Package ‘oligo’

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VignetteBuilder knitr

Description A package to analyze oligonucleotide arrays (expression/SNP/tiling/exon) at probe-level. It currently supports Affymetrix (CEL files) and NimbleGen arrays (XYS files).

License LGPL (>= 2)


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The **oligo** package: a tool for low-level analysis of oligonucleotide arrays

**Description**

The **oligo** package provides tools to preprocess different oligonucleotide arrays types: expression, tiling, SNP and exon chips. The supported manufacturers are Affymetrix and NimbleGen.

It offers support to large datasets (when the **bigmemory** is loaded) and can execute preprocessing tasks in parallel (if, in addition to **bigmemory**, the **snow** package is also loaded).

**Details**

The package will read the raw intensity files (CEL for Affymetrix; XYS for NimbleGen) and allow the user to perform analyses starting at the feature-level.

Reading in the intensity files require the existence of data packages that contain the chip specific information (X/Y coordinates; feature types; sequence). These data packages packages are built using the **pdInfoBuilder** package.

For Affymetrix SNP arrays, users are asked to download the already built annotation packages from BioConductor. This is because these packages contain metadata that are not automatically created. The following annotation packages are available:

- 50K Xba - pd.mapping50kxba.240
- 50K Hind - pd.mapping50khind.240
- 250K Sty - pd.mapping250k.sty
- 250K Nsp - pd.mapping250k.nsp
- GenomeWideSnp 5 (SNP 5.0) - pd.genomewidesnp.5
- GenomeWideSnp 6 (SNP 6.0) - pd.genomewidesnp.6

For users interested in genotype calls for SNP 5.0 and 6.0 arrays, we strongly recommend the use the **crlmm** package, which implements a more efficient version of CRLMM.

**Author(s)**

Benilton Carvalho - <carvalho@bclab.org>

**References**

basecontent  

Sequence Base Contents

Description
Function to compute the amounts of each nucleotide in a sequence.

Usage
basecontent(seq)

Arguments
seq  character vector of length n containing a valid sequence (A/T/C/G)

Value
matrix with n rows and 4 columns with the counts for each base.

Examples
sequences <- c("ATATATCCCCG", "TTTCCGAGC")
basecontent(sequences)

basicPLM  

Simplified interface to PLM.

Description
Simplified interface to PLM.

Usage
basicPLM(pmMat, pnVec, normalize = TRUE, background = TRUE, transfo = log2, method = c("plm", "plmr", "plmrr", "plmrc"), verbose = TRUE)

Arguments
pmMat Matrix of intensities to be processed.
 pnVec Probeset names
 normalize Logical flag: normalize?
 background Logical flag: background adjustment?
 transfo function: function to be used for data transformation prior to summarization.
 method Name of the method to be used for normalization. 'plm' is the usual PLM model; 'plmr' is the (row and column) robust version of PLM; 'plmrr' is the row-robust version of PLM; 'plmrc' is the column-robust version of PLM.
 verbose Logical flag: verbose.
Value

A list with the following components:

- **Estimates**: A \((\text{length}(\text{pnVec}) \times \text{ncol}(\text{pmMat}))\) matrix with probeset summaries.
- **StdErrors**: A \((\text{length}(\text{pnVec}) \times \text{ncol}(\text{pmMat}))\) matrix with standard errors of 'Estimates'.
- **Residuals**: A \((\text{nrow}(\text{pmMat}) \times \text{ncol}(\text{pmMat}))\) matrix of residuals.

Note

Currently, only RMA-bg-correction and quantile normalization are allowed.

Author(s)

Benilton Carvalho

See Also

- `rcModelPLM`, `rcModelPLMr`, `rcModelPLMrr`, `rcModelPLMrc`, `basicRMA`

Examples

```r
set.seed(1)
pms <- 2^matrix(rnorm(1000), nc=20)
colnames(pms) <- paste("sample", 1:20, sep="")
pns <- rep(letters[1:10], each=5)
res <- basicPLM(pms, pns, TRUE, TRUE)
res[['Estimates']][1:4, 1:3]
res[['StdErrors']][1:4, 1:3]
res[['Residuals']][1:20, 1:3]
```

---

**basicRMA**

_Simplified interface to RMA._

Description

Simple interface to RMA.

Usage

```
basicRMA(pmMat, pnVec, normalize = TRUE, background = TRUE, bgversion = 2, destructive = FALSE, verbose = TRUE, ...)```

Arguments

- **pmMat**: Matrix of intensities to be processed.
- **pnVec**: Probeset names.
- **normalize**: Logical flag: normalize?
- **background**: Logical flag: background adjustment?
- **bgversion**: Version of background correction.
- **destructive**: Logical flag: use destructive methods?
- **verbose**: Logical flag: verbose.
- **...**: Not currently used.
Value

Matrix.

Examples

```r
set.seed(1)
pms <- 2^matrix(rnorm(1000), nc=20)
colnames(pms) <- paste("sample", 1:20, sep="")
pns <- rep(letters[1:10], each=5)
res <- basicRMA(pms, pns, TRUE, TRUE)
res[, 1:3]
```

Description

Boxplot for observed (log-)intensities in a FeatureSet-like object (ExpressionFeatureSet, ExonFeatureSet, SnpFeatureSet, TilingFeatureSet) and ExpressionSet.

Usage

```r
## S4 method for signature 'FeatureSet'
boxplot(x, which=c("pm", "mm", "bg", "both", "all"), transfo=log2, nsample=10000, ...)

## S4 method for signature 'ExpressionSet'
boxplot(x, which, transfo=identity, nsample=10000, ...)
```

Arguments

- `x` a FeatureSet-like object or ExpressionSet object.
- `which` character defining what probe types are to be used in the plot.
- `transfo` a function to transform the data before plotting. See 'Details'.
- `nsample` number of units to sample and build the plot.
- `...` arguments to be passed to the default boxplot method.

Details

The 'transfo' argument will set the transformation to be used. For raw data, 'transfo=log2' is a common practice. For summarized data (which are often in log2-scale), no transformation is needed (therefore 'transfo=identity').

Note

The boxplot methods for FeatureSet and Expression use a sample (via sample) of the probes/probesets to produce the plot. Therefore, the user interested in reproducibility is advised to use set.seed.

See Also

`hist`, `image`, `sample`, `set.seed`
### chromosome

**Accessor for chromosome information**

**Description**

Returns chromosome information.

**Usage**

```r
pmChr(object)
```

**Arguments**

- `object` TilingFeatureSet or SnpCallSet object

**Details**

`chromosome()` returns the chromosomal information for all probes and `pmChr()` subsets the output to the PM probes only (if a TilingFeatureSet object).

**Value**

Vector with chromosome information.

---

### crlmm

**Genotype Calls**

**Description**

Performs genotype calls via CRLMM (Corrected Robust Linear Model with Maximum-likelihood based distances).

**Usage**

```r
# Perform CRLMM
 crlmm(filenames, outdir, batch_size=40000, balance=1.5, 
       minLLRforCalls=c(5, 1, 5), recalibrate=TRUE, 
       verbose=TRUE, pkgname, reference=TRUE)

crlmm(filenames = file, outdir = tempdir(), batch_size = 40000, 
       balance = 1.5, minLLRforCalls = c(5, 1, 5), 
       recalibrate = TRUE, verbose = TRUE, 
       pkgname = NULL, reference = TRUE)

crlmm(filenames, outdir, batch_size=40000, balance=1.5, 
       minLLRforCalls = c(5, 1, 5), recalibrate = TRUE, 
       verbose=TRUE, pkgname=NULL, reference=TRUE, 
       phenoData = NULL, tmpdir = tempdir())
```

```r
# Just CRLMM
 justCRLMM(filenames, batch_size = 40000, minLLRforCalls = c(5, 1, 5), 
          recalibrate = TRUE, balance = 1.5, phenoData = NULL, 
          verbose = TRUE, pkgname = NULL, tmpdir = tempdir())
```
Arguments

- **filenames** character vector with the filenames.
- **outdir** directory where the output (and some tmp files) files will be saved.
- **batch_size** integer defining how many SNPs should be processed at a time.
- **recalibrate** Logical - should recalibration be performed?
- **balance** Control parameter to balance homozygotes and heterozygotes calls.
- **minLLRforCalls** Minimum thresholds for genotype calls.
- **verbose** Logical.
- **phenoData** phenoData object or NULL
- **pkgname** alt. pdInfo package to be used
- **reference** logical, defaulting to TRUE ...
- **tmpdir** Directory where temporary files are going to be stored at.

Value

SnpCallSetPlus object.

darkColors  

Create set of colors, interpolating through a set of preferred colors.

Description

Create set of colors, interpolating through a set of preferred colors.

Usage

- darkColors(n)
- seqColors(n)
- seqColors2(n)
- divColors(n)

Arguments

- **n** integer determining number of colors to be generated

Details

darkColors is based on the Dark2 palette in RColorBrewer, therefore useful to describe qualitative features of the data.

seqColors is based on Blues and generates a gradient of blues, therefore useful to describe quantitative features of the data. seqColors2 behaves similarly, but it is based on OrRd (white-orange-red).

divColors is based on the RdBu palette in RColorBrewer, therefore useful to describe quantitative features ranging on two extremes.
Examples

```r
x <- 1:10
ty <- 1:10
cols1 <- darkColors(10)
cols2 <- seqColors(10)
cols3 <- divColors(10)
cols4 <- seqColors2(10)
plot(x, y, col=cols1, xlim=c(1, 13), pch=19, cex=3)
points(x+1, y, col=cols2, pch=19, cex=3)
points(x+2, y, col=cols3, pch=19, cex=3)
points(x+3, y, col=cols4, pch=19, cex=3)
abline(0, 1, lty=2)
abline(-1, 1, lty=2)
abline(-2, 1, lty=2)
abline(-3, 1, lty=2)
```

---

**fitProbeLevelModel**

**Tool to fit Probe Level Models.**

**Description**

Fits robust Probe Level linear Models to all the (meta)probesets in an FeatureSet. This is carried out on a (meta)probeset by (meta)probeset basis.

**Usage**

```r
fitProbeLevelModel(object, background=TRUE, normalize=TRUE, target="core", method="plm", verbose=TRUE, S4=TRUE, ...)
```

**Arguments**

- **object**: FeatureSet object.
- **background**: Do background correction?
- **normalize**: Do normalization?
- **target**: character vector describing the summarization target. Valid values are: 'probe-set', 'core' (Gene/Exon), 'full' (Exon), 'extended' (Exon).
- **method**: summarization method to be used.
- **verbose**: verbosity flag.
- **S4**: return final value as an S4 object (oligoPLM) if TRUE. If FALSE, final value is returned as a list.
- **...**: subset to be passed down to `getProbeInfo` for subsetting. See `subset` for details.

**Value**

fitProbeLevelModel returns an oligoPLM object, if S4=TRUE; otherwise, it will return a list.

**Note**

This is the initial port of fitPLM to oligo. Some features found on the original work by Ben Bolstad (in the affyPLM package) may not be yet available. If you found one of this missing characteristics, please contact Benilton Carvalho.
getAffinitySplineCoefficients

**getAffinitySplineCoefficients**

Estimate affinity coefficients.

### Description

Estimate affinity coefficients using sequence information and splines.

### Usage

```r
getAffinitySplineCoefficients(intensities, sequences)
```

### Arguments

- `intensities`: Intensity matrix
- `sequences`: Probe sequences

### Value

Matrix with estimated coefficients.

### See Also

`getBaseProfile`
**getBaseProfile**  
*Compute and plot nucleotide profile.*

**Description**  
Computes and, optionally, plots nucleotide profile, describing the sequence effect on intensities.

**Usage**  
```r  
getBaseProfile(coefs, probeLength = 25, plot = FALSE, ...)  
```

**Arguments**  
- `coefs`: affinity spline coefficients.  
- `probeLength`: length of probes  
- `plot`: logical. Plots profile?  
- `...`: arguments to be passed to matplot.

**Value**  
Invisibly returns a matrix with estimated effects.

---

**getContainer**  
*Get container information for NimbleGen Tiling Arrays.*

**Description**  
Get container information for NimbleGen Tiling Arrays. This is useful for better identification of control probes.

**Usage**  
```r  
getContainer(object, probeType)  
```

**Arguments**  
- `object`: A `TilingFeatureSet` or `TilingFeatureSet` object.  
- `probeType`: String describing which probes to query ('pm', 'bg')

**Value**  
'character' vector with container information.
getCr1mmSummaries  
*Function to get CRLMM summaries saved to disk*

**Description**

This will read the summaries written to disk and return them to the user as a SnpCallSetPlus or SnpCnvCallSetPlus object.

**Usage**

```r
cr1mmSummaries(tmpdir)
```

**Arguments**

- `tmpdir` directory where CRLMM saved the results to.

**Value**

If the data were from SNP 5.0 or 6.0 arrays, the function will return a SnpCnvCallSetPlus object. It will return a SnpCallSetPlus object, otherwise.

getNetAffx  
*NetAffx Biological Annotations*

**Description**

Gets NetAffx Biological Annotations saved in the annotation package (Exon and Gene ST Affymetrix arrays).

**Usage**

```r
cr1mmSummaries(object, type = "probeset")
```

**Arguments**

- `object` 'ExpressionSet' object (eg., result of rma())
- `type` Either 'probeset' or 'transcript', depending on what type of summaries were obtained.

**Details**

This retrieves NetAffx annotation saved in the (pd) annotation package - annotation(object). It is only available for Exon ST and Gene ST arrays.

The 'type' argument should match the summarization target used to generate 'object'. The 'rma' method allows for two targets: 'probeset' (target='probeset') and 'transcript' (target='core', target='full', target='extended').

**Value**

'AnotatedDataFram' that can be used as featureData(object)
getNgsColorsInfo

Author(s)
Benilton Carvalho

---

**getNgsColorsInfo**

*Helper function to extract color information for filenames on Nimble-Gen arrays.*

**Description**

This function will (try to) extract the color information for NimbleGen arrays. This is useful when using `read.xysfiles2` to parse XYS files for Tiling applications.

**Usage**

```r
getNgsColorsInfo(path = ".", pattern1 = "_.532", pattern2 = ".635", ...)
```

**Arguments**

- `path` path where to look for files
- `pattern1` pattern to match files supposed to go to the first channel
- `pattern2` pattern to match files supposed to go to the second channel
- `...` extra arguments for `list.xysfiles`

**Details**

Many NimbleGen samples are identified following the pattern `sampleID_532.XYS / sampleID_635.XYS`. The function suggests sample names if all the filenames follow the standard above.

**Value**

A data.frame with, at least, two columns: 'channel1' and 'channel2'. A third column, 'sampleNames', is returned if the filenames follow the `sampleID_532.XYS / sampleID_635.XYS` standard.

**Author(s)**

Benilton Carvalho <bcarvalh@jhsph.edu>
getPlatformDesign  
*Retrieve Platform Design object*

**Description**
Retrieves platform design object.

**Usage**
getPlatformDesign(object)
getPD(object)

**Arguments**
- **object**  FeatureSet object

**Details**
Retrieve platform design object.

**Value**
- platformDesign or PDInfo object.

getProbeInfo  
*Probe information selector.*

**Description**
A tool to simplify the selection of probe information, so user does not need to use the SQL approaches.

**Usage**
getProbeInfo(object, field, probeType = "pm", target = "core", sortBy = c("fid", "man_fsetid", "none"), ...)

**Arguments**
- **object**  FeatureSet object.
- **field**  character string with names of field(s) of interest to be obtained from database.
- **probeType**  character string: ‘pm’ or ‘mm’
- **target**  Used only for Exon or Gene ST arrays: ‘core’, ‘full’, ‘extended’, ‘probeset’.
- **sortBy**  Field to be used for sorting.
- ...  Arguments to be passed to subset

**Value**
A data.frame with the probe level information.
**Note**

The code allows for querying info on MM probes, however it has been used mostly on PM probes.

**Author(s)**

Benilton Carvalho

**Examples**

```r
if (require(oligoData)){
  data(affyGeneFS)
  availProbeInfo(affyGeneFS)
  probeInfo <- getProbeInfo(affyGeneFS, c('fid', 'x', 'y', 'chrom'))
  head(probeInfo)
  ## Selecting antigenomic background probes
  agenGene <- getProbeInfo(affyGeneFS, field=c('fid', 'fsetid', 'type'), target='probeset', subset= type == 'control->bgp->antigenomic')
  head(agenGene)
}
```

---

###getX

**Accessors for physical array coordinates.**

**Description**

Accessors for physical array coordinates.

**Usage**

```r
getX(object, type)
getY(object, type)
```

**Arguments**

- `object` FeatureSet object
- `type` character defining the type of the probes to be queried. Valid options are 'pm', 'mm', 'bg'

**Value**

A vector with the requested coordinates.

**Examples**

```r
## Not run:
x <- read.celfiles(list.celfiles())
theXpm <- getX(x, "pm")
theYpm <- getY(x, "pm")

## End(Not run)
```
hist

Density estimate

Description
Plot the density estimates for each sample

Usage

## S4 method for signature 'FeatureSet'
hist(x, transfo=log2, which=c("pm", "mm", "bg", "both", "all"),
     nsample=10000, ...)

## S4 method for signature 'ExpressionSet'
hist(x, transfo=identity, nsample=10000, ...)

Arguments

x FeatureSet or ExpressionSet object
transfo a function to transform the data before plotting. See 'Details'.
nsample number of units to sample and build the plot.
which set of probes to be plotted ("pm", "mm", "bg", "both", "all").
... arguments to be passed to matplot

Details
The 'transfo' argument will set the transformation to be used. For raw data, 'transfo=log2' is a common practice. For summarized data (which are often in log2-scale), no transformation is needed (therefore 'transfo=identity').

Note
The hist methods for FeatureSet and Expression use a sample (via sample) of the probes/probesets to produce the plot (unless nsample > nrow(x)). Therefore, the user interested in reproducibility is advised to use set.seed.

image

Display a pseudo-image of a microarray chip

Description

Produces a pseudo-image (graphics::image) for each sample.
justSNPRMA

Usage

```r
## S4 method for signature 'FeatureSet'
image(x, which, transfo=log2, ...)
## S4 method for signature 'PLMset'
image(x, which=0,
      type=c("weights","resids","pos.resids","neg.resids","sign.resids"),
      use.log=TRUE, add.legend=FALSE, standardize=FALSE,
      col=NULL, main, ...)
```

Arguments

- `x` FeatureSet object
- `which` integer indices of samples to be plotted (optional).
- `transfo` function to be applied to the data prior to plotting.
- `type` Type of statistics to be used.
- `use.log` Use log.
- `add.legend` Add legend.
- `standardize` Standardize residuals.
- `col` Colors to be used.
- `main` Main title.
- `...` parameters to be passed to `image`

Examples

```r
if(require(oligoData) & require(pd.hg18.60mer.expr)){
  data(nimbleExpressionFS)
  par(mfrow=c(1, 2))
  image(nimbleExpressionFS, which=4)
  ## fit <- fitPLM(nimbleExpressionFS)
  ## image(fit, which=4)
  plot(1) ## while fixing fitPLM TODO
}
```

Description

This function implements the SNPRMA method for summarization of SNP data. It works directly with the CEL files, saving memory.

Usage

```r
justSNPRMA(filenames, verbose = TRUE, phenoData = NULL, normalizeToHapmap = TRUE)
```
Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>filenames</td>
<td>character vector with the filenames.</td>
</tr>
<tr>
<td>verbose</td>
<td>logical flag for verbosity.</td>
</tr>
<tr>
<td>phenoData</td>
<td>a phenoData object or NULL</td>
</tr>
<tr>
<td>normalizeToHapmap</td>
<td>Normalize to Hapmap? Should always be TRUE, but it’s kept here for future use.</td>
</tr>
</tbody>
</table>

Value

SnpQSet or a SnpCnvQSet, depending on the array type.

Examples

```r
## snprmaResults <- justSNPRMA(list.celfiles())
```

---

**Description**

Lists the XYS files.

**Usage**

```r
list.xysfiles(...)```

**Arguments**

```r
... parameters to be passed to list.files```

**Details**

The functions interface `list.files` and the user is asked to check that function for further details.

**Value**

Character vector with the filenames.

**See Also**

`list.files`

**Examples**

```r
list.xysfiles()```
MAplots

Description

Create MA plots using a reference array (if one channel) or using channel2 as reference (if two channel).

Usage

MAplot(object, ...)  
## S4 method for signature 'FeatureSet'
MAplot(object, what=pm, transfo=log2, groups,  
    refSamples, which, pch=".", summaryFun=rowMedians,  
    plotFun=smoothScatter, main="vs pseudo-median reference chip",  
    pairs=FALSE, ...)

## S4 method for signature 'TilingFeatureSet'
MAplot(object, what=pm, transfo=log2, groups,  
    refSamples, which, pch=".", summaryFun=rowMedians,  
    plotFun=smoothScatter, main="vs pseudo-median reference chip",  
    pairs=FALSE, ...)

## S4 method for signature 'PLMset'
MAplot(object, what=coefs, transfo=identity, groups,  
    refSamples, which, pch=".", summaryFun=rowMedians,  
    plotFun=smoothScatter, main="vs pseudo-median reference chip",  
    pairs=FALSE, ...)

## S4 method for signature 'matrix'
MAplot(object, what=identity, transfo=identity,  
    groups, refSamples, which, pch=".", summaryFun=rowMedians,  
    plotFun=smoothScatter, main="vs pseudo-median reference chip",  
    pairs=FALSE, ...)

## S4 method for signature 'ExpressionSet'
MAplot(object, what=exprs, transfo=identity,  
    groups, refSamples, which, pch=".", summaryFun=rowMedians,  
    plotFun=smoothScatter, main="vs pseudo-median reference chip",  
    pairs=FALSE, ...)

Arguments

- **object**: FeatureSet, PLMset or ExpressionSet object.
- **what**: function to be applied on object that will extract the statistics of interest, from which log-ratios and average log-intensities will be computed.
- **transfo**: function to transform the data prior to plotting.
MAplot

groups: factor describing groups of samples that will be combined prior to plotting. If missing, MVA plots are done per sample.

refSamples: integers (indexing samples) to define which subjects will be used to compute the reference set. If missing, a pseudo-reference chip is estimated using summaryFun.

which: integer (indexing samples) describing which samples are to be plotted.

data with plots

pch: same as pch in plot

summaryFun: function that operates on a matrix and returns a vector that will be used to summarize data belonging to the same group (or reference) on the computation of grouped-stats.

plotFun: function to be used for plotting. Usually smoothScatter, plot or points.

main: string to be used in title.

pairs: logical flag to determine if a matrix of MVA plots is to be generated

... Other arguments to be passed downstream, like plot arguments.

Details

MAplot will take the following extra arguments:

1. subset: indices of elements to be plotted to reduce impact of plotting 100’s thousands points (if pairs=FALSE only);
2. span: see loess;
3. family.loess: see loess;
4. addLoess: logical flag (default TRUE) to add a loess estimate;
5. parParams: list of params to be passed to par() (if pairs=TRUE only);

Value

Plot

Author(s)

Benilton Carvalho - based on Ben Bolstad’s original MAplot function.

See Also

plot, smoothScatter

Examples

if(require(oligoData) & require(pd.hg18.60mer.expr)){
  data(nimbleExpressionFS)
  nimbleExpressionFS
  groups <- factor(rep(c('brain', 'UnivRef'), each=3))
  data.frame(sampleNames(nimbleExpressionFS), groups)
  MAplot(nimbleExpressionFS, pairs=TRUE, ylim=c(-.5, .5), groups=groups)
}

Accessors and replacement methods for the intensity/PM/MM/BG matrices.

Usage

```r
intensity(object)
mm(object, subset = NULL, target='core')
pm(object, subset = NULL, target='core')
bg(object, subset = NULL)
mm(object, subset = NULL, target='core')<-value
pm(object, subset = NULL, target='core')<-value
bg(object)<-value
```

Arguments

- `object` FeatureSet object.
- `subset` Not implemented yet.
- `value` matrix object.
- `target` One of 'probeset', 'core', 'full', 'extended'. This is ignored if the array design is something other than Gene ST or Exon ST.

Details

For all objects but TilingFeatureSet, these methods will return matrices. In case of TilingFeatureSet objects, the value is a 3-dimensional array (probes x samples x channels).

intensity will return the whole intensity matrix associated to the object. pm, mm, bg will return the respective PM/MM/BG matrix.

When applied to ExonFeatureSet or GeneFeatureSet objects, pm will return the PM matrix at the transcript level ('core' probes) by default. The user should set the target argument accordingly if something else is desired. The valid values are: 'probeset' (Exon and Gene arrays), 'core' (Exon arrays), 'full' (Exon arrays) and 'extended' (Exon arrays).

The target argument has no effects when used on designs other than Gene and Exon ST.

Examples

```r
if (require(maqcExpression4plex) & require(pd.hg18.60mer.expr)){
xysPath <- system.file("extdata", package="maqcExpression4plex")
xysFiles <- list.xysfiles(xysPath, full.name=TRUE)
geneExpressionFeatureSet <- read.xysfiles(xysFiles)
mm(geneExpressionFeatureSet)[1:10,]
}
```
**mmSequence**

**Probe Sequences**

Accessor to the (PM/MM/background) probe sequences.

**Usage**

```
mmSequence(object)
pmSequence(object, ...)
bgSequence(object, ...)
```
Arguments

object FeatureSet, AffySNPPDInfo or DBPDInfo object

... additional arguments

Value

A DNAStringSet containing the PM/MM/background probe sequence associated to the array.

Description

The functions or variables listed here are no longer part of 'oligo'

Usage

fitPLM(...)  
coefs(...)  
resids(...)

Arguments

... Arguments.

Details

fitPLM was replaced by fitProbeLevelModel, allowing faster execution and providing more specific models. fitPLM was based in the code written by Ben Bolstad in the affyPLM package. However, all the model-fitting functions are now in the package preprocessCore, on which fitProbeLevelModel depends.

coeefs and resid(s), like fitPLM, were inherited from the affyPLM package. They were replaced respectively by coef and residuals, because this is how these statistics are called everywhere else in R.

oligoPLM-class Class "oligoPLM"

Description

A class to represent Probe Level Models.

Objects from the Class

Objects can be created by calls of the form fitProbeLevelModel(FeatureSetObject), where FeatureSetObject is an object obtained through read.celfiles or read.xysfiles, representing intensities observed for different probes (which are grouped in probesets or meta-probesets) across distinct samples.
Slots

- chip.coefs: "matrix" with chip/sample effects - probeset-level
- probe.coefs: "numeric" vector with probe effects
- weights: "matrix" with weights - probe-level
- residuals: "matrix" with residuals - probe-level
- se.chip.coefs: "matrix" with standard errors for chip/sample coefficients
- se.probe.coefs: "numeric" vector with standard errors for probe effects
- residualSE: scale - residual standard error
- geometry: array geometry used for plots
- method: "character" string describing method used for PLM
- manufacturer: "character" string with manufacturer name
- annotation: "character" string with the name of the annotation package
- narrays: "integer" describing the number of arrays
- nprobes: "integer" describing the number of probes before summarization
- nprobesets: "integer" describing the number of probesets after summarization

Methods

- annotation signature(object = "oligoPLM"): accessor/replacement method to annotation slot
- boxplot signature(x = "oligoPLM"): boxplot method
- coef signature(object = "oligoPLM"): accessor/replacement method to coef slot
- coefs.probe signature(object = "oligoPLM"): accessor/replacement method to coefs.probe slot
- geometry signature(object = "oligoPLM"): accessor/replacement method to geometry slot
- image signature(x = "oligoPLM"): image method
- manufacturer signature(object = "oligoPLM"): accessor/replacement method to manufacturer slot
- method signature(object = "oligoPLM"): accessor/replacement method to method slot
- ncol signature(x = "oligoPLM"): accessor/replacement method to ncol slot
- nprobes signature(object = "oligoPLM"): accessor/replacement method to nprobes slot
- nprobesets signature(object = "oligoPLM"): accessor/replacement method to nprobesets slot
- residuals signature(object = "oligoPLM"): accessor/replacement method to residuals slot
- residualSE signature(object = "oligoPLM"): accessor/replacement method to residualSE slot
- se signature(object = "oligoPLM"): accessor/replacement method to se slot
- se.probe signature(object = "oligoPLM"): accessor/replacement method to se.probe slot
- show signature(object = "oligoPLM"): show method
- weights signature(object = "oligoPLM"): accessor/replacement method to weights slot
- NUSE signature(x = "oligoPLM"): Boxplot of Normalized Unscaled Standard Errors (NUSE) or NUSE values.
- RLE signature(x = "oligoPLM"): Relative Log Expression boxplot or values.
- opset2eset signature(x = "oligoPLM"): Convert to ExpressionSet.
Author(s)

This is a port from Ben Bolstad’s work implemented in the affyPLM package. Problems with the implementation in oligo should be reported to the package's maintainer.

References


See Also

rma, summarize

Examples

```r
## TODO: review code and fix broken
## Not run:
if (require(oligoData)){
  data(nimbleExpressionFS)
  fit <- fitProbeLevelModel(nimbleExpressionFS)
  image(fit)
  NUSE(fit)
  RLE(fit)
}
## End(Not run)
```

### paCalls

Methods for P/A Calls

Description

Methods for Present/Absent Calls are meant to provide means of assessing whether or not each of the (PM) intensities are compatible with observations generated by background probes.

Usage

```r
paCalls(object, method, ..., verbose=TRUE)
## S4 method for signature 'ExonFeatureSet'
paCalls(object, method, verbose = TRUE)
## S4 method for signature 'GeneFeatureSet'
paCalls(object, method, verbose = TRUE)
## S4 method for signature 'ExpressionFeatureSet'
paCalls(object, method, ..., verbose = TRUE)
```

Arguments

- **object**: Exon/Gene/Expression-FeatureSet object.
- **method**: String defining what method to use. See 'Details'.
- **...**: Additional arguments passed to MAS5. See 'Details'
- **verbose**: Logical flag for verbosity.
Details

For Whole Transcript arrays (Exon/Gene) the valid options for method are 'DABG' (p-values for each probe) and 'PSDABG' (p-values for each probeset). For Expression arrays, the only option currently available for method is 'MAS5'.

ABOUT MAS5 CALLS:
The additional arguments that can be passed to MAS5 are:

1. alpha1: a significance threshold in (0, alpha2);
2. alpha2: a significance threshold in (alpha1, 0.5);
3. tau: a small positive constant;
4. ignore.saturated: if TRUE, do the saturation correction described in the paper, with a saturation level of 46000;

This function performs the hypothesis test:
H0: median(Ri) = tau, corresponding to absence of transcript
H1: median(Ri) > tau, corresponding to presence of transcript
where Ri = (PMi - MMi) / (PMi + MMi) for each i a probe-pair in the probe-set represented by data.
The p-value that is returned estimates the usual quantity:
Pr(observe a more "present looking" probe-set than data | data is absent)
So that small p-values imply presence while large ones imply absence of transcript. The detection call is computed by thresholding the p-value as in:
call "P" if p-value < alpha1 call "M" if alpha1 <= p-value < alpha2 call "A" if alpha2 <= p-value

Value

A matrix (of dimension dim(PM) if method="DABG" or "MAS5"; of dimension length(unique(probeNames(object))) x ncol(object) if method="PSDABG") with p-values for P/A Calls.

Author(s)

Benilton Carvalho

References


plotM-methods

Methods for Log-Ratio plotting

Description

The plotM methods are meant to plot log-ratios for different classes of data.

Methods

- **object = "SnpQSet", i = "character"**  Plot log-ratio for SNP data for sample i.
- **object = "SnpQSet", i = "integer"**  Plot log-ratio for SNP data for sample i.
- **object = "SnpQSet", i = "numeric"**  Plot log-ratio for SNP data for sample i.
- **object = "TilingQSet", i = "missing"**  Plot log-ratio for Tiling data for sample i.

pmAllele

Access the allele information for PM probes.

Description

Accessor to the allelic information for PM probes.

Usage

```r
pmAllele(object)
```

Arguments

- **object**  SnpFeatureSet or PDInfo object.
pmFragmentLength

*Access the fragment length for PM probes.*

**Description**

Accessor to the fragment length for PM probes.

**Usage**

```r
pmFragmentLength(object, enzyme, type=c('snp', 'cn'))
```

**Arguments**

- `object`: PDInfo or SnpFeatureSet object.
- `enzyme`: Enzyme to be used for query. If missing, all enzymes are used.
- `type`: Type of probes to be used: 'snp' for SNP probes; 'cn' for Copy Number probes.

**Value**

A list of length equal to the number of enzymes used for digestion. Each element of the list is a data.frame containing:

- `row`: the row used to link to the PM matrix;
- `length`: expected fragment length.

**Note**

There is not a 1:1 relationship between probes and expected fragment length. For one enzyme, a given probe may be associated to multiple fragment lengths. Therefore, the number of rows in the data.frame may not match the number of PM probes and the `row` column should be used to match the fragment length with the PM matrix.

pmPosition

*Accessor to position information*

**Description**

`pmPosition` will return the genomic position for the (PM) probes.

**Usage**

```r
pmPosition(object)

pmOffset(object)
```

**Arguments**

- `object`: AffySNPPDInfo, TilingFeatureSet or SnpCallSet object.
pmStrand

Details

pmPosition will return genomic position for PM probes on a tiling array.

pmOffset will return the offset information for PM probes on SNP arrays.

pmStrand  Accessor to the strand information

Description

Returns the strand information for PM probes (0 - sense / 1 - antisense).

Usage

pmStrand(object)

Arguments

object  AffySNPPDInfo or TilingFeatureSet object

probeNames  Accessor to feature names

Description

Accessors to featureset names.

Usage

probeNames(object, subset = NULL, ...)

probesetNames(object, ...)

Arguments

object  FeatureSet or DBPDIInfo

subset  not implemented yet.

...  Arguments (like ‘target’) passed to downstream methods.

Value

probeNames returns a string with the probeset names for each probe on the array. probesetNames, on the other hand, returns the unique probeset names.
read.celfiles  Parser to CEL files

Description

Reads CEL files.

Usage

read.celfiles(..., filenames, pkgname, phenoData, featureData, experimentData, protocolData, notes, verbose=TRUE, sampleNames, rm.mask=FALSE, rm.outliers=FALSE, rm.extra=FALSE, checkType=TRUE)

read.celfiles2(channel1, channel2, pkgname, phenoData, featureData, experimentData, protocolData, notes, verbose=TRUE, sampleNames, rm.mask=FALSE, rm.outliers=FALSE, rm.extra=FALSE, checkType=TRUE)

Arguments

... names of files to be read.
filenames a character vector with the CEL filenames.
channel1 a character vector with the CEL filenames for the first 'channel' on a Tiling application
channel2 a character vector with the CEL filenames for the second 'channel' on a Tiling application
pkgname alternative data package to be loaded.
phenoData phenoData
featureData featureData
experimentData experimentData
protocolData protocolData
notes notes
verbose logical
sampleNames character vector with sample names (usually better descriptors than the filenames)
rm.mask logical. Read masked?
rm.outliers logical. Remove outliers?
rm.extra logical. Remove extra?
checkType logical. Check type of each file? This can be time consuming.

Details

When using 'affyio' to read in CEL files, the user can read compressed CEL files (CEL.gz). Additionally, 'affyio' is much faster than 'affxparser'.

The function guesses which annotation package to use from the header of the CEL file. The user can also provide the name of the annotation package to be used (via the pkgname argument). If the annotation package cannot be loaded, the function returns an error. If the annotation package is not available from BioConductor, one can use the pdInfoBuilder package to build one.
read.xysfiles

Value

ExpressionFeatureSet if Expression arrays
ExonFeatureSet if Exon arrays
SnpFeatureSet if SNP arrays
TilingFeatureSet if Tiling arrays

See Also

list.celfiles, read.xysfiles

Examples

if(require(pd.mapping50k.xba240) & require(hapmap100kxba)){
celPath <- system.file("celFiles", package="hapmap100kxba")
celFiles <- list.celfiles(celPath, full.name=TRUE)
affySnpFeatureSet <- read.celfiles(celFiles)
}

read.xysfiles

Parser to XYS files

Description

NimbleGen provides XYS files which are read by this function.

Usage

read.xysfiles(..., filenames, pkgname, phenoData, featureData,
experimentData, protocolData, notes, verbose=TRUE, sampleNames,
checkType=TRUE)

read.xysfiles2(channel1, channel2, pkgname, phenoData, featureData,
experimentData, protocolData, notes, verbose=TRUE, sampleNames,
checkType=TRUE)

Arguments

... file names
filenames character vector with filenames.
channel1 a character vector with the XYS filenames for the first 'channel' on a Tiling application
channel2 a character vector with the XYS filenames for the second 'channel' on a Tiling application
pkgname character vector with alternative PD Info package name
phenoData phenoData
featureData featureData
experimentData experimentData
**readSummaries**

Read summaries generated by crlmm

**Description**

This function reads the different summaries generated by crlmm.

**Usage**

readSummaries(type, tmpdir)

**Arguments**

- **type**: type of summary of character class: 'alleleA', 'alleleB', 'alleleA-sense', 'alleleA-antisense', 'alleleB-sense', 'alleleB-antisense', 'calls', 'llr', 'conf'.
- **tmpdir**: directory containing the output saved by crlmm.

---

**readSummaries**

- **protocolData**: protocolData
- **notes**: notes
- **verbose**: verbose
- **sampleNames**: character vector with sample names (usually better descriptors than the filenames)
- **checkType**: logical. Check type of each file? This can be time consuming.

**Details**

The function will read the XYS files provided by NimbleGen Systems and return an object of class FeatureSet.

The function guesses which annotation package to use from the header of the XYS file. The user can also provide the name of the annotation package to be used (via the pkgname argument). If the annotation package cannot be loaded, the function returns an error. If the annotation package is not available from BioConductor, one can use the pdInfoBuilder package to build one.

**Value**

- ExpressionFeatureSet if Expression arrays
- TilingFeatureSet if Tiling arrays

**See Also**

- list.xysfiles
- read.celfiles

**Examples**

```r
if (require(maqcExpression4plex) & require(pd.hg18.60mer.expr)){
  xysPath <- system.file("extdata", package="maqcExpression4plex")
  xysFiles <- list.xysfiles(xysPath, full.name=TRUE)
  ngsExpressionFeatureSet <- read.xysfiles(xysFiles)
}
```

---

**readSummaries**

Read summaries generated by crlmm
Details

On the 50K and 250K arrays, given a SNP, there are probes on both strands (sense and antisense). For this reason, the options ‘alleleA-sense’, ‘alleleA-antisense’, ‘alleleB-sense’ and ‘alleleB-antisense’ should be used **only** with such arrays (XBA, HIND, NSP or STY).

On the SNP 5.0 and SNP 6.0 platforms, this distinction does not exist in terms of algorithm (note that the actual strand could be queried from the annotation package). For these arrays, options ‘alleleA’, ‘alleleB’ are the ones to be used.

The options calls, llr and conf will return, respectively, the CRLMM calls, log-likelihood ratios (for devel purpose **only**) and CRLMM confidence calls matrices.

Value

Matrix with values of summaries.

---

Description

Robust Multichip Average preprocessing methodology. This strategy allows background subtraction, quantile normalization and summarization (via median-polish).

Usage

```r
## S4 method for signature 'ExonFeatureSet'
rma(object, background=TRUE, normalize=TRUE, subset=NULL, target="core")
## S4 method for signature 'HTAFeatureSet'
rma(object, background=TRUE, normalize=TRUE, subset=NULL, target="core")
## S4 method for signature 'ExpressionFeatureSet'
rma(object, background=TRUE, normalize=TRUE, subset=NULL)
## S4 method for signature 'GeneFeatureSet'
rma(object, background=TRUE, normalize=TRUE, subset=NULL, target="core")
## S4 method for signature 'SnpCnvFeatureSet'
rma(object, background=TRUE, normalize=TRUE, subset=NULL)
```

Arguments

- **object**: Exon/HTA/Expression/Gene/SnpCnv-FeatureSet object.
- **background**: Logical - perform RMA background correction?
- **normalize**: Logical - perform quantile normalization?
- **subset**: To be implemented.
- **target**: Level of summarization (only for Exon/Gene arrays)
**Methods**

signature(object = "ExonFeatureSet") When applied to an ExonFeatureSet object, rma can produce summaries at different levels: probeset (as defined in the PGF), core genes (as defined in the core.mps file), full genes (as defined in the full.mps file) or extended genes (as defined in the extended.mps file). To determine the level for summarization, use the `target` argument.

signature(object = "ExpressionFeatureSet") When used on an ExpressionFeatureSet object, rma produces summaries at the probeset level (as defined in the CDF or NDF files, depending on the manufacturer).

signature(object = "GeneFeatureSet") When applied to a GeneFeatureSet object, rma can produce summaries at different levels: probeset (as defined in the PGF) and 'core genes' (as defined in the core.mps file). To determine the level for summarization, use the `target` argument.

signature(object = "HTAFeatureSet") When applied to a HTAFeatureSet object, rma can produce summaries at different levels: probeset (as defined in the PGF) and 'core genes' (as defined in the core.mps file). To determine the level for summarization, use the `target` argument.

signature(object = "SnpCnvFeatureSet") If used on a SnpCnvFeatureSet object (ie., SNP 5.0 or SNP 6.0 arrays), rma will produce summaries for the CNV probes. Note that this is an experimental feature for internal (and quick) assessment of CNV probes. We recommend the use of the 'crlmm' package, which contains a Copy Number tool specifically designed for these data.

**References**


**See Also**

snprma

**Examples**

```r
if (require(maqcExpression4plex) & require(pd.hg18.60mer.expr)){
  xysPath <- system.file("extdata", package="maqcExpression4plex")
  xysFiles <- list.xysfiles(xysPath, full.name=TRUE)
  ngsExpressionFeatureSet <- read.xysfiles(xysFiles)
  summarized <- rma(ngsExpressionFeatureSet)
  show(summarized)
}
```
runDate

<table>
<thead>
<tr>
<th>runDate</th>
<th>Date of scan</th>
</tr>
</thead>
</table>

**Description**
Retrieves date information in CEL/XYS files.

**Usage**
runDate(object)

**Arguments**
- object: 'FeatureSet' object.

sequenceDesignMatrix

**Description**
Creates design matrix for sequences.

**Usage**
sequenceDesignMatrix(seqs)

**Arguments**
- seqs: character vector of 25-mers.

**Details**
This assumes all sequences are 25bp long. The design matrix is often used when the objective is to adjust intensities by sequence.

**Value**
Matrix with length(seqs) rows and 75 columns.

**Examples**
```r
genSequence <- function(x)
paste(sample(c("A", "T", "C", "G"), 25, rep=TRUE), collapse="", sep="")
seqs <- sapply(1:10, genSequence)
X <- sequenceDesignMatrix(seqs)
Y <- rnorm(10, mean=12, sd=2)
Ydemean <- Y-mean(Y)
X[1:10, 1:3]
fit <- lm(Ydemean~X)
coef(fit)
```
snprma  Preprocessing SNP Arrays

Description
This function preprocess SNP arrays.

Usage

\[ \text{snprma}(\text{object}, \text{verbose} = \text{TRUE}, \text{normalizeToHapmap} = \text{TRUE}) \]

Arguments

\begin{itemize}
  \item \text{object} SnpFeatureSet object
  \item \text{verbose} Verbosity flag. logical
  \item \text{normalizeToHapmap} internal
\end{itemize}

Value
A SnpQSet object.

summarize  Tools for microarray preprocessing

Description
These are tools to preprocess microarray data. They include background correction, normalization
and summarization methods.

Usage

\begin{verbatim}
backgroundCorrectionMethods()
normalizationMethods()
backgroundCorrect(object, method=backgroundCorrectionMethods(), copy=TRUE, extra, subset=NULL, target="Var.core", verbose=TRUE, ...)
summarize(object, probes=rownames(object), method="medianpolish", verbose=TRUE, ...)
\end{verbatim}

\[ \text{normalize}(\text{object}, \text{method}=\text{normalizationMethods}(), \text{copy}=\text{TRUE}, \text{subset}=\text{NULL}, \text{target}='\text{core}', \text{verbose}=\text{TRUE}, \text{...}) \]

\[ \text{normalize}(\text{object}, \text{method}=\text{normalizationMethods}(), \text{copy}=\text{TRUE}, \text{verbose}=\text{TRUE}, \text{...}) \]

\[ \text{normalizeToTarget}(\text{object}, \text{targetDist}, \text{method}="\text{quantile}", \text{copy}=\text{TRUE}, \text{verbose}=\text{TRUE}) \]

\[ \text{normalizeToTarget}(\text{object}, \text{targetDist}, \text{method}="\text{quantile}", \text{copy}=\text{TRUE}, \text{verbose}=\text{TRUE}) \]
### Arguments

- **object**: Object containing probe intensities to be preprocessed.
- **method**: String determining which method to use at that preprocessing step.
- **targetDist**: Vector with the target distribution.
- **probes**: Character vector that identifies the name of the probes represented by the rows of `object`.
- **copy**: Logical flag determining if data must be copied before processing (TRUE), or if data can be overwritten (FALSE).
- **subset**: Not yet implemented.
- **target**: One of the following values: 'core', 'full', 'extended', 'probeset'. Used only with Gene ST and Exon ST designs.
- **extra**: Extra arguments to be passed to other methods.
- **verbose**: Logical flag for verbosity.
- ...: Arguments to be passed to methods.

### Details

Number of rows of `object` must match the length of `probes`.

### Value

- `backgroundCorrectionMethods` and `normalizationMethods` will return a character vector with the methods implemented currently.
- `backgroundCorrect`, `normalize` and `normalizeToTarget` will return a matrix with same dimensions as the input matrix. If they are applied to a FeatureSet object, the PM matrix will be used as input.

The `summarize` method will return a matrix with `length(unique(probes))` rows and `ncol(object)` columns.

### Examples

```r
ns <- 100
nps <- 1000
np <- 10
intensities <- matrix(rnorm(ns*nps*np, 8000, 400), nc=ns)
ids <- rep(as.character(1:nps), each=np)
bgCorrected <- backgroundCorrect(intensities)
normalized <- normalize(bgCorrected)
summarizationMethods()
expression <- summarize(normalized, probes=ids)
intensities[1:20, 1:3]
expression[1:20, 1:3]
target <- rnorm(np*nps)
normalizedToTarget <- normalizeToTarget(intensities, target)

if (require(oligoData) & require(pd.hg18.60mer.expr)){
  ## Example of normalization with real data
  data(nimbleExpressionFS)
  boxplot(nimbleExpressionFS, main=’Original’)
  for (mtd in normalizationMethods()){
    message(’Normalizing with ’, mtd)
  }
```
res <- normalize(nimbleExpressionFS, method=mtd, verbose=FALSE)
boxplot(res, main=mtd)
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