Package 'funtooNorm'

November 12, 2026

Type Package

Title Normalization Procedure for Infinium HumanMethylation450 BeadChip Kit

Version 1.36.0

Date 2017-09-19

Author Celia Greenwood <celia.greenwood@mcgill.ca>,Stepan Grinek <stepan.grinek@ladydavis.ca>, Maxime Turgeon <maxime.turgeon@mail.mcgill.ca>, Kathleen Klein <kathleen.klein@mail.mcgill.ca>

Maintainer Kathleen Klein <kathleen.klein@mail.mcgill.ca>

Description Provides a function to normalize Illumina Infinium Human Methylation 450 BeadChip (Illumina 450K), correcting for tissue and/or cell type.

License GPL-3

Imports pls, matrixStats, minfi, methods, IlluminaHumanMethylation450kmanifest, IlluminaHumanMethylation450kanno.ilmn12.hg19, GenomeInfoDb, grDevices, graphics, stats

Suggests prettydoc, minfiData, knitr, rmarkdown

Depends R(>= 3.4)

LazyData true

VignetteBuilder knitr

biocViews DNAMethylation, Preprocessing, Normalization

RoxygenNote 6.0.1

git_url https://git.bioconductor.org/packages/funtooNorm

git_branch RELEASE_3_23

git_last_commit 9526945

git_last_commit_date 2026-04-28

Repository Bioconductor 3.23

Date/Publication 2026-11-11

Contents

funtooNorm-package . . . 2
agreement . . . 3
fromGenStudFiles . . . 3
fromRGChannelSet . . . 4
funtooNorm . . . 5
getGRanges . . . 6
getNormBeta . . . 6
getNormM . . . 7
getRawBeta . . . 8
getSnpM . . . 9
plotValidationGraph . . . 9
SampleSet-class . . . 10
show,SampleSet-method . . . 11

Index **12**

`funtooNorm-package` *funtooNorm*

Description

The funtooNorm Package provides a normalization method for data arising from the Illumina Infinium Human Methylation 450 BeadChip (Illumina 450K), including explicit considerations of differences between tissues or cell types. This method should only be used when the data set contains samples fom multiple different tissues or cell types.

Details

Package:	funtooNorm
Type:	Package
License:	GPL-3

Author(s)

Celia Greenwood, Stepan Grinek, Raphael Poujol, Maxime Turgeon, Kathleen Oros Klein

agreement *Function to measure intra-replicate agreement for methylation data.*

Description

Function to measure intra-replicate agreement for methylation data.

Usage

```
agreement(Beta, individualID)
```

Arguments

Beta	: Matrix with beta-values, rows corresponding to probes, columns corresponding to samples.
individualID	: a vector where 2 replicates have the exact same value for two technical replicates. Order of samples should nmatch the samples (columns) in Beta

Details

We expect that the values returned by the agreement function after normalization by funtooNorm to be smaller than before.

Value

The average value of the square distance between replicates: a measure of agreement between replicates in methylation data.

Examples

```
agreement(cbind(rnorm(n = 10),rnorm(n = 10),rnorm(n = 10)),c(1,1,1))
```

fromGenStudFiles *Creates a S4 object of class 'SampleSet' from GenomeStudio files*

Description

Creates a S4 object of class 'SampleSet' from GenomeStudio files

Usage

```
fromGenStudFiles(controlProbeFile, signalFile, cell_type)
```

Arguments

controlProbeFile	The control probe file exported from GenomeStudio
signalFile	The signals exported from GenomeStudio samples must be in same order as the control probe File
cell_type	A vector of cell types, names must match control probes and signal files.

Value

An object of class 'SampleSet'.

---

fromRGChannelSet *Creates an object of class SampleSet from a RGChannelSet minfi*

Description

Creates a object of class SampleSet from the raw unprocessed data in RGChannelSet

Usage

```
fromRGChannelSet(myRGChannelSet)
```

Arguments

myRGChannelSet : RGChannelSet, from minfi package, should contain a cell_type vector in pData

Value

An object of class 'SampleSet'

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
```

funtooNorm *The funtooNorm normalization function*

Description

funtooNorm Returns the normalized signals to the SampleSet object

Usage

```
funtooNorm(object, type.fits = "PCR", ncmp = 4, force = FALSE,
  sex = NULL)

## S4 method for signature 'SampleSet'
funtooNorm(object, type.fits = "PCR", ncmp = 4,
  force = FALSE, sex = NULL)
```

Arguments

object	Object of class SampleSet
type.fits	Choice between "PCR" or "PLS" (default="PCR")
ncmp	Number of components included in the analysis (default=4)
force	If set to TRUE, forces the normalization procedure to re-compute
sex	Boolean vector if male. if NULL Beta values from ChrY are used for classification.

Details

This is a generic function which applies to autosomes and the X chromosome. Chromosome Y requires separate analysis as there are few probes on Y. We use a straightforward quantile normalization applied to males only.

Value

a S4 object of class SampleSet containing the normalized signal

Methods (by class)

- SampleSet: The funtooNorm normalization function

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
mySampleSet=funtooNorm(mySampleSet)
```

getGRanges *Build GRange object of methylation probes*

Description

Build GRange object of methylation probes

Usage

```
getGRanges(object)

## S4 method for signature 'SampleSet'
getGRanges(object)
```

Arguments

object	Object of class SampleSet.

Value

A GRange object of the positions of each cpg.

Methods (by class)

- SampleSet: Build GRange object of methylation probes

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
gr=getGRanges(mySampleSet)
```

getNormBeta *Computes Beta values from normalized signals*

Description

Computes Beta values from normalized signals

Usage

```
getNormBeta(object, offset = 100)

## S4 method for signature 'SampleSet'
getNormBeta(object, offset = 100)
```

Arguments

object	of type SampleSet
offset	default is 100 as Illumina standard

Value

a matrix containing beta after normalization value for each CpG position and each samples

Methods (by class)

- SampleSet: Computes Beta values from normalized signals

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
b=getNormBeta(funtooNorm(mySampleSet))
```

---

getNormM *Computes M values,log2(Meth/Unmeth), from normalized signals*

Description

Computes M values,log2(Meth/Unmeth), from normalized signals

Usage

```
getNormM(object)

## S4 method for signature 'SampleSet'
getNormM(object)
```

Arguments

object	An object of class SampleSet

Value

a matrix containing M values, log2(Meth/Unmeth), after normalization

Methods (by class)

- SampleSet: Computes M values, log2(Meth/Unmeth), from normalized signals

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
m=getNormM(funtooNorm(mySampleSet))
```

`getRawBeta` *Computes Beta value from raw signals*

Description

Computes Beta value from raw signals

Usage

```
getRawBeta(object, offset = 100)

## S4 method for signature 'SampleSet'
getRawBeta(object, offset = 100)
```

Arguments

`object`	object of class SampleSet
`offset`	default is 100 as Illumina standard

Value

a matrix containing the raw beta value for each position and each samples

Methods (by class)

- `SampleSet`: Computes Beta value from raw signals

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
r=getRawBeta(mySampleSet)
```

getSnpM *Computes M values after normalization of SNP data.*

Description

Computes M values after normalization of SNP data.

Usage

```
getSnpM(object)

## S4 method for signature 'SampleSet'
getSnpM(object)
```

Arguments

object	of class SampleSet

Value

a matrix containing M values, log2(Meth/Unmeth), after normalization for SNP data

Methods (by class)

- SampleSet: Computes M values, log2(Meth/Unmeth), for normalized SNP data

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
snp=getSnpM(funtooNorm(mySampleSet))
```

plotValidationGraph *plot of Validation Graph for determing number of components*

Description

Plots a series of graphs for each signal type, to determine the number of components to include in the normalization procedure.

Usage

```
plotValidationGraph(object, type.fits = "PCR", pdf.file = NULL)

## S4 method for signature 'SampleSet'
plotValidationGraph(object, type.fits = "PCR",
  pdf.file = NULL)
```

Arguments

object	of class SampleSet
type.fits	can be "PCR" or "PLS" (default "PCR")
pdf.file	if no file name is provided print pdf file plotValidationGraph.pdf in working directory.

Value

No value is returned. The function prints the plots to a pdf file.

Methods (by class)

- SampleSet: Plots a series of graphs for each signal type, to determine the number of components to include in the normalization procedure.

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
plotValidationGraph(mySampleSet)
```

SampleSet-class *S4 class object SampleSet*

Description

SampleSet is an S4 class defined for the purpose of running the funtooNorm algorithm. They are lists containing signal data and different variables useful for funtooNorm. The data is separated into the 3 probes types, each having 2 channels (methylated and unmethylated ie : A and B) We then define then the 6 (2*3) labels: AIGrn BIGrn AIRed BIRed AII BII

Value

a S4 object of class SampleSet

Slots

`type` Character: is 'minfi' or 'GenomeStudio'

`sampleNames` character vector: contain the list of sample names in order used

`sampleSize` numeric: the number of samples

`nPos` numeric: the number of positions in the ILLUMINA chip

`annotation` character: the annotation object from minfi package

`cell_type` factor: vector of the cell type for each sample as factors

`qntllist` numeric: vector of ordered quantiles

`quantiles` list: list of 6 quantiles tables for the 6 signal types

`ctl.covmat` matrix: covariance matrix for the model fit

`signal` list: list of the values for all 6 probe types.

`names` list: list of probes for each type

`predmat` list: list of the normalized values for all 6 probe types.

Examples

```
showClass("SampleSet")
```

`show,SampleSet-method` *Show Object SampleSet*

Description

Display informations about the SampleSet object

Usage

```
## S4 method for signature 'SampleSet'
show(object)
```

Arguments

`object`	an object of class SampleSet
`...`	optional arguments passed to or from other methods.

Value

No value is returned. The function prints the summary of object of class SampleSet to screen

Examples

```
require(minfiData)
pData(RGsetEx)$cell_type <- rep(c("type1","type2"),3)
mySampleSet=fromRGChannelSet(RGsetEx)
mySampleSet
```

Index

∗ **Methylation, Preprocessing, PLS**
funtooNorm-package, 2

agreement, 3

fromGenStudFiles, 3
fromRGChannelSet, 4
funtooNorm, 5
funtooNorm,SampleSet-method *(*funtooNorm*)*, 5
funtooNorm-package, 2

getGRanges, 6
getGRanges,SampleSet-method *(*getGRanges*)*, 6
getNormBeta, 6
getNormBeta,SampleSet-method *(*getNormBeta*)*, 6
getNormM, 7
getNormM,SampleSet-method *(*getNormM*)*, 7
getRawBeta, 8
getRawBeta,SampleSet-method *(*getRawBeta*)*, 8
getSnpM, 9
getSnpM,SampleSet-method *(*getSnpM*)*, 9

plotValidationGraph, 9
plotValidationGraph,SampleSet-method *(*plotValidationGraph*)*, 9

SampleSet-class, 10
show,SampleSet-method, 11