Package ‘CNAnorm’

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Title A normalization method for Copy Number Aberration in cancer samples
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Depends R (>= 2.10.1), methods
Description Performs ratio, GC content correction and normalization of data obtained using low coverage (one read every 100-10,000 bp) high throughput sequencing. It performs a “discrete” normalization looking for the ploidy of the genome. It will also provide tumour content if at least two ploidy states can be found.
License GPL-2
Imports DNAcopy
URL http://www.r-project.org
LazyLoad yes
biocViews CopyNumberVariation, Sequencing, Coverage, Normalization, WholeGenome, DNASeq, GenomicVariation
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R topics documented:

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addDNACopy

Methods for Function addDNACopy in Package ‘CNAnorm’

Description

addSmooth segment ratio values in Package ‘CNAnorm’ using DNACopy

Usage

## S4 method for signature 'CNAnorm'
addDNACopy(object, independent.arms = FALSE, ideograms = NULL,
DNAcopy.smooth = list(), DNAcopy.weight = character(), DNAcopy.segment = list())

Arguments

object An object of Class "CNAnorm"
independent.arms Boolean. If TRUE chromosomes arms will be treated as independent, ideograms must be provided
ideograms A data frame containing information about banding. See ?hg19_hs_ideogr for more information
DNAcopy.smooth A list of parameters to be passed to function ‘smooth.CNA’ in package DNAcopy
DNAcopy.weight A character value of one of these values. ‘poisson’, ‘gaussian’, ‘twoTailQuantile’, ‘oneTailQuantile’. It specifies a way to give weight to each window depending on how much coverage in the normal deviates from the median for that chromosome. Options are listed in decreasing order of stringency. See Details
DNAcopy.segment A list of parameters to be passed to function ‘segment’ in package DNAcopy. Parameters ‘weights’ and ‘verbose’ are not accepted
addSmooth

Details

'poisson': windows with coverage more or less than 2*sqrt(mean) from the mean are weighted down. The most stringent. Recommended for unbiased genome wide sequencing.

'gaussian': windows with coverage more or less than 2*sd from the median are weighted down. Recommended for genome wide sequencing where coverage in the normal is far from poisson distribution.

'twoTailQuantile': windows with coverage outside 5-95th quantile are weighted down. Recommended when coverage is far from a normal distribution - such as capture experiments -

'oneTailQuantile': windows with coverage lower than 5th quantile are weighted down. Recommended when coverage is far from a normal distribution - such as capture experiments. Does not weight down windows with very high coverage.

Value

An object of class "CNAnorm"

Methods

signature(object = "CNAnorm") Segment ratio values on an object of class "CNAnorm". Returns the same object with extra slots (segMean, segID)

Author(s)

Stefano Berri <s.berri@leeds.ac.uk> and Arief Gusnanto <a.gusnanto@leeds.ac.uk>

References


See Also

segMean, CNAnom-class, DNAcopy, hg19_hs_ideogr

Examples

data(LS041)
CN <- DataFrame2object(LS041)
CN <- addDNAcopy(CN)

addSmooth Methods for Function addSmooth in Package ‘CNAnorm’

Description

addSmooth segment and smooth perform ratio values in Package ‘CNAnorm’

Usage

## S4 method for signature 'CNAnom'
addSmooth(object, lambda = 7, ...)

```r
```
Arguments

object An object of Class "CNAnorm"
lambda Degree of smoothness. See reference for more details
...

Further arguments to pass to the function smoothseg

Value

An object of class "CNAnorm"

Methods

signature(object = "CNAnorm") Segment and smooth perform ratio values on an object of class "CNAnorm". Returns the same object with extra slot (ratio.s)

Author(s)

Stefano Berri <s.berri@leeds.ac.uk> and Arief Gusnanto <a.gusnanto@leeds.ac.uk>

References


See Also

ratio.s, CNAnorm-class

Examples

data(LS041)
CN <- dataFrame2object(LS041)
CN.gcNorm <- gcNorm(CN, exclude = c("chrX", "chrY", "chrM"))
CN.smooth <- addSmooth(CN)

Description

chrs returns/set the name of chromosomes/contigs
arms returns the name of the chromosome and arm. A data frame containing ideogram information has to be provided. See ?hg19_hs_ideogr for an example
pos returns/set the position of starting window. Be careful! If you need to change data, it is better to change the input data and start over.

Usage

chrs(object)
## S4 method for signature 'CNAnorm'
pos(object, show = "start")
## S4 method for signature 'CNAnorm'
arms(object, banding_df)
Arguments

object   An object of Class “CNAnorm”
show     The position to show: ‘start’, ‘end’
banding_df A data frame with information about ideogram

Value

chrs and arms return a character vector, pos returns a numeric vector

Author(s)

Stefano Berri <s.berri@leeds.ac.uk>

See Also

gcNorm, CNAnorm-class, hg19_hs_ideogr

Examples

data(LS041)
data(hg19_hs_ideogr)
CN <- dataFrame2object(LS041)
DataFrameNames <- as.character(LS041$Chr)
objectNames <- chrs(CN)
armNames <- arms(CN, hg19_hs_ideogr)
# check the names are, indeed, the same
all(DataFrameNames == objectNames)
# make shorter names, drop the first three letters (‘chr’)
shortNames <- substr(chrs(CN), 4, nchar(chrs(CN)))
chrs(CN) <- shortNames

# retrieve all new names
unique(chrs(CN))
unique(armNames)

---

**CN**  
A **CNAnorm** object with information about most abundant ploidy states, obtained from data LS041.

Description

This data is to provide an object to use in several examples without having to wait for computing it. To see how it was generated, see documentation of function peakPloidy.

Usage

data(CN)

Format

A **CNAnorm** object
Class to Contain and Describe copy number aberration (CNA) data from low coverage (approx 0.01 - 0.5X) Next Generation Sequencing

Objects from the Class

Objects can be created by calls of the form `new("CNAnorm", InData)`.

Slots

* **InData**: Object of class "InData". Contains input data provided by the user. All slots have same length. Each element describe one window. See Class "InData"

* **DerivData**: Object of class "DerivData". Contains data derived from "InData". It can be retrieved by the user, but methods should be used to populate "DerivData". All slots have same length as input data. See Class DerivData

* **Res**: Object of class "Res". Contains slots with obtained results. See Class "Res"

* **Params**: Object of class "Params". Contains crucial parameters passed to some of the methods for reusing in later steps or for documentation.

Methods

Summary of methods for class "CNAnorm". Type "methods ? methodName" for more details about methodName.

* **chrs** signature(object = "CNAnorm"): Retrieve Chromosomes/contig name

* **chrs<-** signature(object = "CNAnorm"): Set Chromosomes/contig name

* **guessPeaksAndPloidy** signature(object = "CNAnorm"): Estimate ploidy of the sample, tumor content and other results saved in Slot "Res"

* **length** signature(x = "CNAnorm"): Returns number of element/windows

* **plotGenome** signature(object = "CNAnorm"): Plot annotated normalized genome copy number

* **plotPeaks** signature(object = "CNAnorm"): Plot peaks and estimated/validated ploidy

* **pos** signature(object = "CNAnorm"): Retrieve Chromosomes/contig position

* **pos<-** signature(object = "CNAnorm"): Set Chromosomes/contig position

* **ratio** signature(object = "CNAnorm"): Retrieve ratio (Test/Control). If gcNorm was called, ratio is GC normalized

* **ratio.n** signature(object = "CNAnorm"): Retrieve normalized ratio (not smoothed)

* **ratio.s** signature(object = "CNAnorm"): Retrieve smoothed ratio

* **ratio.n.s** signature(object = "CNAnorm"): Retrieve normalized smoothed ratio

* **segMean** signature(object = "CNAnorm"): Retrieve segmented ratio (as provided by DNA-copy)

* **segMean.n** signature(object = "CNAnorm"): Retrieve normalized segmented ratio
Author(s)
Stefano Berri <s.berri@leeds.ac.uk> and Arief Gusnanto <a.gusnanto@leeds.ac.uk>

References
CNA-norm: Discrete Normalization of Copy Number Alteration data from clinical samples (in preparation)

See Also
InData, DerivData for documentation on the slots.

Examples
```r
data(LS041)
CNA <- new("CNAnorm", InData = new("InData", Chr = as.character(LS041$Chr), Pos = LS041$Pos,
                               Test = LS041$Test, Norm = LS041$Norm, GC = LS041$GC))
```

Description
This function is a wrapper to use for a fully automated CNAnorm workflow where interactivity is not required. It contains MOST possible parameterers. Defaults are set to to run a standard and conservative workflow.

Usage
```r
CNAnormWorkflow(dataFrame, gc.do=FALSE, gc.exclude=character(0),
                 gc.maxNumPoints=10000, smooth.do=TRUE, smooth.lambda=7,
                 smooth.other=list(), peak.method="closest", peak.exclude=character(0),
                 peak.ploidyToTest=12, peak.sd=5, peak.dThresh=0.01, peak.n=2048,
                 peak.adjust=9, peak.force.smooth=TRUE, peak.reg=FALSE, peak.ds=1.5,
                 peak.zero.count=FALSE, peak.other=list(), DNAcopy.do=TRUE,
                 DNAcopy.independent.arms=FALSE, DNAcopy.ideograms=NULL,
                 DNAcopy.smooth=list(), DNAcopy.segment=list(), DNAcopy.weight=character(),
                 dNorm.normBy=NULL)
```

Arguments
All arguments are explained in the relative functions
A data frame with columns Chr, Pos, Test, Norm and optional GC. See dataFrame2object
gdataframe Specify if GC correction need to be done. See gcNorm
gc.exclude See gcNorm
gc.maxNumPoints See gcNorm
smooth.do Specify if smoothing need to be done. See addSmooth
smooth.lambda See addSmooth
smooth.other  A list of other parameters to pass to the smoothing function. See addSmooth
peak.method    See peakPloidy
peak.exclude    See peakPloidy
peak.ploidyToTest   See peakPloidy
peak.sd         See peakPloidy
peak.dThresh    See peakPloidy
peak.n          See peakPloidy
peak.adjust     See peakPloidy
peak.force.smooth        See peakPloidy
peak.reg         See peakPloidy
peak.ds          See peakPloidy
peak.zero.count  See peakPloidy
peak.other       A list of other parameters to be passed to functions for peak detection. See peakPloidy
DNAcopy.do   Specify if segmentation with DNAcopy need to be done. See addDNACopy
DNAcopy.independent.arms   See addDNACopy
DNAcopy.ideograms  See addDNACopy
DNAcopy.smooth     See addDNACopy
DNAcopy.segment    See addDNACopy
DNAcopy.weight     See addDNACopy
dNorm.normBy      See discreteNorm

Value

An object of Class "CNAnorm"

Author(s)

Stefano Berri <s.berri@leeds.ac.uk>

See Also

dataFrame2object, gcNorm, addSmooth, peakPloidy, addDNACopy, discreteNorm

Examples

data(LS041)
CN <- CNAnormWorkflow(LS041)
**dataFrame2object**

*Convert a data frame into an object of Class "CNAnorm"*

**Description**

Convert a data frame with column: Chr, Pos, Test, Norm and optional GC into object of class "CNAnorm"

**Usage**

dataFrame2object(dataFrame)

**Arguments**

dataFrame A data frame with columns Chr, Pos, Test, Norm and optional GC

**Value**

An object of Class "CNAnorm"

**Author(s)**

Stefano Berri <s.berri@leeds.ac.uk>

**See Also**

CNAnorm-class, InData-class, data.frame

**Examples**

data(LS041)
CN <- dataFrame2object(LS041)

---

**DerivData-class**

*Class "DerivData"*

**Description**

A Class containing data derived from InData used for further computation and plotting.

**Objects from the Class**

Objects can be created by calls of the form new("DerivData"), however DerivData is typically populated using methods. If a slot has not been populated yet, it has zero length, otherwise slots have the same length as InData.
discreteNorm

Slots

discreteNorm performs normalization of data using information on ploidy. Implicitly calls "validation" if no validation was performed.

Usage

## S4 method for signature 'CNAnorm'
discreteNorm(object, normBy = object)
exportTable

Arguments

object An object of Class "CNAnorm" to normalize
normBy An object of Class "CNAnorm" used to set normalization. It is possible, for instance, to normalize a sample at high resolution, using information obtained from the same sample at low resolution

Value
An object of class "CNAnorm"

Author(s)
Stefano Berri <s.berri@leeds.ac.uk> and Arief Gusnanto <a.gusnanto@leeds.ac.uk>

References

See Also
validation, peakPloidy

Examples

data(CN)
# see peakPloidy documentation to know how object CN is created
CN <- discreteNorm(CN)

Methods for Function exportTable in Package 'CNAnorm'

Description
exportTable write a table with normalised values of each window. A wrapper to "write.table"

Usage

## S4 method for signature 'CNAnorm'
exportTable(object, file = "CNAnorm_table.tab", show = 'ratio', sep = "\t", row.names = FALSE, ...)

Arguments

object an object of Class "CNAnorm"
file name of the file to save to
show what should be reported in the table: "ratio": the normalized ratio (a value of 1 means diploid). "ploidy": the same as ratio * 2. "center": report ratio centered on the most abundant copy. Ratio of 1 means that the most abundant "state" is centered to 1
gcNorm

sep
row.names
... Extra arguments to be passed to "write.table"

Details

It produces a tab delimited text file with the following columns:

Chr: Chromosome/contig name.
Pos: Starting position of the window.
Ratio: Ratio Test/Normal for each window after GC correction.
Ratio.n: Ratio Test/Normal or ploidy for each window after normalisation.
Ratio.s.n: Smoothed and normalised ratio Test/Normal or ploidy for each window.
SegMean: Mean of the segment this window belongs to.
SegMean.n: Normalised mean ratio Test/Normal or ploidy of the segment this window belongs to.

Value

An object of class "CNAnorm"

Author(s)

Stefano Berri <s.berri@leeds.ac.uk>

See Also

write.table

Examples

data(CN)
CN <- validation(CN)
CN <- discreteNorm(CN)
exportTable(CN, file = "CNAnorm_table.tab", show = 'ploidy')

Methods for Function gcNorm in Package 'CNAnorm'

Description

gcNorm perform GC content normalization on ratio Test/Normal in Package 'CNAnorm'

Usage

## S4 method for signature 'CNAnorm'
gcNorm(object, exclude = character(0), maxNumPoints = 10000)
Arguments

- **object**: An object of Class "CNAnorm"
- **exclude**: A character vector with name of chromosomes/contigues not to use to calculate GC content correction. All genome, however, will be corrected
- **maxNumPoints**: Maximum number of data points to fit the loess correction. For computational purposes, if the number of points in ratio(object) is greater than maxNumPoints, only maxNumPoints randomly selected will be used

Value

An object of class "CNAnorm"

Methods

- **signature(object = "CNAnorm")**: Perform GC content correction on an object of class "CNAnorm". Returns the same object with corrected ratio

Author(s)

Stefano Berri <s.berri@leeds.ac.uk>

See Also

- loess, CNAnorm-class, ratio

Examples

```r
data(LS041)
CN <- dataFrame2object(LS041)
# correct for GC content, but ignoring data from sex chromosomes and mitocondria
CN.gcNorm <- gcNorm(CN, exclude = c("chrX", "chrY", "chrM"))
```

Description

This data object is used by some plotting methods and contains the default values. User can change graphical parameters by changing this object. The object consists of several layers referring to different plots and different properties. Here an indicative description:

- **gPar$genome**: parameters here refer to the plot produced by plotGenome
- **graphical parameters**: see ?par
- **$colors**: specify colors
- **$cex**: specify relative size - points, text...
- **$lwd**: specify line width
- **$lty**: specify line type - solid, dashed
- **$mar**: specify margins

Usage

```r
data(gPar)
```
**InData-class**

**Format**

A S3 object

---

hg19_hs_ideogr  
*An object with the ideogram information for homo sapiens - hg19*

**Description**

This is bundles data that can be provided to plotGenome in order to plot location of the centromere. In future release it might be used to produce an ideogram too

**Usage**

```r
data(hg19_hs_ideogr)
```

**Format**

A data.frame

---

**InData-class**  
*Class “InData”***

**Description**

A Class containing input data for CNA

**Objects from the Class**

Objects can be created by calls of the form `new("InData", Chr, Pos, Test, Norm, ratio, GC)`.

**Slots**

- **Chr**: Object of class "character". Name of the Chromosomes/Contigs of each window.
- **Pos**: Object of class "numeric". Starting position of the each window.
- **Test**: Object of class "numeric". Number of reads from Test in each window.
- **Norm**: Object of class "numeric". Number of reads from Normal (Control) in each window.
- **ratio**: Object of class "numeric". Ratio Test/Control in each window. Automatically computed if Test and Norm are provided, or user generated if Test and Norm are not know.
- **GC**: Object of class "numeric". GC content of each window.

**Methods**

- **length** signature(x = "InData"): Returns number of windows from input data.

**Author(s)**

Stefano Berri
References


See Also

CNAnorm

Examples

data(LS041)

inObject <- new("InData", Chr = as.character(LS041$Chr), Pos = LS041$Pos,
    Test = LS041$Test, Norm = LS041$Norm, GC = LS041$GC)

CNA <- new("CNAnorm", InData = inObject)

LS041

Mapped reads in tumor and matched blood for patient LS041

Description

This data set provide reads in tumor and matched blood for patient LS041. Each row has information about non-overlapping window across the genome. In particular it reports: chromosome name, starting position of the window (1 based), number of mapped reads in the test (lung tumor), number of reads in the control (matched blood) and GC content of the window.

Usage

data(LS041)

Format

A dataframe

References

Description
A Class containing some Parameters used in the analysis. Not heavily used at the moment.

Objects from the Class
Objects can be created by calls of the form new("Params"), it is usually iniziated and populated with methods and functions of class CNAnorm.

Slots
- method: variable of class "character". Record if the peakPloidy function was called using density or mixture.
- density.n: The variable "n" used when calling peakPloidy. This variable is saved so that can be used later for drawing plots.
- density.adjust: The variable "adjust" used when calling peakPloidy. This variable is saved so that can be used later for drawing plots.
- gc.excludeFromGCNorm: Vector of class "character". Name of the Chromosomes/Contigs not used for GC content correction.
- gc.maxNumPoints: One element vector of class "numeric". Specify how many points to use for GC correction.
- gp.excludeFromDensity: Vector of class "character". Name of the Chromosomes/Contigs not used for peak guessing.

Methods
- length signature(x = "Params")

Author(s)
Stefano Berri

References

See Also
CNAnorm

Examples
```r
data(LS041)
inObject <- new("InData", Chr = as.character(LS041$Chr), Pos = LS041$Pos,
    Test = LS041$Test, Norm = LS041$Norm, GC = LS041$GC)
CNA <- new("CNAnorm", InData = inObject)
```
peakPloidy

Methods for Function peakPloidy in Package `CNAnorm`

Description

peakPloidy Estimate most likely ploidy of genome looking at distribution of smoothed ratio.

Usage

```r
## S4 method for signature 'CNAnorm'
peakPloidy(object, method = 'mixture', exclude = character(0),
  ploidyToTest = 12, sd = 5, dThresh = 0.01, n = 2048, adjust = .9, force.smooth = TRUE,
  reg = FALSE, ds = 1.5, zero.cont = FALSE, ...)
```

Arguments

- `object` An object of Class "CNAnorm"
- `exclude` A character vector with names of Chromosomes/Contigs not to use to estimate ploidy.
- `method` A character element matching either "mixture", "density", "median", "mode" or "closest". "mixture" will fit a mixture model to find peaks; "density" will use the density function to find peaks; "median" "mode" and "closest" will only find one peak at the median, mode or peak closest to the median respectively. No tumour content or reliable estimated ploidy will be provided. These methods are meant to perform a more "standard" normalisation, without stretching the data. Suggested for germline CNV or a fully automated process that does not requires a normalisation on integer copy number or for highly heterogeneous sample where such normalisation would not be possible. Non ambiguous partial matches can be used.
- `ploidyToTest` Maximum ploidy allowed. **Warnings!** Computation time increases exponentially with this parameter if using "density".
- `adjust` The "adjust" parameter passed to the density function.
- `n` The "n" parameter passed to the density function.
- `force.smooth` If the input object does not have smoothed ratio, it will smooth using "addSmooth". It is highly recomended to use "force.smooth = TRUE"
- `sd` Parameter to filter outliers. Values greater than median + sd * standard deviations will be ignored while detecting peaks and ploidy.
- `dThresh` Parameter to filter outliers. Values with a density lower than max(density)*dThresh will be ignored while detecting peaks and ploidy.
- `reg` Parameter for mixture model: If set TRUE, the starting point for EM algorithm will be optimized through several methods including regular grid on the ratio distribution. The default is FALSE, by which the starting values are taken from the quantiles of the distribution.
- `ds` Parameter for mixture model: A constraint in EM algorithm of minimum distance between mean estimates, in terms of median standard deviation of the mixture components.
- `zero.cont` Parameter for mixture model: An argument for the mixture model. If set TRUE, the EM algorithm considers exactly-zero ratios as a mixture component.
- `...` Extra parameters to be passed to functions for peak detection, specific to each of the methods (density or mixture), se below for details.
plotGenome

Value
An object of class "CNAnorm"

Note
Other optional parameters to be passed (...)

  mixture method
  density method

  peakRatio
Threshold used to call a peak. Peaks smaller than maxPeakHeight/peakRatio are not
considered peaks.

  spacingTolerance
A parameter smaller than 1 which describes how strict the program should be
on alternative solutions. Only solution with the best R^2 >= max(R^2)*spacingTolerance will be
considered as valid.

  interceptRatio
Minimum value for the intercept of the linear model. Ideally, should be zero, but the
default allows a little flexibility.

Author(s)
Stefano Berri <s.berri@leeds.ac.uk> and Arief Gusnanto <a.gusnanto@leeds.ac.uk>

References
genome size and tumour cell content enables better estimation of copy number alterations from
next generation sequence data. Bioinformatics

See Also
CNAnorm-class, density

Examples

data(LS041)
CN <- dataFrame2object(LS041)
chr2skip <- c("chrY", "chrM")
CN <- gcNorm(CN, exclude = chr2skip)
CN <- addSmooth(CN, lambda = 3)
CN <- peakPloidy(CN, exclude = chr2skip)
# this object CN is what you obtain when you load
# data(CN)

plotGenome

Methods for Function plotGenome in Package 'CNAnorm'

Description
plotGenome plot normalized ratio and optionally segmented and/or smoothed normalized ratio val-
ues in Package 'CNAnorm'. It also shows annotation.
Usage

```r
## S4 method for signature 'CNAnorm'
plotGenome(object, maxRatio = 8, minRatio = -1,
    superimpose = character(0), gPar = NULL, numHorLables = 10,
    colorful = FALSE, show.centromeres = TRUE, idiogram = NULL, fixVAxes = FALSE,
    supLineColor = character(0), supLineCex = character(0), dot.cex = .2, ...)
```

Arguments

- `object`  
  An object of Class "CNAnorm"

- `maxRatio`  
  The maximum ratio to be shown on the plot. Values or ratio greater than maxRatio will be displayed as green triangulars

- `minRatio`  
  The minimum ratio to be shown on the plot. Values or ratio smaller than minRatio will be displayed as green triangulars

- `superimpose`  
  A character vector with one or both of the following: "smooth", "DNACopy"

- `numHorLables`  
  Number of maximum horizontal lables. The function will try to annotate numHorLables so that they are approximately equally spaced.

- `colorful`  
  A switch to decide if the background dots representing the ratio of each window should be gray or colored according their value in relation to the peak closest to the median

- `show.centromeres`  
  A switch to decide if location of centromere are displayed on the graph. The location of the centromere is stored in idiogram

- `idiogram`  
  A data frame containing banding information. if NULL -default- human information will be loaded by data(hg19_hs_ideogr)

- `fixVAxes`  
  A switch to decide if the vertical axes should be fixed to minRatio and maxRatio or fit the data within minRatio and maxRatio.

- `gPar`  
  A S3 object with all graphical parameters. If NULL (default) data(gPar) is called

- `supLineColor`  
  A three element character vector with colors to be used for first superimposed line, second superimposed line, normalized ratio dots. If none is provided, defaults are: c("black", "cyan", "grey60")

- `supLineCex`  
  A two element character vector with cex values to be used for width of first superimposed line and second superimposed line. If none is provided, defaults are: c(0.5, 0.5)

- `dot.cex`  
  size of the dots in the plot

- `...`  
  Further arguments to pass to the function `plot`

Value

An object of class "CNAnorm"

Author(s)

Stefano Berri <s.berri@leeds.ac.uk> and Arief Gusnanto <a.gusnanto@leeds.ac.uk>

See Also

- `plot`, `par`, `peakPloidy`, `gPar`, `hg19_hs_ideogr`
### Examples

```r
data(CN)
# see peakPloidy documentation to know how object CN is created
CN <- addDNACopy(CN)
CN <- validation(CN)
CN <- discreteNorm(CN)
plotGenome(CN, superimpose = 'DNACopy')
```

---

**plotPeaks**  
*Methods for Function plotPeaks in Package `CNAnorm`*

#### Description

plotPeaks plot annotated distribution of ratio Test/Normal

#### Usage

```r
## S4 method for signature 'CNAnorm'
plotPeaks(object, special1 = character(0), special2 = character(0), show = c('suggested', ...)
```

#### Arguments

- `object` An object of Class "CNAnorm"
- `special1` The chromosome/contig whose distribution will be shown with a different color
- `special2` The chromosome/contig whose distribution will be shown with a different color
- `show` A character vector with one or both of the following: "suggested", "validated". Specify what need to be plotted
- `...` Further arguments to pass to the function plot

#### Author(s)

Stefano Berri <s.berri@leeds.ac.uk>

#### See Also

plot, validation, peakPloidy

#### Examples

```r
data(CN)
# see peakPloidy documentation to know how object CN is created
plotPeaks(CN, special1 = 'chrX', special2 = 'chrY')
```
Methods for Function ratio in Package ‘CNAnorm’

Description

ratio returns the Test/Normal ratio from an object of class CNAnorm. ratio is corrected for GC content if gcNorm was called.
ratio.n returns the Test/Normal normalized ratio from an object of class CNAnorm after normalization. Its input is ratio(object)
ratio.s returns the Test/Normal smoothed ratio from an object of class CNAnorm Its input is ratio(object)
ratio.s.n returns the Test/Normal smoothed and normalized ratio from an object of class CNAnorm. Its input is ratio.s(object)
segMean returns the mean of the segments as produced by DNACopy
segMean.n returns the normalized mean of the segments

Usage

ratio(object)
ratio.n(object)
ratio.s(object)
ratio.s.n(object)
segMean(object)
segMean.n(object)

Arguments

object An object of Class "CNAnorm"

Value

A numeric vector

Author(s)

Stefano Berri <s.berri@leeds.ac.uk>

See Also

gcNorm, CNAnorm-class, DNACopy

Examples

data(LS041)
CN <- dataFrame2object(LS041)
ratio.original <- ratio(CN)
CN.gcNorm <- gcNorm(CN, exclude = c("chrX", "chrY", "chrM"))
ratio.gc.corrected <- ratio(CN.gcNorm)
retrieve peaks and ploidy

Methods for Function to retrieve suggested/validated ploidy and peaks in Package ‘CNAnorm’

Description

sugg.peaks returns the location of peaks before normalization as suggested by peakPloidy.
sugg.ploidy returns the ploidy of the peaks as suggested by peakPloidy.
valid.peaks returns the location of peaks before normalization as validated after calling method "validation"
valid.ploidy returns the validated ploidy of the peaks as validated after calling method "validation"

Usage

sugg.peaks(object)
sugg.ploidy(object)
valid.peaks(object)
valid.ploidy(object)

Arguments

object An object of Class “CNAnorm” after method "peakPloidy" was called

Value

A numeric vector

Author(s)

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See Also

gcNorm, CNAnorm-class, DNAcopy

Examples

data(CN)
  # see peakPloidy documentation to know how object CN is created
plot(sugg.ploidy(CN), sugg.peaks(CN))
validation

Methods for Function addSmooth in Package ‘CNAnorm’

Description

validation segment and smooth perform ratio values in Package ‘CNAnorm’

Usage

## S4 method for signature 'CNAnorm'
validation(object, peaks = sugg.peaks(object),
            ploidy = sugg.ploidy(object))

Arguments

object An object of Class “CNAnorm”
peaks The user validated location (ratio Test/Normal) of the peaks before normalization.
ploidy The user validated ploidy of the peaks before normalization.

Value

An object of class "CNAnorm"

Note

It is implicitly called by discreteNorm if no validation was manually performed

Author(s)

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See Also

ratio.s, CNAnorm-class

Examples

data(CN)
# see peakPloidy documentation to know how object CN is created
CN <- validation(CN)
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