

Package ‘frma’

May 17, 2024

Version 1.56.0

Date 2017-11-08

Title Frozen RMA and Barcode

Description Preprocessing and analysis for single microarrays and microarray batches.

Author Matthew N. McCall <mccallm@gmail.com>, Rafael A. Irizarry <rafa@jhu.edu>, with contributions from Terry Therneau

Maintainer Matthew N. McCall <mccallm@gmail.com>

Depends R (>= 2.10.0), Biobase (>= 2.6.0)

Imports Biobase, MASS, DBI, affy, methods, oligo, oligoClasses, preprocessCore, utils, BiocGenerics

Suggests hgu133afmavecs, frmaExampleData

biocViews Software, Microarray, Preprocessing

License GPL (>= 2)

URL <http://bioconductor.org>

git_url <https://git.bioconductor.org/packages/frma>

git_branch RELEASE_3_19

git_last_commit 35ab3e7

git_last_commit_date 2024-04-30

Repository Bioconductor 3.19

Date/Publication 2024-05-17

Contents

barcode	2
frma	3
frmaExpressionSet-class	4
GNUSE	5
Index	7

barcode	<i>Gene Expression Barcode</i>
---------	--------------------------------

Description

This function converts expression values produced via fRMA to a gene expression barcode.

Usage

```
barcode(object, platform=NULL, mu=NULL, tau=NULL, cutoff=6.5, output="binary")
```

Arguments

object	a vector or matrix of expression values or an ExpressionSet or frmaExpressionSet produced by frma
platform	the platform of the input data. One of GPL96, GPL570, GPL571, GPL1261, GPL6244, GPL6246. Required if object is a vector or matrix and either mu or tau is NULL.
mu	the mean of the unexpressed distribution. If NULL then precomputed values are used if possible.
tau	the standard deviation of the unexpressed distribution. If NULL then precomputed values are used if possible.
cutoff	the lod score cutoff used if output is binary.
output	the desired values to be returned. Options are: p-value, z-score, lod, or binary.

Value

A matrix containing the type of output specified by the output parameter. The option *binary* creates a gene expression barcode where 1s denote expressed genes and 0s denote unexpressed genes. The option *p-value* returns the p-values for the expression values under the unexpressed distribution. The option *lod* returns the LOD scores for expression values under the unexpressed distribution. The option *z-score* returns the z-scores for the expression values under the unexpressed distribution.

Author(s)

Matthew N. McCall

Examples

```
library(frma)
library(frmaExampleData)
data(AffyBatchExample)
object <- frma(AffyBatchExample)
bc <- barcode(object)
```

frma	<i>Frozen Robust Multi-Array Analysis</i>
------	---

Description

This function preprocesses an AffyBatch, ExonFeatureSet, or GeneFeatureSet object using the fRMA method.

Usage

```
frma(object, background="rma", normalize="quantile",
      summarize="robust_weighted_average", target="probeset",
      input.vecs=NULL, output.param=NULL, verbose=FALSE)
```

Arguments

object	an AffyBatch, ExonFeatureSet, or GeneFeatureSet
background	type of background correction to perform: either "none" or "rma".
normalize	type of normalization to perform: either "none" or "quantile".
summarize	type of summarization to perform: one of "median_polish", "average", "median", "weighted_average", "robust_weighted_average", "random_effect".
target	summarization level for exon and gene arrays. Must be one of: probeset, core, full (exon only), extended (exon only).
input.vecs	a list of vectors to be used in preprocessing. If NULL, the correct package with pre-made vectors is loaded if it has been installed. These packages are of the form: <platform>frmavecs.
output.param	a vector of output elements to return. By default only the expression values and standard errors (if applicable) are returned. Additional options are: "residuals", "weights", "random_effects"
verbose	logical value. If TRUE then some messages are displayed while the function runs.

Value

The function returns an ExpressionSet if output.param=NULL or an frmaExpressionSet otherwise.

Author(s)

Matthew N. McCall

Examples

```
library(frmaExampleData)
data(AffyBatchExample)
object <- frma(AffyBatchExample)
```

frmaExpressionSet-class

Class to Contain and Describe High-Throughput Expression Level Assays preprocessed with fRMA

Description

This is a class representation for fRMA-preprocessed expression data. `frmaExpressionSet` class is derived from `ExpressionSet`, and requires a matrix named `exprs` and optionally matrices named `se.exprs`, `weights`, and `residuals`.

Extends

Extends class `ExpressionSet`.

Creating Objects

```
new("frmaExpressionSet", exprs = new("matrix"), se.exprs = new("matrix"), weights=new("matrix"),
residuals=new("matrix"), randomeffects=new("matrix"), phenoData = new("AnnotatedDataFrame"),
featureData = new("AnnotatedDataFrame"), experimentData = new("MIAME"), annotation =
new("character"), ...)
```

This creates a `frmaExpressionSet` with `assayData` implicitly created to contain `exprs` and `se.exprs`. The only required named arguments is `exprs`. Three optional named matrices, `weights`, `residuals`, and `randomeffects` can be added to the object.

```
new("frmaExpressionSet", assayData = assayDataNew(exprs=new("matrix"), se.exprs=new("matrix")),
weights=new("matrix"), residuals=new("matrix"), randomeffects=new("matrix"), phenoData
= new("AnnotatedDataFrame"), featureData = new("AnnotatedDataFrame"), experimentData
= new("MIAME"), annotation = new("character"), ...)
```

This creates a `frmaExpressionSet` with `assayData` provided explicitly. In this form, the only required named argument is `assayData`. Three optional named matrices, `weights`, `residuals`, and `randomeffects` can be added to the object.

Slots

`se.exprs`: standard errors for the expression estimates

`weights`: weights used in the summarization step

`residuals`: residuals from fitting the probe-level model

`randomeffects`: random effect estimates from fitting the probe-level model using random effect summarization

Inherited from `ExpressionSet`:

`assayData`: Contains matrices with equal dimensions, and with column number equal to `nrow(phenoData)`. `assayData` must contain a matrix `exprs` with rows representing features and columns representing samples. It may also contain a matrix `se.exprs` containing standard errors.

`phenoData`: See `eSet`

annotation: See eSet
 featureData: See eSet
 experimentData: See eSet

Methods

Class-specific methods:

se.exprs(frmaExpressionSet) Access elements named se.exprs in the AssayData-class slot.
 weights(frmaExpressionSet) Access elements named weights
 residuals(frmaExpressionSet) Access elements named residuals
 randomeffects(frmaExpressionSet) Access elements named randomeffects

For derived methods (see ExpressionSet).

See Also

eSet-class, ExpressionSet-class, frma.

Examples

```
# create an instance of frmaExpressionSet
new("frmaExpressionSet")
```

G_NU_SE

G_NU_SE

Description

Computes the generalized normalized unscaled standard error (a measure of microarray quality).

Usage

```
GNUSE(object, medianSE=NULL, type=c("plot", "values", "stats", "density"), ...)
```

Arguments

object	an ExpressionSet or frmaExpressionSet containing standard errors produced by frma
medianSE	median standard errors to be used. If NULL, these are obtained from the correct frmavecs package.
type	the desired output
...	additional graphical parameters for types plot or density

Value

If type is plot, boxplots of GNUSE values are displayed. If type is values, the GNUSE values are returned. If type is stats, the median, IQR, 95th, and 99th percentiles are reported. If type is density, a density plots of GNUSE values are displayed.

Author(s)

Matthew N. McCall

Examples

```
library(frma)
library(frmaExampleData)
data(AffyBatchExample)
object <- frma(AffyBatchExample)
GNUSE(object, type="stats")
```

Index

- * **classes**
 - frmaExpressionSet-class, 4
- * **manip**
 - barcode, 2
 - frma, 3
 - GNUSE, 5
- as.ExpressionSet, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- barcode, 2
- class:frmaExpressionSet
(frmaExpressionSet-class), 4
- frma, 3
- frmaExpressionSet
(frmaExpressionSet-class), 4
- frmaExpressionSet-class, 4
- frmaExpressionSet-methods
(frmaExpressionSet-class), 4
- GNUSE, 5
- initialize, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- randomeffects
(frmaExpressionSet-class), 4
- randomeffects, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- randomeffects<-
(frmaExpressionSet-class), 4
- randomeffects<-, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- residuals, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- residuals<- (frmaExpressionSet-class), 4
- residuals<-, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- se.exprs, ExpressionSet-method
(frmaExpressionSet-class), 4
- se.exprs, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- se.exprs<- (frmaExpressionSet-class), 4
- se.exprs<-, ExpressionSet-method
(frmaExpressionSet-class), 4
- se.exprs<-, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- weights, frmaExpressionSet-method
(frmaExpressionSet-class), 4
- weights<- (frmaExpressionSet-class), 4
- weights<-, frmaExpressionSet-method
(frmaExpressionSet-class), 4