

# Package ‘a4Base’

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**Type** Package

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**Description** Automated Affymetrix Array Analysis

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genefilter, limma, multtest, glmnet, a4Preproc, a4Core, gplots

**Suggests** Cairo, ALL

**Enhances** gridSVG, JavaGD

**License** GPL-3

**biocViews** Microarray

**NeedsCompilation** no

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---

a4palette	<i>Utility function that defines a color palette for use in a4</i>
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---

## 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 provide
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](#)**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 groups (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
```

### 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 top right, bottom right, topLeft (the default) or bottomleft
...	Possibility to add extra plot options. See <a href="#">par</a>

### 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 ExpressionSet
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 variances
...	...

**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',

- 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)['dose1'], pData(e)['dose2'], 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 treatment 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='X11',
  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 = new("matrix"), phenoData = new("AnnotatedDataFrame"), varMetadata = N
```

**Arguments**

<code>exprs</code>	gene expression matrix
<code>phenoData</code>	phenotype data associated with <code>exprs</code> columns, as a matrix or <code>data.frame</code>
<code>varMetadata</code>	optional metadata on phenotype data
<code>dimLabels</code>	see 'ExpressionSet'
<code>featureData</code>	see 'ExpressionSet'
<code>experimentData</code>	see 'ExpressionSet'
<code>annotation</code>	see 'ExpressionSet'
<code>changeColumnsNames</code>	Change <code>exprs</code> columns names – see details
<code>...</code>	<code>...</code>

**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` columns. 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

### Objects from the Class

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

### 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"

### 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`*Filter Features 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**

<code>object</code>	ExpressionSet object
<code>IntCutOff</code>	cut-off value used for the intensity filter
<code>IntPropSamples</code>	proportion of samples used by the intensity filter; by default <code>IntPropSamples</code> is set to 0.25
<code>VarCutOff</code>	cut-off value used for the variance filter

**Details**

The intensity filter implies that (by default) the intensity levels must be greater than  $\log_2(100)$  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(
  hclust(d, method = "ward")
), values.min = 0, values.max = 16, title.gpar = gpar(cex = 1.4), title.main = "This is the title p

```

**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 unit (grid package). Space between image matrix zone and columns labels.
col.labels.gpar	Object of class gpar (grid package). 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.

<code>colors.groups.min</code>	Character vector of length 1 corresponding to a valid color. If <code>colors.groups</code> are provided, a shading is done between <code>color.group</code> and this color (default: white).
<code>colors.max</code>	Character vector of length 1 corresponding to a valid color. See <code>colors</code> details.
<code>colors.min</code>	Character vector of length 1 corresponding to a valid color. See <code>colors</code> details.
<code>colors.nbreaks</code>	Integer. Number of cutpoints used to split the color palette/shading.
<code>colors.palette</code>	Character vector of valid color names.
<code>cell.gpar</code>	Object of class <code>gpar</code> (grid package). Parameters used to format cells, for example to add border ( <code>gpar(lty=1)</code> ).
<code>row.groups.sep.height</code>	Object of class <code>unit</code> (grid package). Height between rows sub-groups.
<code>row.labels.sep.height</code>	Object of class <code>unit</code> (grid package). Height between image plot zone and rows labels
<code>row.col.groups.display</code>	Boolean. Display or not colored band for subgroups of individuals.
<code>row.col.groups.display.height</code>	Object of class <code>unit</code> (grid package). If <code>row.col.groups.display</code> is <code>TRUE</code> then height used for the displayed band.
<code>row.labels.gpar</code>	Object of class <code>gpar</code> (grid package). Parameters to be used for labels ( <code>cex,...</code> ).
<code>row.labels.max.nchar</code>	Integer. Number of maximum characters to be used for labels truncation.
<code>row.labels</code>	Character vector or list. If vector, direct labels to be used. If list, elements of the list will be taken from <code>featureData</code> and collapsed using <code>row.labels.sep</code> .
<code>row.labels.sep</code>	In case labels are taken from <code>featureData</code> (list for <code>row.labels</code> ), separator used to paste the provided columns.
<code>row.groups</code>	Boolean specifying whether rows are split into sub-groups.
<code>row.order</code>	Either a vector of indices to be used to reorder features (rows) or "none" or "hclust" to use clustering.
<code>row.groups.hclust</code>	Boolean. If <code>row.order</code> equals "hclust", one can ask to split features into sub-groups based on a cut of the clustering dendrogram.
<code>row.groups.hclust.n</code>	Integer. If <code>row.order</code> equals "hclust" and <code>row.groups.hclust</code> is <code>TRUE</code> , number of sub-groups.
<code>distfun</code>	Function. For <code>row.order</code> equals "hclust", metric function.
<code>hclustfun</code>	Function. For <code>row.order</code> equals "hclust", clustering function.
<code>values.min</code>	Minimum value for the data range. Values that are inferior are assigned to that value. That ensures a maximal cutpoint for the coloring scale.
<code>values.max</code>	Maximum value for the data range. Values that are superior are assigned to that value. That ensures a maximal cutpoint for the coloring scale.
<code>title.gpar</code>	Object of class <code>gpar</code> (grid package). Parameters to be used for the main title ( <code>cex,...</code> ).
<code>title.main</code>	Character vector. Main title to be displayed.
<code>title.just</code>	Title justification, one of "center", "left", "right" (first letter of the word can also be used).

<code>title.maxlines</code>	Maximum number of lines for the title split.
<code>title.cutpoint</code>	Integer. Maximum number of characters a line must have. Title is split into lines according to that cutpoint.
<code>subtitle.gpar</code>	Object of class <code>gpar</code> (grid package). Parameters to be used for the subtitle ( <code>cex, col,...</code> ).
<code>subtitle.main</code>	Character vector. Subtitle. The subtitle will be split into lines following same rules as used for main title.
<code>subtitle.maxlines</code>	Maximum number of lines for the subtitle split.
<code>subtitle.just</code>	Subtitle justification, one of "center", "left", "right" (first letter of the word can also be used).
<code>subtitle.cutpoint</code>	Integer. Maximum number of characters a line must have. Subtitle is split into lines according to that cutpoint.
<code>margin.top</code>	Object of class <code>unit</code> (grid package). Top margin.
<code>margin.left</code>	Object of class <code>unit</code> (grid package). Left margin.
<code>margin.right</code>	Object of class <code>unit</code> (grid package). Right margin.
<code>margin.bottom</code>	Object of class <code>unit</code> (grid package). Bottom margin.
<code>legend.display</code>	Boolean. Display or not the legend. Legend is positionned in upper right corner.
<code>legend.range</code>	Character: "full" (default) or "data". If full, color scale legend ranges from <code>values.min</code> to <code>values.max</code> . If "data", range is <code>c(min(data),max(data))</code> .
<code>legend.data.display</code>	Boolean. Display or not color scale legend.
<code>legend.gpar</code>	Object of class <code>gpar</code> (grid package). Parameters to be used for color scale legend axis ( <code>cex,...</code> ).
<code>legend.width</code>	Object of class <code>unit</code> (grid package). Width for the color scale legend.
<code>legend.height</code>	Object of class <code>unit</code> (grid package). Height for the color scale legend.
<code>...</code>	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"]]
##### !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
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"]]
eset4 <- expressionSetRma[100:230,pData(phenoData(expressionSetRma))[, "sample"]]

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)

```



## 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 'MArrayLM'  
histPvalue(object, coef, ...)
```

## Arguments

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

## See Also

[hist](#), [histpvalueplotter](#)

## 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

### 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	<i>Multiple regression using the Lasso algorithm as implemented in the glmnet package</i>
----------	---

---

**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)
}
```

---

limmaTwoLevels	<i>Wrapper function for the comparison of two groups using limma</i>
----------------	--

---

**Description**

Wrapper function for the comparison of two groups using limma

**Usage**

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

**Arguments**

object	object of class ExpressionSet
group	string indicating the variable defining the two groups to be compared, i.e. the name of a factor with two levels
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	<i>Logistic regression for predicting the probability to belong to a certain class in binary classification problems.</i>
--------	---

---

**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 graph
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 <a href="#">par</a>

**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

**References**

~put references to the literature/web site here ~

**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$fit, classVar = logRegRes$,
```

```
    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

```
data(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")`

## See Also

[nlcv](#)

## Examples

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

## End(Not run)
```

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.
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.
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.
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 <a href="#">par</a>

**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

**References**

~put references to the literature/web site here ~

**See Also**

[plotCombination2genes](#), [boxPlot](#)

**Examples**

```
if (require(ALL)){
  data(ALL, package = "ALL")
  ALL <- addGeneInfo(ALL)

  # one variable (specified by groups)
  aa <- plot1gene(geneSymbol = 'HLA-DPB1', object = ALL, groups = "BT",
    addLegend = TRUE, legendPos = 'topright')
  aa

  # 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](#)

**Author(s)**

W. Talloen

**References**

~put references to the literature/web site here ~

**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, co
```

**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-axis

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 drawn.

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 function

**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 a correlation matrix in gene expression between two samples. Each dot represents a gene, and the dots have a density-dependent coloring.

**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 [par](#)

**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 computed 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` List with components 'var' and 'level' – see `computeLogRatio` help

`within` Vector of characters for pData column – see `computeLogRatio` help

<code>across</code>	Vector of characters for pData column – see <code>computeLogRatio</code> help
<code>nReplicatesVar</code>	Minimum number of replicates to compute variances and pooled standard errors – see <code>computeLogRatio</code> help
<code>filename</code>	Name of the filename to use. No need to specify extension which will be added according to device.
<code>device</code>	One of 'pdf', 'X11', 'png', 'svg'. For svg device, one X11 device is also opened.
<code>orderBy</code>	See details
<code>colorsColumns</code>	A vector of colors to be used for plotting columns; default value is NULL which ends up with red – see Colors section
<code>colorsColumnsBy</code>	A vector of pData columns which combinations specify different colors to be used – see Colors section
<code>colorsColumnsByPalette</code>	If <code>colorsColumns</code> is NULL, vector of colors to be used for coloring columns potentially splitted by <code>colorsColumnsBy</code>
<code>colorsUseMeanQuantiles</code>	Boolean to indicate if the quantile groups computed on averages over all treatments should be used for coloring – see Colors section
<code>colorsMeanQuantilesPalette</code>	if <code>colorsUseMeanQuantiles</code> is TRUE, these colors will be used for the different groups – see Colors section
<code>colorsBarsMatrix</code>	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 <code>orderBy</code> – see Colors section
<code>colorsGenesNames</code>	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 <code>orderBy</code>
<code>main</code>	Main title
<code>shortvarnames</code>	Vector 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: <code>shortvarnames</code> 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.
<code>longvarnames</code>	pData column to be used in SVG tooltip title. If NULL, <code>shortvarnames</code> will be used. Same warning than <code>shortvarnames</code> about ordering.
<code>gene.length</code>	Maximum number of characters that will be printed of the gene names
<code>gene.fontsize</code>	Font size for the gene names, default = 6
<code>main.fontsize</code>	Font size for the main, default = 9
<code>columnhead.fontsize</code>	Font size for the column headers, default = 8
<code>mx</code>	Expansion factor for the width of the bars that represent the expression ratios
<code>exp.width</code>	Expansion factor for global graph width, and the space between the plotted columns
<code>exp.height</code>	Expansion factor for global graph height, and the space between the plotted rows

log2l.show	A logical value. If 'TRUE', the line for log2 values on each column (when $\max(\text{data}) > 2$ ) is drawn
log4l.show	A logical value. If 'TRUE', the line for log4 values on each column (when $\max(\text{data}) > 4$ ) is drawn
quantiles.show	A logical value. If 'TRUE', a line is drawn for quantiles computed separately on each columns
quantiles.compute	A logical value. If 'TRUE', the vector quantiles will be computed and displayed provided that <code>quantile.show</code> 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 names
errorLabel	A character vector describing the error bars, printed at the bottom of the figure
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 computed 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:

- NULL no reordering on rows
- numeric vector use the vector values to sort rows
- alpha use genes names alphabetic order
- effect try to assess global gene expression level by taking `sum(abs(values))` on specified exprs columns)
- hclust use 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 individual 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 columns colors.
- `colorsColumnsBy` To 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 `plotGeneDE`ing. The function `addQuantilesColors` computes quantiles and corresponding mean expression level intervals. If `colorsUseMeanQuantiles` 'TRUE', previous coloring parameters are overridden. 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='X11',
    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	<i>Function to plot the probabilities to belong to a certain class in binary classification problems.</i>
-------------------	---

---

## 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,
```

## 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 to
sampleNames	A vector with the names of the samples
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 default
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 function

## 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

Translate Affymetrix probeset IDs into 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***Description**

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
```

**Arguments**

object	ExpressionSet object for the experiment
probesetIds	The probeset ID. These should be stored in the featureNames of the expressionSet object.
colvec	Vector of colors to be used for the groups. If not specified, the default colors of a4palette are used.
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
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 <a href="#">par</a>

**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. Methods are available for objects of class 'tTest',

**Usage**

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

**Arguments**

object	object of class
...	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

**See Also**

[propDEgenes-methods](#)

---

propDEgenes-methods     *Methods for propDEgenes*

---

**Description**

Methods for propDEgenes

**Arguments**

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

**Author(s)**

Willem Talloen and Tobias Verbeke

**See Also**

[propDEgenes-methods](#)

---

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

**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`*Draw a Spectral Map*

---

**Description**

Generic function to draw a spectral map.

**Usage**

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

**Arguments**

<code>object</code>	object of class <code>ExpressionSet</code>
<code>groups</code>	string indicating the name of the column in the <code>phenoData</code> that defines the groups
<code>...</code>	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., Bijmens, 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**

[spectralMap-methods](#), [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*

---

**Description**

Methods for spectralMap

**Arguments**

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, bottomright, topleft (the default) or bottomleft

**Methods**

ExpressionSet,character  
 wrapper around plot.mpm from the mpm package

---

```
object = "ExpressionSet", groups = "character", makeLognormal = "logical", plot.mpm.args = "list", probe2gene = "logi
```

```
topTable-methods      Methods for topTable
```

---

### Description

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

### 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

### Methods

glmnet

glmnet objects are produced by lassoClass or lassoReg

limma

**fit = "glmnet", n = "numeric"** glmnet objects are produced by lassoClass or lassoReg

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

---

```
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	TODO
logRatio	TODO
pBH	TODO
tStat	TODO

**Author(s)**

Willem Talloen, Tobias Verbeke

**See Also**

[rowttests](#)

**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**

<code>x</code>	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 genes
<code>y</code>	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
<code>pointLabels</code>	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
<code>...</code>	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.

### Arguments

x	either an object of class 'tTest', 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 genes
y	should not be given if an object of class 'tTest' 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)

### 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.

### Methods

tTest,missing,missing

volcanoPlot for an object resulting from tTest

tTest,missing,character

**x = "tTest", y = "missing", pointLabels = "missing"** tTest, y = "missing", pointLabels = "character"

volcanoPlot for an object resulting from tTest

numeric,numeric,character

**x = "numeric", y = "numeric", pointLabels = "character"** volcanoPlot for arbitrary numeric vectors containing log ratio values and p values respectively  
numeric,numeric,missing

**x = "numeric", y = "numeric", pointLabels = "missing"** volcanoPlot for arbitrary numeric vectors containing log ratio values and p values respectively  
limma,missing,missing

**x = "limma", y = "missing", pointLabels = "missing"** volcanoPlot for an object resulting from limma2Groups  
limma,missing,character

**x = "tTest", y = "missing", pointLabels = "missing"** volcanoPlot for an object resulting from limma2Groups

### 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 =
  main = NULL, sub = NULL, newpage = TRUE, additionalPointsToLabel = NULL, additionalLabelColor = "
```

### 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) $-\log_{10}(pValue)$ 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)

<code>main</code>	main title for the graph (string)
<code>sub</code>	subtitle for the graph (string)
<code>newpage</code>	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.
<code>additionalPointsToLabel</code>	Entrez IDs of genes of interest, that will be highlighted on the plot; the color of highlighting is determined by the 'additionalLabelColor' argument.
<code>additionalLabelColor</code>	Color used to highlight the 'additionalPointsToLabel'; defaults to "red".

**Value**

a volcanoplot is drawn to the current device

**Author(s)**

Tobias Verbeke

**See Also**

[volcanoPlot-methods](#)

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