Package ‘oligo’

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Title Preprocessing tools for oligonucleotide arrays

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Imports affyio (>= 1.35.0), affxparser (>= 1.39.4), DBI (>= 0.3.1), ff, graphics, methods, preprocessCore (>= 1.29.0), RSQLite (>= 1.0.0), splines, stats, stats4, utils, zlibbioc

Enhances ff, doMC, doMPI

LinkingTo preprocessCore

Suggests BSgenome.Hsapiens.UCSC.hg18, hapmap100kxba, pd.hg.u95av2, pd.mapping50k.xba240, pd.huex.1.0.st.v2, pd.hg18.60mer.expr, pd.hugene.1.0.st.v1, maqcExpression4plex, genefilter, limma, RColorBrewer, oligoData, BiocStyle, knitr, RUnit, biomaRt, AnnotationDbi, GenomeGraphs, RCurl, ACME, biomaRt, AnnotationDbi, GenomeGraphs, RCurl

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)


LazyLoad Yes
topics documented:

- biocViews
  - Microarray, OneChannel, TwoChannel, Preprocessing, SNP,
    - DifferentialExpression, ExonArray, GeneExpression, DataImport

- git_url
  - https://git.bioconductor.org/packages/oligo

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R topics documented:

- oligo-package
- basecontent
- basicPLM
- basicRMA
- boxplot
- chromosome
- crlmm
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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 (length(pnVec) x ncol(pmMat)) matrix with probeset summaries.
- **StdErrors**: A (length(pnVec) x ncol(pmMat)) matrix with standard errors of 'Estimates'.
- **Residuals**: A (nrow(pmMat) x ncol(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 <- basicRMA(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**

```r
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

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

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

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 pallete in RColorBrewer, therefore useful to describe quantitative features ranging on two extremes.
Examples

```r
x <- 1:10
y <- 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

Estimate affinity coefficients.

Description

Estimate affinity coefficients using sequence information and splines.

Usage

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.
**getCrlmmSummaries**  
*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  
getCrlmmSummaries(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  
getNetAffx(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**  
'AnnotatedDataFrame' 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
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**

Retrieve platform design object.

**Usage**

```r
getPlatformDesign(object)
getPD(object)
```

**Arguments**

- `object` FeatureSet object

**Details**

Retrieve platform design object.

**Value**

A 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**

```r
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

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>object</td>
<td>FeatureSet object</td>
</tr>
<tr>
<td>type</td>
<td>character defining the type of the probes to be queried. Valid options are 'pm', 'mm', 'bg'</td>
</tr>
</tbody>
</table>

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**

```r
## 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
}
```

justSNPRMA  

Summarization of SNP data

Description

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

Usage

```
justSNPRMA(filenames, verbose = TRUE, phenoData = NULL, normalizeToHapmap = TRUE)
```
Arguments
filenames character vector with the filenames.
verbose logical flag for verbosity.
phenoData a phenoData object or NULL
normalizeToHapmap Normalize to Hapmap? Should always be TRUE, but it’s kept here for future use.

Value
SnpQSet or a SnpCnvQSet, depending on the array type.

Examples
## snprmaResults <- justSNPRMA(list.celfiles())

list.xysfiles List XYS files

Description
Lists the XYS files.

Usage
list.xysfiles(...)

Arguments
... 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
list.xysfiles()
MA plot

MA plots

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.

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**

```r
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.

Description
Accessors and replacement methods for the 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 and Gene 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)
  ngsExpressionFeatureSet <- read.xysfiles(xysFiles)
  pm(ngsExpressionFeatureSet)[1:10,]
}
```
**mmSequence**

**mmSequence**

*Probe Sequences*

**Description**

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

**Usage**

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

## mmSequence

### Description

Accessors for PM, MM or background probes indices.

### Usage

```r
mmindex(object, ...)
pmindex(object, ...)
bgindex(object, ...)
```

### Arguments

- **object**: FeatureSet or DBPDInfo object
- **...**: Extra arguments, not yet implemented

### Details

The indices are ordered by 'fid', i.e. they follow the order that the probes appear in the CEL/XYS files.

### Value

A vector of integers representing the rows of the intensity matrix that correspond to PM, MM or background probes.

### Examples

```r
## How pm() works
## Not run:
x <- read.celfiles(list.celfiles())
pms0 <- pm(x)
pms1 <- pmindex(x)
pms1 <- exprs(x)[pm[1],]
identical(pms0, pms1)

## End(Not run)
```
Arguments

object FeatureSet, AffySNPPDInfo or DBPInfo 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.

coeffs and residsl, 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.

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
coeff signature(object = "oligoPLM"): accessor/replacement method to coef slot
coefs.probe signature(object = "oligoPLM"): accessor/replacement method to coefs.probe slot
gallery signature(object = "oligoPLM"): accessor/replacement method to gallery 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.
paCalls

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

## 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

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

Examples

```r
## Not run:
if (require(oligoData) & require(pd.huex.1.0.st.v2)){
data(affyExonFS)
## Get only 2 samples for example
dabgP = paCalls(affyExonFS[, 1:2])
dabgPS = paCalls(affyExonFS[, 1:2], "PSDABG")
head(dabgP) ## for probe
head(dabgPS) ## for probeset
}
## End(Not run)
```

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**

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**

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 DBPDInfo
- `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*.
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.
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

```r
readSummaries
```

**protocolData**

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)
}
```

---

**Description**

This function read the different summaries generated by crlmm.

**Usage**

```r
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
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 'crlmme' 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

Description

Retrieves date information in CEL/XYS files.

Usage

runDate(object)

Arguments

object 'FeatureSet' object.

sequenceDesignMatrix

Create design matrix for sequences

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

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)
summarize

Preprocessing SNP Arrays

Description

This function preprocess SNP arrays.

Usage

```r
snprma(object, verbose = TRUE, normalizeToHapmap = TRUE)
```

Arguments

- `object`: SnpFeatureSet
- `verbose`: Verbosity flag, logical
- `normalizeToHapmap`: internal

Value

A SnpQSet object.

Tools for microarray preprocessing.

Description

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

Usage

```r
backgroundCorrectionMethods()
normalizationMethods()
summarizationMethods()
backgroundCorrect(object, method=backgroundCorrectionMethods(), copy=TRUE, extra, subset=NULL, target=quotesingle.Var core quotesingle.Var, verbose=TRUE, ...)
summarize(object, probes=rownames(object), method="medianpolish", verbose=TRUE, ...)
## S4 method for signature 'FeatureSet'
normalize(object, method=normalizationMethods(), copy=TRUE, subset=NULL, target='core', verbose=TRUE, ...)
## S4 method for signature 'matrix'
normalize(object, method=normalizationMethods(), copy=TRUE, verbose=TRUE, ...)
## S4 method for signature 'ff_matrix'
normalize(object, method=normalizationMethods(), copy=TRUE, verbose=TRUE, ...)
normalizeToTarget(object, targetDist, method="quantile", copy=TRUE, verbose=TRUE)
```
summarize

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)
  }
}
summarize

res <- normalize(nimbleExpressionFS, method=mtd, verbose=FALSE)
boxplot(res, main=mtd)

}
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