames = TRUE)
newE <- combineTwoExpressionSet(eH2009,eSKOV3)

## End(Not run)
```

---

computeLogRatio *Summary statistics for gene expression*

Description

Compute summary statistics per gene of expression data in a ExpressionSet object.

Usage

```
computeLogRatio(
  e,
  reference,
  within = NULL,
  across = NULL,
  nReplicatesVar = 3,
  ...
)
```

Arguments

e	An object of class ExpressionSe
reference	A list with two items: var and level - See details
within	Character vector - names of pData columns - See details
across	Character vector - names of pData columns - See details
nReplicatesVar	Integer - Minimum number of replicates to compute variance
...	...

Details

Summary statistics (mean, variances and difference to reference or control) will be computed on the 'exprs' slot of the ExpressionSet object. The parameters of the computation are specified by the parameters 'reference', 'within' and 'across'.\ The design of the computations is such that the differences and pooled variances are calculated against the sample(s) that was(were) chosen as reference. The reference is specified by the level of a certain variable in the phenoData slot (e.g.: column 'control' and level 'WT' of the phenoData slot or a boolean ('ref') variable with 0 or 1) – the list object of 'var' and 'level' together determine the reference group. \

All groups determined by combining the `reference$var` and `across` variables will be compared to the reference group. Two different approaches to obtain necessary computations:

- Prepare a boolean variable that reflects only the reference group and specify all groupings in the across arguments. E.g.: `reference=list(var = 'boolean', level = 1), across = c('compound','dose')`
- Add an extra column to the phenoData slot that contains all combinations, with a specific one for the reference group: for example, `pData(e)['refvar'] <- paste(pData(e)['compound'], pData(e)['dose'],sep='.')` so as to use `reference = list(var = 'refvar', level ='comp1.dose1')` as argument for reference.

\

Sometimes computations need to be conducted within groups, and are thus nested. For example, when comparing treament values of different cell lines, each will have gene expression values for its own reference. The parameter 'within' allows to define such subgroups, for which computations will be done separately and combined afterwards. Both parameters 'within' and 'across' can be a vector of column names, whose unique combinations will be used for groupings.

Value

Returns an object of class ExpressionSet with pData inherited from the submitted ExpressionSet object, supplemented by the computed statistics in the 'exprs' slot and info thereof in the 'phenoData' slot.

Author(s)

Eric Lecoutre

See Also

`plotLogRatio`

Examples

```
if (require(ALL)){
data(ALL, package = "ALL")
ALL <- addGeneInfo(ALL)
ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
ALL2 <- ALL[,ALL$BT != 'T1']  # omit subtype T1 as it only contains one sample
ALL2$BTtype <- as.factor(substr(ALL2$BT,0,1)) # create a vector with only T and B

# Test for differential expression between B and T cells
tTestResult <- tTest(ALL, "BTtype", probe2gene = FALSE)
topGenes <- rownames(tTestResult)[1:20]

# plot the log ratios versus subtype B of the top genes
LogRatioALL <- computeLogRatio(ALL2, reference=list(var='BT',level='B'))
a <- plotLogRatio(e=LogRatioALL[topGenes,],openFile=FALSE, tooltipvalues=FALSE, device='pdf',
 colorsColumnsBy=c('BTtype'), main = 'Top 20 genes most differentially between T- and B-cells',
  orderBy = list(rows = "hclust"),
  probe2gene = TRUE)
}
```

`createExpressionSet` *combine gene expression and phenotype data onto a ExpressionSet object*

Description

Basically a wrapper for `new('ExpressionSet',...)`, this function gathers gene expression and phenotype data, after having checked their compatibility.

Usage

```
createExpressionSet(
  exprs = matrix(nrow = 0, ncol = 0),
  phenoData = AnnotatedDataFrame(),
  varMetadata = NULL,
  dimLabels = c("rowNames", "colNames"),
  featureData = NULL,
  experimentData = MIAME(),
  annotation = character(0),
  changeColumnsNames = TRUE,
  ...
)
```

Arguments

`exprs`	gene expression matrix
`phenoData`	phenotype data associated with exprs columns, as a matrix or data.frame
`varMetadata`	optional metadata on phenotype data
`dimLabels`	see `ExpressionSet`
`featureData`	see `ExpressionSet`
`experimentData`	see `ExpressionSet`

annotation see ExpressionSet

changeColumnsNames
Change exprs columns names – see details

... ...

Details

If changeColumnsNames is TRUE, then the procedure is the following: first one checks if phenoData contains a column named 'colNames'. If so, content will be used to rename exprs colums. On the other case, one uses combinations of phenoData columns to create new names. In any case, old columns names are stored within a column named 'oldcolnames' in the pData.

Value

An object of class ExpressionSet

Author(s)

Eric Lecoutre

See Also

ExpressionSet

Examples

```
# simulate expression data of 10 features (genes) measured in 4 samples
x <- matrix(rnorm(40), ncol = 4)
colnames(x) <- paste("sample", 1:4, sep = "_")
rownames(x) <- paste("feature", 1:10, sep = "_")
# simulate a phenodata with two variables
ToBePheno <- data.frame(Gender = rep(c('Male','Female'), 2),
  Treatment = rep(c('Trt','Control'), each=2))
rownames(ToBePheno) <- paste("sample", 1:4, sep = "_")
eset <- createExpressionSet(exprs = x, phenoData = ToBePheno)
```

ExpressionSetWithComputation-class

Class "ExpressionSetWithComputation"

Description

This class adds statistical information to the exprs of the ExpressionSet as well as descriptive information to the pData of the ExpressionSet

Slots

assayData Object of class "AssayData"

phenoData Object of class "AnnotatedDataFrame"

featureData Object of class "AnnotatedDataFrame"

experimentData Object of class "MIAME"

annotation Object of class "character"

.__classVersion__ Object of class "Versions"

Objects from the Class

Objects can be created by calls of the form `new("ExpressionSetWithComputation", assayData, phenoData, featureData, experimentData, annotation, exprs, ...)`.

Extends

- Class `ExpressionSet`, directly.
- Class `eSet`, by class "ExpressionSet", distance 2.
- Class `VersionedBiobase`, by class "ExpressionSet", distance 3.
- Class `Versioned`, by class "ExpressionSet", distance 4.

Methods

No methods defined with class "ExpressionSetWithComputation" in the signature.

Author(s)

Tobias Verbeke

See Also

`ExpressionSet`, `computeLogRatio`

`filterVarInt` *Filtering on Intensity and Variance*

Description

Function to filter on intensity and variance as typically used in gene expression studies

Usage

```
filterVarInt(
  object,
  IntCutOff = log2(100),
  IntPropSamples = 0.25,
  VarCutOff = 0.5
)
```

Arguments

`object`	ExpressionSet object
`IntCutOff`	cut-off value used for the intensity filt
`IntPropSamples`	proportion of samples used by the intensity filter; by default `IntPropSamples` is set to 0.25.
`VarCutOff`	cut-off value used for the variance filter

Details

The intensity filter implies that (by default) the intensity levels must be greater than log2(100) in at least 25 percent of the samples. The variance filter requires that the features have an interquartile range (IQR) greater than 0.5. Note that the IQR is quite insensitive to outliers such that genes with outlying expression values in a few samples are excluded as long as their overall variation is small.

Value

Object of class ExpressionSet containing only the features that pass the variance and intensity filter.

Author(s)

Willem Talloen

References

Gentleman, R. et al. (2005). Bioinformatics and Computational Biology Solutions using R and BioConductor, New York: Springer. Goehlmann, H. and W. Talloen (2009). Gene Expression Studies Using Affymetrix Microarrays, Chapman \& Hall/CRC, p. 128.

See Also

pOverA, filterfun

Examples

```
if (require(ALL)){
  data(ALL, package = "ALL")
  fALL <- filterVarInt(ALL)
  fALL
}
```

---

heatmap.expressionSet *Image plot of an expressionSet*

Description

Grid version of heatmap function adapted to expressionSet objects with some specific requirements such as the possibility to display subgroups, define colors, adapt text graphical parameters (sizes...). The function also suggests a size appropriate for a device to generate a complete plot with all elements.

Usage

```
heatmap.expressionSet(
  eset,
  col.groups = pData(phenoData(eset))[, "subGroup"],
  col.orderBy = order(pData(phenoData(eset))[, "subGroup"]),
  col.groups.sep.width = unit(8, "points"),
  col.labels = sampleNames(eset),
  col.labels.sep.width = unit(10, "points"),
  col.labels.gpar = gpar(cex = 1),
```

```
  col.labels.max.nchar = 20,
  colors.pergroup = FALSE,
  colors.groups = NULL,
  colors.groups.min = rgb(1, 1, 1),
  colors.max = rgb(1, 0, 0),
  colors.min = rgb(1, 1, 1),
  colors.nbreaks = 128,
  colors.palette = NULL,
  cell.gpar = gpar(lty = 0),
  row.groups.sep.height = unit(15, "points"),
  row.labels.sep.height = unit(10, "points"),
  row.col.groups.display = ifelse(length(unique(col.groups)) > 1, TRUE, FALSE),
  row.col.groups.display.height = unit(6, "points"),
  row.labels.gpar = gpar(cex = 1, col = "black"),
  row.labels.max.nchar = 45,
  row.labels = list("SYMBOL", "GENENAME"),
  row.labels.sep = " - ",
  row.groups = rep(1, nrow(exprs(eset))),
  row.order = "none",
  row.groups.hclust = FALSE,
  row.groups.hclust.n = 4,
  distfun = dist,
  hclustfun = function(d) {
     hclust(d, method = "ward")
 },
  values.min = 0,
  values.max = 16,
  title.gpar = gpar(cex = 1.4),
  title.main =
   "This is the title  possibly being very long - it will be splited on several lines or even displayed
  title.just = c("right", "top"),
  title.maxlines = 4,
  title.cutpoint = 40,
  subtitle.gpar = gpar(cex = 1),
  subtitle.main = "This is subtitle",
  subtitle.maxlines = 4,
  subtitle.just = title.just,
  subtitle.cutpoint = 40,
  margin.top = unit(2, "lines"),
  margin.left = unit(2, "lines"),
  margin.right = unit(2, "lines"),
  margin.bottom = unit(2, "lines"),
  legend.display = TRUE,
  legend.range = "full",
  legend.data.display = ifelse(legend.range == "full", TRUE, FALSE),
  legend.gpar = gpar(cex = 1),
  legend.width = unit(250, "points"),
  legend.height = unit(40, "points"),
  ...
)
```

Arguments

eset	expressionSet object
col.groups	Vector specifying sub-groups for individual. Sub-groups are treated separately and can thus on plot have different colors.
col.orderBy	Vector specifying ordering for individual. In case there are sub-groups, individual must first be ordered by sub-groups, but an additional variable gives a way to sort individual within sub-groups.
col.groups.sep.width	Object of class unit (grid package). Width used to visually separate sub-groups of individuals. This can be unit(0,"points") for example for no separation.
col.labels	Character vector for columns labels (individuals), by default taken from phenoData.
col.labels.sep.width	Object of class gpar. Parameters to be used for labels (cex,...).
col.labels.gpar	Object of class gpar. Parameters to be used for labels (cex,...).
col.labels.max.nchar	Integer. Number of maximum characters to be used for labels truncation
colors.pergroup	Boolean. If TRUE, separate colors are used to color image matrix. Colors defined for groups are used.
colors.groups	Vector. Colors to be used for each group of individual. If NULL (default), colors are taken from column "sampleColor" of expressionSet phenoData.
colors.groups.min	Character vector of length 1 corresponding to a valid color. If colors.groups are provided, a shading if done between color.group and this color (default: white).
colors.max	Character vector of length 1 corresponding to a valid color. See colors details.
colors.min	Character vector of length 1 corresponding to a valid color. See colors details.
colors.nbreaks	Integer. Number of cutpoints used to split the color palette/shading.
colors.palette	Character vector of valid color names.
cell.gpar	Object of class gpar (grid package). Parameters used to format cells, for example to add border (gpar(lty=1)).
row.groups.sep.height	Object of class unit (grid package). Height between rows sub-groups.
row.labels.sep.height	Object of class unit (grid package). Height between image plot zone and rows labels
row.col.groups.display	Boolean. Display or not colored band for subgroups of individuals.
row.col.groups.display.height	Object of class unit (grid package). If row.col.groups.display is TRUE then height used for the displayed band.
row.labels.gpar	Object of class gpar (grid package). Parameters to be used for labels (cex,...).
row.labels.max.nchar	Integer. Number of maximum characters to be used for labels truncation.

`row.labels` Character vector or list. If vector, direct labels to be used. If list, elements of the list will be taken from featureData and collapsed using row.labels.sep.

`row.labels.sep` In case labels are taken from featureData (list for row.labels), separator used to paste the provided columns.

`row.groups` Boolean specifying whether rows are split into sub-groups.

`row.order` Either a vector of indices to be used to reorder features (rows) or "none" or "hclust" to use clustering.

`row.groups.hclust`
Boolean. If row.order equals "hclust", one can ask to split features into sub-groups based on a cut of the clustering dendogram.

`row.groups.hclust.n`
Integer. If row.order equals "hclust" and row.groups.hclust is TRUE, number of sub-groups.

`distfun` Function. For row.order equals "hclust", metric function.

`hclustfun` Function. For row.order equals "hclust", clustering function.

`values.min` Minimum value for the data range. Values that are inferior are assigned to that value. That ensures a maximal cutpoint for the coloring scale.

`values.max` Maximum value for the data range. Values that are superior are assigned to that value. That ensures a maximal cutpoint for the coloring scale.

`title.gpar` Object of class gpar (grid package). Parameters to be used for the main title (cex,...).

`title.main` Character vector. Main title to be displayed.

`title.just` Title justification, one of "center","left","right" (first letter of the word can also be used).

`title.maxlines` Maximum number of lines for the title split.

`title.cutpoint` Integer. Maximum number of characters a line must have. Title is split into lines according to that cutpoint.

`subtitle.gpar` Object of class gpar (grid package). Parameters to be used for the subtitle (cex, col,...).

`subtitle.main` Character vector. Subtitle. The subtitle will be split into lines following same rules as used for main title.

`subtitle.maxlines`
Maximum number of lines for the subtitle split.

`subtitle.just` Subtitle justification, one of "center","left","right" (first letter of the word can also be used).

`subtitle.cutpoint`
Integer. Maximum number of characters a line must have. Subtitle is split into lines according to that cutpoint.

`margin.top` Object of class unit (grid package). Top margin.

`margin.left` Object of class unit (grid package). Left margin.

`margin.right` Object of class unit (grid package). Right margin.

`margin.bottom` Object of class unit (grid package). Bottom margin.

`legend.display` Boolean. Display or not the legend. Legend is positionned in upper right corner.

`legend.range` Character: "full" (default) or "data". If full, color scale legend ranges from values.min to values.max. If "data", range is c(min(data),max(data)).

legend.data.display	Boolean. Display or not color scale legend.
legend.gpar	Object of class gpar (grid package). Parameters to be used for color scale legend axis (cex,...).
legend.width	Object of class unit (grid package). Width for the color scale legend.
legend.height	Object of class unit (grid package). Height for the color scale legend.
...	Additional parameters the function may have. Not used currently

Value

The function suggests a size (width, height) for the graphic returned as a vector. A typical usage will be to call the function a first time to get those values and call it again with an output device

Colors

There are several ways to specify colors used for the image zone. The usual way is to have a shading from colors.groups.min to a color per group (typically the same). By default, a shading is indeed proposed between white (for colors.groups.min) and a same color shared by groups (red for colors.groups.max). The number of possible colors in the shading is determined by colors.nbreaks. In case one asks for distinct colors for groups, only a single value for colors.groups.min is allowed. By default, subgroups colors are taken from phenoData ("sampleColor" column), consequence of colors.groups being NULL. Colors for groups are overided by providing a vector of valid colors for this colors.groups argument. An additional and flexible way to determine colors is to provide a complete palette of possible colors, as a character vector of valid colors (argument colors.palette). Note that in this case the argument colors.nbreaks has no effect as the number of possible values is the length of the palette.

Author(s)

Eric Lecoutre <eric.lecoutre@gmail.com>

Examples

```
## Not run:
 library(RColorBrewer)
 library(dichromat)

 library(Biobase)
 library(grid)
 pdf.directory=getwd()


 load(file.path(getwd(),"expressionSetRma.Rda"))      #expressionSetRma


 eset <- expressionSetRma[100:130,pData(phenoData(expressionSetRma))[,"sample"]%in%c(1:10,41:50)] # ARG
 ##### !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 exprs(eset)[1,5] <- 13.8
 exprs(eset)[10,7] <- 0.5
 eset2 <- expressionSetRma[200:250,] # ARG
 eset3 <- expressionSetRma[1000:1009,pData(phenoData(expressionSetRma))[,"sample"]%in%c(1:3,41:46)] # ARG
 eset4 <- expressionSetRma[100:230,pData(phenoData(expressionSetRma))[,"sample"]%in%c(1:20,31:50)] # ARG

 eset5 <- expressionSetRma[1:400,] # ARG
```

```
# eset <- eset2

pdf(file.path(pdf.directory,"eset.pdf"))
size <- heatmap.expressionSet(eset,subtitle.main=" ")
dev.off()
pdf(file.path(pdf.directory,"eset.pdf"),width=size[1],height=size[2])
heatmap.expressionSet(eset,subtitle.main=" ")
dev.off()


pdf(file.path(pdf.directory,"eset2.pdf"))
size <- heatmap.expressionSet(
  eset2,
  colors.nbreaks = 20,
  colors.pergroup=TRUE,
  legend.range="data",
  row.col.groups.display=FALSE,
  cell.gpar=gpar(lwd=0.5),
  legend.height=unit(50,"points"),
  title.just=c("center","center"),
  title.maxlines=2,
  col.groups.sep.width=unit(0,"points"),
  row.labels=featureNames(eset),
  subtitle.main="This is subtitle",
  row.order="hclust",row.groups.hclust=FALSE,
  title.gpar=gpar(cex=2),
  subtitle.gpar=gpar(cex=1.5)
)
dev.off()
pdf(file.path(pdf.directory,"eset2.pdf"),width=size[1],height=size[2])
size <- heatmap.expressionSet(
  eset2,
  colors.nbreaks = 20,
  colors.pergroup=TRUE,
  legend.range="data",
  row.col.groups.display=FALSE,
  cell.gpar=gpar(lwd=0.5),
  legend.height=unit(50,"points"),
  title.just=c("center","center"),
  title.maxlines=2,
  col.groups.sep.width=unit(0,"points"),
  row.labels=featureNames(eset),
  subtitle.main="This is subtitle",
  row.order="hclust",row.groups.hclust=FALSE,
  title.gpar=gpar(cex=2),
  subtitle.gpar=gpar(cex=1.5)

)
dev.off()




pdf(file.path(pdf.directory,"eset3.pdf"))
size <- heatmap.expressionSet(
```

```
  eset3,
 row.labels.gpar=gpar(cex=0.4,col=c(rep("red",2),rep("black",49)) ), # col will correctly be a vector only if
  col.labels.gpar=gpar(cex=0.6),
  colors.nbreaks = 20,
  colors.pergroup=TRUE,
  legend.range="data",
  row.col.groups.display=FALSE,
  cell.gpar=gpar(lwd=0.5),
  legend.height=unit(50,"points"),
  title.just=c("center","center"),
  title.maxlines=2,
  col.groups.sep.width=unit(0,"points"),
  row.labels=featureNames(eset),
  subtitle.main="Essai subtitle",
  row.order="hclust",row.groups.hclust=FALSE,
  interactive=FALSE
)
dev.off()

pdf(file.path(pdf.directory,"eset3.pdf"),width=size[1],height=size[2])
size <- heatmap.expressionSet(
  eset3,
 row.labels.gpar=gpar(cex=0.4,col=c(rep("red",2),rep("black",49)) ), # col will correctly be a vector only if
  col.labels.gpar=gpar(cex=0.6),
  colors.nbreaks = 20,
  colors.pergroup=TRUE,
  legend.range="data",
  row.col.groups.display=FALSE,
  cell.gpar=gpar(lwd=0.5),
  legend.height=unit(50,"points"),
  title.just=c("center","center"),
  title.maxlines=2,
  col.groups.sep.width=unit(0,"points"),
  row.labels=featureNames(eset),
  subtitle.main="Essai subtitle",
  row.order="hclust",row.groups.hclust=FALSE,
  interactive=FALSE
)
dev.off()



pdf(file.path(pdf.directory,"eset4.pdf"))
size <- heatmap.expressionSet(
  eset4,
  legend.range="data",
  colors.palette = dichromat(rich.colors(190)[1:128]),
  row.col.groups.display=TRUE,
  title.just=c("left","top"),
  title.maxlines=2,
  row.labels=featureNames(eset),
  subtitle.main="",
  row.order="hclust",row.groups.hclust=FALSE,
)
dev.off()

pdf(file.path(pdf.directory,"eset4.pdf"),width=size[1],height=size[2])
```

```
size <- heatmap.expressionSet(
  eset4,
  legend.range="data",
  colors.palette = dichromat(rich.colors(190)[1:128]),
  row.col.groups.display=TRUE,
  title.just=c("left","top"),
  title.maxlines=2,
  row.labels=featureNames(eset),
  subtitle.main="",
  row.order="hclust",row.groups.hclust=FALSE,
)
dev.off()

pdf(file.path(pdf.directory,"eset5.pdf"))
size <- heatmap.expressionSet(eset5,row.order="hclust",row.groups.hclust=FALSE)
dev.off()

pdf(file.path(pdf.directory,"eset5.pdf"),width=size[1],height=size[2])
heatmap.expressionSet(eset5,row.order="hclust",row.groups.hclust=FALSE)
dev.off()


## End(Not run)
```

`histPvalue` *Plot the Distribution of P Values*

Description

This function displays the distribution of the p values using a histogram; the horizontal line represents a uniform distribution based on the p value distribution between 0.5 and 1. This represents the hypothetical p value distribution arising just by chance. This uniform distribution is used to estimate the proportion of differentially expressed genes.

Usage

```
histPvalue(object, ...)

## S4 method for signature 'limma'
histPvalue(object, ...)

## S4 method for signature 'MArrayLM'
histPvalue(object, coef, ...)

## S4 method for signature 'numeric'
histPvalue(object, ...)
```

Arguments

`object`	either a numeric vector of p-values, or an object of class `tTest`, `limma` or `MArrayLM`
`...`	further arguments passed to the method
`coef`	index of the coefficient for which the p values should be plotted; only applies to the MArrayLM method

Value

The histogram is displayed on the current device.

Author(s)

Willem Talloen and Tobias Verbeke

References

Goehlmann, H. and W. Talloen (2009). Gene Expression Studies Using Affymetrix Microarrays, Chapman \& Hall/CRC, p. 253.

Examples

```
if (require(ALL)){
 data(ALL, package = "ALL")
 ALL <- addGeneInfo(ALL)
 ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
 tTestResult <- tTest(ALL, "BTtype")
 histPvalue(tTestResult[,"p"], addLegend = TRUE)
 propDEgenesRes <- propDEgenes(tTestResult[,"p"])
}
```

---

histpvalueplotter *Workhorse function for the histPvalue function*

Description

Workhorse function for the histPvalue function. This function displays the distribution of the p values using a histogram; the horizontal line represents a uniform distribution based on the p value distribution between 0.5 and 1. This represents the hypothetical p value distribution arising just by chance. This uniform distribution is used to estimate the proportion of differentially expressed genes.

Usage

```
histpvalueplotter(
  pValue,
  addLegend = FALSE,
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  ...
)
```

Arguments

pValue	numeric vector of p values
addLegend	logical; should a legend be added (TRUE) or not (FALSE; default
xlab	label for the x axis; defaults to NULL (no label)
ylab	label for the y axis; defaults to NULL (no label
main	main title for the plot; if NULL (default) no main title is displayed
...	further arguments for the hist call; currently none are used

Value

no returned value, a plot is drawn to the current device.

Author(s)

Willem Talloen and Tobias Verbeke

See Also

histPvalue, propdegenescalculation

Examples

```
if (require(ALL)){
  data(ALL, package = "ALL")
  ALL <- addGeneInfo(ALL)
  ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
  tTestResult <- tTest(ALL, "BTtype")
  histPvalue(tTestResult[,"p"], addLegend = TRUE, xlab = "Adjusted P Value")
 histPvalue(tTestResult[,"p"], addLegend = TRUE, main = "Histogram of Adjusted P Values")
  propDEgenesRes <- propDEgenes(tTestResult[,"p"])
}
```

---

lassoReg *Multiple regression using the Lasso algorithm as implemented in the glmnet package*

Description

Multiple regression using the Lasso algorithm as implemented in the glmnet package. This is a theoretically nice approach to see which combination of genes predict best a continuous response. Empirical evidence that this actually works with high-dimensional data is however scarce.

Usage

```
lassoReg(object, covariate)
```

Arguments

object	object containing the expression measurements; currently the only method supported is one for ExpressionSet objects
covariate	character string indicating the column containing the continuous covariate.

Value

object of class glmnet

Author(s)

Willem Talloen

References

Goehlmann, H. and W. Talloen (2009). Gene Expression Studies Using Affymetrix Microarrays, Chapman \& Hall/CRC, pp. 211.

See Also

lassoClass

Examples

```
if (require(ALL)){
 data(ALL, package = "ALL")
 ALL <- addGeneInfo(ALL)
 ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
 resultLasso <- lassoReg(object = ALL[1:100,], covariate = "age")
 plot(resultLasso, label = TRUE,
    main = "Lasso coefficients in relation to degree of penalization.")
  featResultLasso <- topTable(resultLasso, n = 15)
}
```

---

limmaReg *Wrapper for the limma function for the comparison of two groups (two factor levels)*

Description

Wrapper for the limma function for the comparison of two groups (two factor levels)

Usage

```
limmaReg(object, covariable, probe2gene = TRUE)
```

Arguments

object	object of class ExpressionSet
covariable	string indicating the variable defining the continuous covariate
probe2gene	logical; if TRUE Affymetrix probeset IDs are translated into gene symbols; if FALSE no such translation is done

limmaTwoLevels — *Wrapper for the limma function for the comparison of two groups (two factor levels)*

Description

Wrapper for the limma function for the comparison of two groups (two factor levels)

Usage

```
limmaTwoLevels(object, group, probe2gene = TRUE)
```

Arguments

object	object of class ExpressionSet
group	string indicating the variable defining the two groups to be compared
probe2gene	logical; if TRUE Affymetrix probeset IDs are translated into gene symbols; if FALSE no such translation is done

Value

S4 object of class 'limma' with the following two components:

MArrayLM	S4 object of class MArrayLM as returned by the limma function of the limma package
geneSymbols	character vector of gene symbols; this slot is only populated if probe2gene=TRUE (and if the ExpressionSet object is appropriately annotated by addGeneInfo for gene symbols to be extracted)

Note

A 'topTable' method is defined for 'limma' objects.

Author(s)

Tobias Verbeke and Willem Talloen

logReg — *Logistic regression for predicting the probability to belong to a certain class in binary classification problems*

Description

Logistic regression for predicting the probability to belong to a certain class in binary classification problems.

Usage

```
logReg(
  object,
  groups,
  probesetId = NULL,
  geneSymbol = NULL,
  main = NULL,
  probe2gene = TRUE,
  ...
)
```

Arguments

object	ExpressionSet object for the experiment
groups	String containing the name of the grouping variable. This should be a the name of a column in the pData of the expressionSet object.
probesetId	The probeset ID. These should be stored in the featureNames of the expressionSet object.
geneSymbol	The gene symbol. These should be stored in the column `Gene Symbol` in the featureData of the expressionSet object.
main	Main title on top of the gra
probe2gene	Boolean indicating whether the probeset should be translated to a gene symbol (used for the default title of the plot)
...	Possibility to add extra plot options. See plot

Details

It will always estimate probability scores to belong to the second level of the factor variable. If a probability score to other level is preferred, then you need to change the order of the levels of the factor.

Value

A data.frame object with three columns and rownames

rownames	The 'sampleNames' of the expressionSet object
x	The expression values for the specified gene for all samples
y	The labels of the samples
fit	The fitted probability score to belong to one of the two classes.

Author(s)

Willem Talloen

See Also

ROCcurve,probabilitiesPlot

Examples

```
## Not run:
if (require(ALL)){
  data(ALL, package = "ALL")
  ALL <- addGeneInfo(ALL)
  ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
  logRegRes <- logReg(geneSymbol = "HLA-DPB1", object = ALL, groups = "BTtype")
  # scoresplot
  probabilitiesPlot(proportions = logRegRes$fit, classVar = logRegRes$y,
      sampleNames = rownames(logRegRes), main = 'Probability of being a T-cell type ALL')
  # barplot
  probabilitiesPlot(proportions = logRegRes$fit, classVar = logRegRes$y, barPlot=TRUE,
      sampleNames = rownames(logRegRes), main = 'Probability of being a T-cell type ALL')
 }

## End(Not run)
```

---

nlcvTT *Data to Demonstrate nlcv and Co Functions*

Description

Simulated data set used to demonstrate nlcv and accompanying plot functions to study classification problems

Usage

```
nlcvTT
```

Format

The object is of class "nlcv", an object as produced by the nlcv function.

Source

data simulated using: nlcvTT <- nlcv(selBcrAblOrNeg, classVar = 'mol.biol', classdist = "unbalanced", nRuns = 10, fsMethod = "t.test",verbose = TRUE)

See Also

nlcv

Examples

```
## Not run:
data(nlcvTT)
if (require(nlcv)) # on R-Forge
 scoresPlot(nlcvTT, tech = 'svm', nfeat = 25)

## End(Not run)
```

oaColors *Pick One or More OA Colors*

Description

Pick One or More OA Colors

Usage

```
oaColors(color = NULL, alpha = 1)
```

Arguments

color	a character vector of color names; possible values are "red", "orange", "yellow", "green", "cyan", "blue", "pink", "limegreen", "purple", "black", "white", "grey" or "gray"
alpha	transparency level for the color(s)

Value

character vector of colors

Author(s)

Tobias Verbeke

oaPalette *Generate a Palette of OA Colors*

Description

Generate a Palette of OA Colors

Usage

```
oaPalette(numColors = NULL, alpha = 1)
```

Arguments

numColors	number of colors to be contained in the palette
alpha	transparency level of the colors

Value

vector of colors

Author(s)

Jason Waddell

plot1gene *Create a Profile Plot for a given Gene*

Description

Create a profile plot for a given gene. A profile plot displays the expression values (y-axis) by samples (x-axis), sorted by group. This is a useful working graph as samples can be directly identified. For presentation purposes, a `boxPlot` can also be considered. with jittered for readability of the plot.

Usage

```
plot1gene(
  probesetId = NULL,
  geneSymbol = NULL,
  object,
  groups,
  main = NULL,
  colvec = NULL,
  colgroups = NULL,
  probe2gene = TRUE,
  sampleIDs = TRUE,
  addLegend = TRUE,
  legendPos = "topleft",
  cex = 1.5,
  ...
)
```

Arguments

`probesetId`	The probeset ID. These should be stored in the `featureNames` of the `expressionSet` object.
`geneSymbol`	The gene symbol. These should be stored in the column `` `Gene Symbol` `` in the `featureData` of the `expressionSet` object
`object`	ExpressionSet object for the experiment
`groups`	String containing the name of the grouping variable. This should be a name of a column in the `pData` of the `expressionSet` object.
`main`	Main title on top of the graph
`colvec`	Vector of colors to be used for the groups. If not specified, the default colors of `a4palette` are used.
`colgroups`	String containing the name of the variable to color the superimposed dots. This should be a the name of a column in the `pData` of the `expressionSet` object
`probe2gene`	Boolean indicating whether the probeset should be translated to a gene symbol (used for the default title of the plot)
`sampleIDs`	A boolean or a string to determine the labels on the x-axis. Setting it to FALSE results in no labels (interesting when the labels are unreadable due to large sample sizes). Setting it to a string will put the values of that particular `pData` column as labels. The string should be a name of a column in the `pData` of the `expressionSet` object."

addLegend	Boolean indicating whether a legend for the colors of the dots should be added.
legendPos	Specify where the legend should be placed. Typically either topright, bottomright, topleft (the default) or bottomleft
cex	character expansion used for the plot symbols; defaults to 1.5
...	Further arguments, e.g. to add extra plot options. See par

Value

If a geneSymbol is given that has more than one probeSet, the plots for only the first probeSet is displayed. A character vector of corresponding probeset IDs is returned invisibly, so that one can check the profiles of the other related probeset IDs with an extra plot1gene statement If a probesetId is given, one single profile plot for the probeset is displayed.

Author(s)

S. Osselaer, W. Talloen, T. Verbeke

See Also

plotCombination2genes, boxPlot

Examples

```
if (require(ALL)){
  data(ALL, package = "ALL")
  ALL <- addGeneInfo(ALL)
  # one variable (specified by groups)
  plot1gene(geneSymbol = 'HLA-DPB1', object = ALL, groups = "BT",
     addLegend = TRUE, legendPos = 'topright')
  # two variables (specified by groups and colGroups)
 ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
  plot1gene(probeset = '1636_g_at', object = ALL, groups = 'BT',
      colgroups = 'mol.biol', legendPos='topright', sampleIDs = 'BT')
}
```

---

plotComb2Samples *Plots the correlation in gene expression between two samples*

Description

Plots the correlation in gene expression between two samples. Each dot represents a gene, and the dots have a density-dependent coloring. Genes with exceptional behavior can be highlighted by showing their gene symbol.

Usage

```
plotComb2Samples(
  object,
  x,
  y,
  trsholdX = NULL,
  trsholdY = NULL,
```

```
  probe2gene = TRUE,
  ...
)
```

Arguments

object	ExpressionSet object for the experiment
x	String containing the name of the first sample. This should be a the name of a column in the exprs data of the expressionSet object.
y	String containing the name of the second sample. See x
trsholdX	Vector of two values specifying the X-axis thresholds within which genes should be highlighted by their gene symbol.
trsholdY	Vector of two values specifying the Y-axis thresholds within which genes should be highlighted by their gene symbol.
probe2gene	Boolean indicating whether the probeset should be translated to a gene symbol (used for the default title of the plot)
...	Possibility to add extra plot options. See par

Value

No returned value, a plot is drawn to the current device.

Author(s)

W. Talloen

See Also

plotCombMultSamples

Examples

```
if (require(ALL)){
  data(ALL, package = "ALL")
  ALL <- addGeneInfo(ALL)
 plotComb2Samples(ALL,"84004", "01003",
    trsholdX = c(10,12), trsholdY = c(4,6),
    xlab = "a B-cell", ylab = "a T-cell")
}
```

---

plotCombination2genes *Plot a Combination of Two Genes*

Description

Plot a Combination of Two Genes

Usage

```
plotCombination2genes(
  probesetId1 = NULL,
  probesetId2 = NULL,
  geneSymbol1 = NULL,
  geneSymbol2 = NULL,
  object,
  groups,
  addLegend = TRUE,
  legendPos = "topleft",
  probe2gene = TRUE,
  colvec = NULL,
  ...
)
```

Arguments

probesetId1	First probeset id, plotted in the x-axis
probesetId2	Second probeset id, plotted in the y-axis
geneSymbol1	First gene symbol, plotted in the x-axis
geneSymbol2	Second gene symbol, plotted in the y-axi
object	ExpressionSet object for the experiment
groups	string containing the name of the grouping variable
addLegend	Logical value to indicate whether a legend needs to be draw
legendPos	Position on the graph where to put the legend
probe2gene	should the probeset be translated to a gene symbol (used for the default title of the plot
colvec	a character vector of colors. If not specified it will be automatically generated by a4palette
...	This allows to specify typical arguments in the plot functio

Value

If a gene id is given, the plots for only the first probeset is displayed and a character vector of corresponding probeset IDs is returned invisibly. It is a list containing

probeset1	Probeset ids measuring 'gene1'
probeset1	Probeset ids measuring 'gene1'

If a probeset id is given, one single profile plot for the probeset is displayed.

Author(s)

W. Talloen, T. Verbeke

See Also

plot1gene

Examples

```
if (require(ALL)){
 data(ALL, package = "ALL")
 ALL <- addGeneInfo(ALL)
 aa <- plotCombination2genes(geneSymbol1 = 'HLA-DPB1', geneSymbol2 = 'CD3D',
  object = ALL, groups = "BT",
  addLegend = TRUE, legendPos = 'topright')
 aa
}
```

---

plotCombMultSamples *Plots the correlation in gene expression between more than 2 samples*

Description

Plots the correlation in gene expression between more than 2 samples

Usage

```
plotCombMultSamples(exprsMatrix, ...)
```

Arguments

exprsMatrix	ExpressionSet object to plot. For larger datasets, this will typically be a subset of the data.
...	Further arguments, e.g. to add extra plot options. See pairs

Value

no returned value, a plots is drawn in the current device

Author(s)

Willem Talloen

See Also

plotComb2Samples

Examples

```
if (require(ALL)){
 data(ALL, package = "ALL")
 ALL <- addGeneInfo(ALL)
 plotCombMultSamples(exprs(ALL)[,c("84004", "11002", "01003")])
}
```

plotLogRatio *Plot a summary gene expression graph*

Description

Plot ratios of expression values observed in a treatment versus those of a reference. First the ratios and variances are computated on the gene expression data.

Usage

```
plotLogRatio(
  e,
  reference,
  within = NULL,
  across = NULL,
  nReplicatesVar = 3,
  filename = "Rplots",
  device = "svg",
  orderBy = list(rows = "hclust", cols = NULL),
  colorsColumns = NULL,
  colorsColumnsBy = NULL,
 colorsColumnsByPalette = c("#1B9E77", "#D95F02", "#7570B3", "#E7298A", "#66A61E",
    "#E6AB02", "#A6761D", "#666666"),
  colorsUseMeanQuantiles = FALSE,
  colorsMeanQuantilesPalette = c("orange", "red", "darkred"),
  colorsBarsMatrix = NULL,
  colorsGenesNames = c("black"),
  main = paste("log2 ratio's"),
  shortvarnames = NULL,
  longvarnames = NULL,
  gene.length = 50,
  gene.fontsize = 6,
  main.fontsize = 9,
  columnhead.fontsize = 8,
  mx = 1.5,
  exp.width = 1.8,
  exp.height = 0.2,
  log2l.show = TRUE,
  log4l.show = FALSE,
  quantiles.show = FALSE,
  quantiles.compute = c(0.9),
  error.show = TRUE,
  view.psid = FALSE,
  errorLabel = "Error bars show the pooled standard deviation",
  closeX11 = FALSE,
  openFile = FALSE,
  tooltipvalues = FALSE,
  probe2gene = TRUE,
  ...
)
```

Arguments

e	ExpressionSet object to use
reference	A list with two items: var and level - See details
within	Character vector - names of pData columns - See details
across	Character vector - names of pData columns - See details
nReplicatesVar	Integer - Minimum number of replicates to compute variance
filename	Name of the filename to use. No need to specify extension which will be added according to device.
device	One of 'pdf', 'X11', 'png', 'svg'. For svg device, one X11 device is also opened.
orderBy	See details
colorsColumns	A vector of colors to be used for plotting columns; default value is NULL which ends up with red – see Colors section
colorsColumnsBy	A vector of pData columns which combinations specify different colors to be used – see Colors section
colorsColumnsByPalette	If colorsColumns is NULL, vector of colors to be used for coloring columns potentially splitted by colorsColumnsBy
colorsUseMeanQuantiles	Boolean to indicate if the quantile groups computed on averages over all treatments should be used for coloring – see Colors section
colorsMeanQuantilesPalette	if colorsUseMeanQuantiles is TRUE, these colors will be used for the different groups – see Colors section
colorsBarsMatrix	Matrix of colors to be used for each individual bar; colors are provided for genes in data order and thus are possibly reordered according to orderBy – see Colors sectio
colorsGenesNames	Vector of colors to be used for gene names; will be recycled if necessary; colors are provided for genes in data order and thus are possibly reordered according to orderBy
main	Main title
shortvarnames	ector or pData column to be used to display in graph columns. If NULL, those names will be used from the coded names added to pData during computations (list of columns values pasted with a dot). Warning: shortvarnames must be defined in the order columns are present in the ExpressionSet object so that they will be reordered if one asks to order columns.
longvarnames	pData column to be used in SVG tooltip title. If NULL, shortvarnames will be used. Same warning than shortvarnames about ordering
gene.length	Maximum number of characters that will be printed of the gene names
gene.fontsize	Font size for the gene names , default =
main.fontsize	Font size for the main, default = 9
columnhead.fontsize	Font size for the column headers, default = 8
mx	Expansion factor for the width of the bars that represent the expression ratios

exp.width	Expansion factor for global graph width, and the space between the plotted colum
exp.height	Expansion factor for global graph height, and the space between the plotted row
log2l.show	A logical value. If 'TRUE', the line for log2 values on each column (when max(data) > 2) is draw
log4l.show	A logical value. If 'TRUE', the line for log4 values on each column (when max(data) > 4) is drawn
quantiles.show	A logical value. If 'TRUE', a line is drawn for quantiles computed separately on each column
quantiles.compute	A logical value. If 'TRUE', the vector quantiles will be computed and displayed provided that quantile.show is TRUE
error.show	A logical value. If 'TRUE', errors bars are displayed on the graph (only for those columns for which they are available
view.psid	A logical value. If 'TRUE', the genes psid is displayed on the gene name
errorLabel	A character vector describing the error bars, printed at the bottom of the figu
closeX11	If device is SVG, do we close the required X11 device at the end?
openFile	A logical value. If 'TRUE', the produced output file is opened
tooltipvalues	If device is SVG, one can choose to display each bar separately, with data values as tooltips. Note however that each bar will be considered as a distinct object instead of a column, which will takes much more time to create the graph and produces a much bigger SVG file
probe2gene	Boolean indicating whether the probeset should be translated to a gene symbol (used for the default title of the plot
...	...

Value

The ExpressionSet object with the computated variables is returned.

Ordering

orderBy: A list with two components, rows and cols, each one possibly being NULL (no ordering on the specific dimension). Ordering on cols can be done according to (a) pData column(s) (for example: c('cellline','compound','dose'. Ordering on rows can be done using of the following values:

- NULLno reordering on rows
- numeric vectoruse the vector values to sort rows
- alphause genes names alphabetice order
- effecttry to assess global gene expression level by taking sum(abs(values)) on specified exprs columns)
- hclustuse the ordering returned by hclust invoked on specified exprs columns

Colors

The management of colors is very flexible but is a little bit tricky, as a variety of parameters are available to the user. Basically, combinations of arguments allow to set colors for columns headers (text), columns as a whole (different colors for the different columns) or for each of the inividual horizontal bars. By default, everything is red. There are four main different arguments that can be used and that are applied in a consecutive order. Each one may override a previous argument value. Below is a list of arguments and their consecutive actions:

- `colorsColumns` The first way to assign colors is to provide a vector of colors that will be used for each column (headers and its horizontal bars). This vector is recycled so that providing one unique value will color all columns, whereas providing a vector of length 2 will alternate columnns colors.
- `colorsColumnsByTo` be used when the experiment involves groupings for pData, for example dose, cellline or treatment. In order to see the effects of such variables, one can color columns using combinations of those. The argument is a vector of pData columns such as `c('cellline','dose')`. Unique combinations will be computed and a color will be assigned for each group of columns. The vector that is provided with the argument `colorsColumnsByPalette` is used to assign colors. If the argument `colorColumnsBy` is not `NULL` then it overrides the previous argument `colorsColumns`.
- `colorsUseMeanQuantiles` A logical value. The default plotGeneDE displays for each gene the expression value difference between treatment and reference, but does not reveal any information about the expression levels in these conditions. Parameter `colorsUseMeanQuantiles` allows to color the horizontal bars according to expression level that is derived from quantiles computed on averages of the complete ExpressionSet object. As it involves the expression data of all probesets, computations must be done before subsetting the ExpressionSet object and the plotGeneDEting. The function `addQuantilesColors` computes quantiles and corresponding mean expression level intervals. If `colorsUseMeanQuantiles` 'TRUE', previous coloring parameters are overriden. The parameter `colorsMeanQuantilesPalette` is used to assign colors for average-quantiles-groups. Note that columns headers are still given by previous arguments.
- `colorsBarsMatrix`The most flexible way to assign colors as the matrix will be used to color each bar of the plot individually. A check is done to ensure that the number of rows and columns are not less than the number of probesets and columns. If not `NULL`, this parameter overrides the previous ones.

Author(s)

Hinrich Goehlmann and Eric Lecoutre

See Also

`computeLogRatio`,`addQuantilesColors`

Examples

```
if (require(ALL)){
 data(ALL, package = "ALL")
 ALL <- addGeneInfo(ALL)
 ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
 ALL2 <- ALL[,ALL$BT != 'T1']  # omit subtype T1 as it only contains one sample
 ALL2$BTtype <- as.factor(substr(ALL2$BT,0,1)) # create a vector with only T and B

 # Test for differential expression between B and T cells
```

```
 tTestResult <- tTest(ALL, "BTtype", probe2gene = FALSE)
 topGenes <- rownames(tTestResult)[1:20]

 # plot the log ratios versus subtype B of the top genes
 LogRatioALL <- computeLogRatio(ALL2, reference=list(var='BT',level='B'))
 a <- plotLogRatio(e=LogRatioALL[topGenes,],openFile=FALSE, tooltipvalues=FALSE, device='pdf',
  colorsColumnsBy=c('BTtype'), main = 'Top 20 genes most differentially between T- and B-cells',
   orderBy = list(rows = "hclust"), probe2gene = TRUE)
## Not run:
 a <- plotLogRatio(e=LogRatioALL[topGenes,],openFile=TRUE, tooltipvalues=FALSE, device='pdf',
  colorsColumnsBy=c('BTtype'), main = 'Top 20 genes most differentially between T- and B-cells',
   orderBy = list(rows = "hclust", cols = "sex"), probe2gene = TRUE)

## End(Not run)
}
```

`probabilitiesPlot` *Function to plot the probabilities to belong to a certain class in binary classification problems.*

Description

Function to plot the probabilities to belong to a certain class in binary classification problems. These probabilities are often calculated using a logistic regression model. The class membership of the samples is displayed using a colored strip (with legend below the plot).

Usage

```
probabilitiesPlot(
  proportions,
  classVar,
  sampleNames,
  plot = TRUE,
  barPlot = FALSE,
  layout = TRUE,
  main = NULL,
  sub = NULL,
  ...
)
```

Arguments

`proportions`	A vector containing the calculated probabilities to belong to a certain class in binary classification problems. These probabilities are often calculated using a logistic regression model.
`classVar`	A vector containing the class where the sample belongs t
`sampleNames`	A vector with the names of the samp
`plot`	logical. If `FALSE`, nothing is plotted
`barPlot`	Should a barplot be drawn (`TRUE`) or a scatterplot like MCREstimate-type scores plot (the default, `FALSE`

layout	boolean indicating whether mcrPlot should prespecify a layout for a single plot (default, TRUE) or whether the user takes care of the layout (FALSE)
main	Main title for the scores plot; if not supplied, 'Scores Plot' is used as a defaul
sub	Subtitle for the scores plot; if not supplied, the classification technique and the chosen number of features are displayed
...	Additional graphical parameters to pass to the plot functio

Value

no returned value, a plot is drawn in the current device.

Author(s)

Willem Talloen and Tobias Verbeke

See Also

logReg

Examples

```
## Not run:
  if (require(ALL)){
  data(ALL, package = "ALL")
    ALL <- addGeneInfo(ALL)
    ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
    logRegRes <- logReg(geneSymbol = "HLA-DPB1", object = ALL, groups = "BTtype")
    # scoresplot
    probabilitiesPlot(proportions = logRegRes$fit, classVar = logRegRes$y,
      sampleNames = rownames(logRegRes), main = 'Probability of being a T-cell type ALL')
    # barplot
    probabilitiesPlot(proportions = logRegRes$fit, classVar = logRegRes$y, barPlot=TRUE,
      sampleNames = rownames(logRegRes), main = 'Probability of being a T-cell type ALL')
  }

## End(Not run)
```

---

probe2gene *Translate Affymetrix probeset IDs into gene symbols*

Description

Auxiliary function for (currently) spectralMap allowing the conversion of Affy probeset IDs to gene symbols

Usage

```
probe2gene(probesetIds, chipPkg)
```

Arguments

probesetIds	Affymetrix probeset IDs
chipPkg	string indicating the annotation package for the chip

Value

Vector containing the respective gene symbols

Author(s)

Tobias Verbeke

See Also

spectralMap, lassoClass, ...

Examples

```
if (require(ALL)){
 data(ALL, package = "ALL")
 chip <- annotation(ALL)
 chipAnnotationPkg <- paste(chip, "db", sep = ".")
 res <- probe2gene(featureNames(ALL), chipAnnotationPkg)
 head(res)
}
```

`profilesPlot` *Plot expression profiles of multiple genes or probesets Plot expression profiles of multiple genes or probesets. Each line depicts a gene, and the color legend can be used to identify the gene.*

Description

Plot expression profiles of multiple genes or probesets Plot expression profiles of multiple genes or probesets. Each line depicts a gene, and the color legend can be used to identify the gene.

Usage

```
profilesPlot(
  object,
  probesetIds,
  sampleIDs = TRUE,
  addLegend = TRUE,
  legendPos = "topleft",
  colvec = NULL,
  orderGroups = NULL,
  ...
)
```

Arguments

`object`	ExpressionSet object for the experiment
`probesetIds`	The probeset ID. These should be stored in the `featureNames` of the `expressionSet` object.

sampleIDs	A boolean or a string to determine the labels on the x-axis. Setting it to FALSE results in no labels (interesting when the labels are unreadable due to large sample sizes). Setting it to a string will put the values of that particular pData column as labels. The string should be a name of a column in the pData of the expressionSet object
addLegend	Boolean indicating whether a legend for the colors of the dots should be added.
legendPos	Specify where the legend should be placed. Typically either topright, bottomright, topleft (the default) or bottomleft
colvec	Vector of colors to be used for the groups. If not specified, the default colors of a4palette are used
orderGroups	String containing the name of the grouping variable to order the samples in the x-axis accordingly. This should be a name of a column in the pData of the expressionSet object.
...	Possibility to add extra plot options. See par

Value

No returned value, a plot is drawn in the current device.

Author(s)

W. Talloen

See Also

plot1gene, boxPlot

Examples

```
if (require(ALL)){
data(ALL, package = "ALL")
ALL <- addGeneInfo(ALL)
ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
myGeneSymbol <- c("LCK") # a gene
probesetPos <- which(myGeneSymbol == featureData(ALL)$SYMBOL)
myProbesetIds <- featureNames(ALL)[probesetPos]
profilesPlot(object = ALL, probesetIds = myProbesetIds,
      orderGroups = "BT", sampleIDs = "BT")
}
```

---

propDEgenes *Generic function to compute the proportion of differentially expressed genes that are present*

Description

Generic function to compute the proportion of differentially expressed genes that are present

Usage

```
propDEgenes(object, ...)
```

Arguments

object	object of class propDEgene
...	further arguments for the method (currently none implemented)

Value

numeric of length one giving the proportion of differentially expressed genes

Author(s)

Willem Talloen and Tobias Verbeke

---

propDEgenes-methods *Generic function to compute the proportion of differentially expressed genes that are present*

Description

Generic function to compute the proportion of differentially expressed genes that are present

Usage

```
## S4 method for signature 'limma'
propDEgenes(object, ...)

## S4 method for signature 'numeric'
propDEgenes(object, ...)
```

Arguments

object	object of class propDEgene
...	further arguments for the method (currently none implemented)

Value

numeric of length one giving the proportion of differentially expressed genes

Methods

limma

propDEgenes method for a limma object numeric

object = "limma" **object = "numeric"** propDEgenes method for a numeric vector, i.e. a vector of P Values

Author(s)

Willem Talloen and Tobias Verbeke

propdegenescalculation *Estimation of proportion of differentially expressed genes*

Description

Estimation of proportion of differentially expressed genes. This estimation is based on a histogram of the p-values. More specifically, based on the horizontal line representing a uniform distribution based on the p value distribution between 0.5 and 1. This represents the hypothetical p value distribution arising just by chance. All genes with small p-values above this line reflect the expected number of differentially expressed genes not by chance.

Usage

```
propdegenescalculation(pValue)
```

Arguments

pValue	a vector of p-values

Value

proportion of differential genes

Author(s)

Willem Talloen and Tobias Verbeke

See Also

histPvalue

Examples

```
if (require(ALL)){
 data(ALL, package = "ALL")
 ALL <- addGeneInfo(ALL)
 ALL$BTtype <- as.factor(substr(ALL$BT,0,1))

 tTestResult <- tTest(ALL, "BTtype")
 histPvalue(tTestResult[,"p"], addLegend = TRUE)
 propDEgenesRes <- propDEgenes(tTestResult[,"p"])
}
```

replicates *computes replicates across a vector*

Description

Given a vector, returns the replicates in order

Usage

```
replicates(x)
```

Arguments

x	character or numeric vector

Value

numeric vector

Author(s)

Henrique Dallazuanna

References

R-help mailing list

See Also

rle

Examples

```
x <- c('a','b','a','a','b','a','c','c','c')
  data.frame(val=x,rep=replicates(x))
```

spectralMap *Generic function to draw a spectral map, according to JnJ Standards*

Description

Generic function to draw a spectral map, according to JnJ Standards

Usage

```
spectralMap(object, groups, ...)
```

Arguments

object	object of class ExpressionSet
groups	string indicating the name of the column in the phenoData that defines the groups
...	further arguments to be passed to the methods

Value

Object of class plot.mpm, i.e. the S3 output object of the plot.mpm function of the mpm package

Note

Coloring of groups on the spectralMap uses the a4 palette as produced by a4palette

Author(s)

Tobias Verbeke

References

Wouters, L., Goehlmann, H., Bijnens, L., Kass, S.U., Molenberghs, G., Lewi, P.J. (2003). Graphical exploration of gene expression data: a comparative study of three multivariate methods. *Biometrics* **59**, 1131-1140. Goehlmann, H. and W. Talloen (2009). Gene Expression Studies Using Affymetrix Microarrays, Chapman \& Hall/CRC, pp. 148 - 153.

See Also

plot.mpm

Examples

```
if (require(ALL)){
 data(ALL, package = "ALL")
 ALL <- addGeneInfo(ALL)
 spectralMap(object = ALL, groups = "BT", legendPos = 'bottomright')
 spectralMap(object = ALL, groups = "BT",
  plot.mpm.args = list(label.tol = 10, rot = c(-1, 1), sub = "", lab.size = 0.65,
     dim = c(1,2), sampleNames = FALSE, zoom = c(1,5), col.size = 2,
     do.smoothScatter = TRUE))
 spectralMap(object = ALL, groups = "BT",
   plot.mpm.args = list(label.tol = 10, rot = c(-1, 1), sub = "", lab.size = 0.65,
     dim = c(1,2), sampleNames = as.character(pData(ALL)$BT),
     zoom = c(1,5), col.size = 2, do.smoothScatter = TRUE))
}
```

spectralMap-methods *Methods for Function spectralMap according to JnJ Standards*

Description

Methods for spectralMap

Usage

```
## S4 method for signature 'ExpressionSet,character'
spectralMap(
  object,
  groups,
  makeLognormal = TRUE,
  mpm.args = list(row.weight = "mean", col.weight = "constant", logtrans = TRUE),
  plot.mpm.args = list(zoom = c(1, 2), label.tol = 10, rot = c(-1, 1), sub = "", lab.size
    = 0.85, col.group = pData(object)[, groups], colors = c("wheat", "darkgrey",
   a4palette(nlevels(pData(object)[, groups]))), col.size = 2, do.smoothScatter = TRUE),
  probe2gene = TRUE,
  addLegend = TRUE,
  legendPos = "topleft",
  ...
)
```

Arguments

object	object of class ExpressionSet
groups	string indicating the name of the column in the phenoData that defines the groups
makeLognormal	boolean indicating whether one wants to exponentiate the data to make them lognormally shaped (TRUE; the default) or not (FALSE)
mpm.args	list of arguments that can be passed to the mpm function
plot.mpm.args	list of arguments that can be passed to the plot.mpm function that actually draws the plot
probe2gene	boolean indicating whether one wants to display the gene symbols for the labeled points (TRUE) or not (FALSE; the default)
addLegend	Boolean indicating whether a legend for the colors of the dots should be added.
legendPos	Specify where the legend should be placed. Typically either topright,
...	further arguments to be passed to the methods, currently not used.

Value

the plot is returned invisibly

Author(s)

Tobias Verbeke

topTable,limma-method *Methods for topTable*

Description

Methods for topTable. topTable extracts the top n most important features for a given classification or regression procedure

Usage

```
## S4 method for signature 'limma'
topTable(
  fit,
  n = 10,
  coef = 2,
  genelist = fit$genes,
  eb = fit[c("t", "p.value", "lods")],
  adjust.method = "BH",
  sort.by = "B",
  resort.by = NULL,
  p.value = 1,
  lfc = 0
)

## S4 method for signature 'MArrayLM'
topTable(
  fit,
  n,
  coef = 2,
  genelist = fit$genes,
  eb = fit[c("t", "p.value", "lods")],
  adjust.method = "BH",
  sort.by = "B",
  resort.by = NULL,
  p.value = 1,
  lfc = 0
)

## S4 method for signature 'tTest'
topTable(fit, n)

## S4 method for signature 'fTest'
topTable(fit, n)
```

Arguments

fit	object resulting from a classification or regression procedure
n	number of features that one wants to extract from a table that ranks all features according to their importance in the classification or regression model; defaults to 10 for limma objects

coef	column number or column name specifying which coefficient or contrast of the linear model is of interest. For topTable, can also be a vector of column subscripts, in which case the gene ranking is by F-statistic for that set of contrasts.
genelist	data frame or character vector containing gene information. For topTable only, this defaults to fit$genes.
eb	subset of fit containing Empirical Bayesian estimates, so columns: 't', 'p-value' and 'lods' by default. For expert use only.
adjust.method	method used to adjust the p-values for multiple testing. Options, in increasing conservatism, include "none", "BH", "BY" and "holm". See p.adjust for the complete list of options. A NULL value will result in the default adjustment method, which is "BH".
sort.by	character string specifying which statistic to rank the genes by. Possible values for topTable are "logFC", "AveExpr", "t", "P", "p", "B" or "none". (Permitted synonyms are "M" for "logFC", "A" or "Amean" for "AveExpr", "T" for "t" and "p" for "P".) Possible values for topTableF are "F" or "none". topTreat accepts the same values as topTable except for "B".
resort.by	character string specifying statistic to sort the selected genes by in the output data.frame. Possibilities are the same as for sort.by.
p.value	cutoff value for adjusted p-values. Only genes with lower p-values are listed.
lfc	optional minimum log2-fold-change required, equal to log2(fc). fc and lfc are alternative ways to specify a fold-change cutoff and, if both are specified, then fc take precedence. If specified, then the results from topTable, topTableF or topTreat will include only genes with (at least one) absolute log-fold-change greater than lfc. This argument is not normally used with topTreat, which handles fold-change thresholds differently via the treat function.

Methods

glmnet

glmnet objects are produced by lassoClass or lassoReg limma

fit = "glmnet", n = "numeric" **fit = "limma", n = "numeric"** limma objects are produced by limma2Groups MarrayLM

fit = "limma", n = "numeric" MarrayLM objects are produced by lmFit of the limma package pamClass

fit = "pamClass", n = "numeric" pamClass objects are produced by pamClass rfClass

fit = "rfClass", n = "numeric" rfClass objects are produced by rfClass tTest

fit = "tTest", n = "numeric" tTest objects are produced by tTest fTest

fit = "fTest", n = "numeric" fTest objects are produced by fTest

See Also

- topTable-methods for: glmnet, lognet and elnet
- topTable,pamClass-method
- topTable,rfClass-method

tTest *Use t Test to Compare Two Groups*

Description

Use a (modified) t test to compare two groups

Usage

```
tTest(object, groups, probe2gene = TRUE)
```

Arguments

object	ExpressionSet object
groups	string indicating the name of the variable of the phenoData containing the group information
probe2gene	logical; if TRUE Affymetrix probeset IDs are translated into gene symbols; if FALSE no such translation is conducted

Details

For multiple testing the mt.rawp2adjp function of package multtest is used.

Value

Object of class "tTest", a data frame with the following columns

gSymbol	Gene Symbol
p	p-value of the difference between the groups
logRatio	Log ratio of the expression between the groups
pBH	p-value of the difference between the groups, with Benjamini-Hochberg multiplicity correction
tStat	Student t-statistic of the different between groups

Author(s)

Willem Talloen, Tobias Verbeke

See Also

rowttests in rowFtests

Examples

```
if (require(ALL)){
  data(ALL, package = "ALL")
  ALL <- addGeneInfo(ALL)
  ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
  tTestRes <- tTest(object = ALL, groups = "BTtype", probe2gene = TRUE)
  volcanoPlot(tTestRes)
}
```

volcanoPlot *Draw a Volcano Plot*

Description

Generic function to draw a volcano plot. A volcano plot is a graph that allows to simultaneously assess the P values (statistical significance) and log ratios (biological difference) of differential expression for the given genes.

Usage

```
volcanoPlot(x, y, pointLabels, ...)
```

Arguments

x	either an object of class 'tTest', of class 'limma' or a numeric vector of log ratios, i.e. the log of the fold change values; the names of the logRatio vector will be used to display the names of the most interesting gene
y	should not be given if an object of class 'tTest' or 'limma' is passed as argument 'x'; if 'x' is a numeric vector of log ratios, 'y' should be given and should be a numeric vector of P-values indicating the statistical significance
pointLabels	Labels for points on the volcano plot that are interesting taking into account both the x and y dimensions; typically this is a vector of gene symbols; most methods can access the gene symbols directly from the object passed as 'x' argument; the argument allows for custom labels if needed
...	further arguments to specific methods

Value

The volcano plot is drawn to the current device.

Author(s)

Tobias Verbeke, based on code by Willem Talloen

References

Goehlmann, H. and W. Talloen (2009). Gene Expression Studies Using Affymetrix Microarrays, Chapman \& Hall/CRC, pp. 148 - 153.

See Also

See volcanoplotter

Examples

```
if (require(ALL)){
  data(ALL, package = "ALL")
  ALL <- addGeneInfo(ALL)
  ALL$BTtype <- as.factor(substr(ALL$BT,0,1))
  tTestRes <- tTest(object = ALL, groups = "BTtype", probe2gene = TRUE)
  volcanoPlot(tTestRes)
}
```

volcanoPlot-methods *Draw a Volcano Plot*

Description

This function draws a volcano plot, a graph that allows to simultaneously assess the statistical and biological significance of differential expression for the given genes.

Usage

```
## S4 method for signature 'tTest,missing,missing'
volcanoPlot(
  x,
  y,
  pointLabels,
  topPValues = 10,
  topLogRatios = 10,
  smoothScatter = TRUE,
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  sub = NULL,
  newpage = TRUE,
  additionalPointsToLabel = NULL,
  additionalLabelColor = "red"
)

## S4 method for signature 'tTest,missing,character'
volcanoPlot(
  x,
  y,
  pointLabels,
  topPValues = 10,
  topLogRatios = 10,
  smoothScatter = TRUE,
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  sub = NULL,
  newpage = TRUE,
  additionalPointsToLabel = NULL,
  additionalLabelColor = "red"
)

## S4 method for signature 'limma,missing,missing'
volcanoPlot(
  x,
  y,
  pointLabels,
  topPValues = 10,
  topLogRatios = 10,
```

```
  smoothScatter = TRUE,
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  sub = NULL,
  newpage = TRUE,
  additionalPointsToLabel = NULL,
  additionalLabelColor = "red"
)

## S4 method for signature 'limma,missing,character'
volcanoPlot(
  x,
  y,
  pointLabels,
  topPValues = 10,
  topLogRatios = 10,
  smoothScatter = TRUE,
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  sub = NULL,
  newpage = TRUE,
  additionalPointsToLabel = NULL,
  additionalLabelColor = "red"
)

## S4 method for signature 'numeric,numeric,character'
volcanoPlot(
  x,
  y,
  pointLabels,
  topPValues = 10,
  topLogRatios = 10,
  smoothScatter = TRUE,
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  sub = NULL,
  newpage = TRUE,
  additionalPointsToLabel = NULL,
  additionalLabelColor = "red"
)

## S4 method for signature 'numeric,numeric,missing'
volcanoPlot(
  x,
  y,
  pointLabels,
  topPValues = 10,
  topLogRatios = 10,
  smoothScatter = TRUE,
```

```
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  sub = NULL,
  newpage = TRUE,
  additionalPointsToLabel = NULL,
  additionalLabelColor = "red"
)
```

Arguments

x	either an object of class 'tTest', of class 'limma' or a numeric vector of log ratios, i.e. the log of the fold change values; the names of the logRatio vector will be used to display the names of the most interesting gene
y	should not be given if an object of class 'tTest' or 'limma' is passed as argument 'x'; if 'x' is a numeric vector of log ratios, 'y' should be given and should be a numeric vector of P-values indicating the statistical significance
pointLabels	Labels for points on the volcano plot that are interesting taking into account both the x and y dimensions; typically this is a vector of gene symbols; most methods can access the gene symbols directly from the object passed as 'x' argument; the argument allows for custom labels if needed
topPValues	top n points that will be included in the points to label based on their low P Values
topLogRatios	top n points that will be included in the points to label based on their high absolute values of the log ratio
smoothScatter	use color saturation to indicate dots that are in densely populated regions of the graph; defaults to TRUE
xlab	label for the x axis (string)
ylab	label for the y axis (string)
main	main title for the graph (string)
sub	subtitle for the graph (string)
newpage	should the graph be drawn to a new grid page? Defaults to TRUE. This argument is useful for including several volcano plots in one layout.
additionalPointsToLabel	Entrez IDs of genes of interest, that will be highlighted on the plot; the color of highlighting is determined by the 'additionalLabelColor' argument.
additionalLabelColor	Color used to highlight the 'additionalPointsToLabel'; defaults to "red"

Details

The set of genes for which labels are displayed is the *union* of the set of genes that have lowest P-values (topPValues) and the set of genes that display the highest absolute values for the log ratios (topLogRatios).

Value

The volcano plot is drawn to the current device.

Author(s)

Tobias Verbeke, based on code by Willem Talloen

`volcanoplotter` *Workhorse function for the different volcanoPlot methods*

Description

Workhorse function for the different volcanoPlot methods. A volcano plot is a graph that allows to simultaneously assess the P values (statistical significance) and log ratios (biological difference) of differential expression for the given genes.

Usage

```
volcanoplotter(
  logRatio,
  pValue,
  pointLabels,
  topPValues = 10,
  topLogRatios = 10,
  logTransformP = TRUE,
  smoothScatter = TRUE,
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  sub = NULL,
  newpage = TRUE,
  additionalPointsToLabel = NULL,
  additionalLabelColor = "red"
)
```

Arguments

`logRatio`	numeric vector of log ratios
`pValue`	numeric vector of P values
`pointLabels`	Labels for points on the volcano plot that are interesting taking into account both the x and y dimensions; typically this is a vector of gene symbols; most methods can access the gene symbols directly from the object passed as 'x' argument; the argument allows for custom labels if needed
`topPValues`	top n points that will be included in the points to label based on their low P Values
`topLogRatios`	top n points that will be included in the points to label based on their high absolute values of the log ratio
`logTransformP`	if `TRUE` (default) -log10(pValue) is used for the plot instead of the raw P values
`smoothScatter`	use color saturation to indicate dots that are in densely populated regions of the graph; defaults to `TRUE`
`xlab`	label for the x axis (string)
`ylab`	label for the y axis (string)

main	main title for the graph (string)
sub	subtitle for the graph (string)
newpage	should the graph be drawn to a new grid page? Defaults to TRUE. This argument is useful for including several volcano plots in one layout.
additionalPointsToLabel	Entrez IDs of genes of interest, that will be highlighted on the plot; the color of highlighting is determined by the 'additionalLabelColor' argument.
additionalLabelColor	Color used to highlight the 'additionalPointsToLabel'; defaults to "red"

Value

a volcanoplot is drawn to the current device

Author(s)

Tobias Verbeke

Index

∗ **classes**
ExpressionSetWithComputation-class, 9
∗ **datasets**
nlcvTT, 24
∗ **data**
combineTwoExpressionSet, 5
computeLogRatio, 6
createExpressionSet, 8
∗ **dplot**
a4palette, 2
computeLogRatio, 6
histPvalue, 18
plot1gene, 26
volcanoPlot, 47
volcanoPlot-methods, 48
volcanoplotter, 51
∗ **hplot**
spectralMap, 41
spectralMap-methods, 43
∗ **htest**
propDEgenes, 38
propDEgenes-methods, 39
tTest, 46
∗ **manip**
computeLogRatio, 6
filterVarInt, 10
probe2gene, 36
replicates, 41
topTable,limma-method, 44
∗ **methods**
spectralMap-methods, 43
topTable,limma-method, 44
∗ **models**
limmaTwoLevels, 22

a4palette, 2
addQuantilesColors, 3, *34*

boxPlot, 4, *27*, *38*

combineTwoExpressionSet, 5
computeLogRatio, 6, *10*, *34*
createExpressionSet, 8

eSet, *10*
ExpressionSet, *6*, *8–10*
ExpressionSetWithComputation-class, 9

filterfun, *11*
filterVarInt, 10

gpar, *13*

heatmap.expressionSet, 11
histPvalue, 18, *20*, *40*
histPvalue,limma-method *(*histPvalue*)*, 18
histPvalue,MArrayLM-method *(*histPvalue*)*, 18
histPvalue,numeric-method *(*histPvalue*)*, 18
histpvalueplotter, 19

lassoClass, *21*, *37*
lassoReg, 20
limmaReg, 21
limmaTwoLevels, 22
logReg, 22, *36*

nlcv, *24*
nlcvTT, 24

oaColors, 25
oaPalette, 25

p.adjust, *45*
pairs, *30*
palettes, *3*
par, *5*, *27*, *28*, *38*
plot, *23*
plot.mpm, *42*
plot1gene, *5*, 26, *29*, *38*
plotComb2Samples, 27, *30*
plotCombination2genes, *27*, 28
plotCombMultSamples, *28*, 30
plotLogRatio, *4*, *7*, 31
pOverA, *11*
probabilitiesPlot, *23*, 35
probe2gene, 36
profilesPlot, 37

propDEgenes, 38
propDEgenes,limma
(propDEgenes-methods), 39
propDEgenes,limma-method
(propDEgenes-methods), 39
propDEgenes,numeric
(propDEgenes-methods), 39
propDEgenes,numeric-method
(propDEgenes-methods), 39
propDEgenes-methods, 39
propdegenescalculation, *20*, 40

replicates, 41
rle, *41*
ROCcurve, *23*
rowFtests, *46*

spectralMap, *37*, 41
spectralMap,ExpressionSet,character
(spectralMap-methods), 43
spectralMap,ExpressionSet,character-method
(spectralMap-methods), 43
spectralMap-methods, 43

topTable,fTest (topTable,limma-method),
44
topTable,fTest-method
(topTable,limma-method), 44
topTable,limma (topTable,limma-method),
44
topTable,limma-method, 44
topTable,MArrayLM
(topTable,limma-method), 44
topTable,MArrayLM-method
(topTable,limma-method), 44
topTable,tTest (topTable,limma-method),
44
topTable,tTest-method
(topTable,limma-method), 44
topTable-methods
(topTable,limma-method), 44
tTest, 46

Versioned, *10*
VersionedBiobase, *10*
volcanoPlot, 47
volcanoPlot,ExpressionSet,character
(spectralMap-methods), 43
volcanoPlot,limma,missing,character
(volcanoPlot-methods), 48
volcanoPlot,limma,missing,character-method
(volcanoPlot-methods), 48
volcanoPlot,limma,missing,missing
(volcanoPlot-methods), 48
volcanoPlot,limma,missing,missing-method
(volcanoPlot-methods), 48
volcanoPlot,numeric,numeric,character
(volcanoPlot-methods), 48
volcanoPlot,numeric,numeric,character-method
(volcanoPlot-methods), 48
volcanoPlot,numeric,numeric,missing
(volcanoPlot-methods), 48
volcanoPlot,numeric,numeric,missing-method
(volcanoPlot-methods), 48
volcanoPlot,tTest,character
(volcanoPlot-methods), 48
volcanoPlot,tTest,missing
(volcanoPlot-methods), 48
volcanoPlot,tTest,missing,character-method
(volcanoPlot-methods), 48
volcanoPlot,tTest,missing,missing-method
(volcanoPlot-methods), 48
volcanoPlot-methods, 48
volcanoplotter, *47*, 51