Package ‘soGGi’

November 22, 2016

Type Package

Title Visualise ChIP-seq, MNase-seq and motif occurrence as aggregate plots Summarised Over Grouped Genomic Intervals

Version 1.6.0

Date 2015-12-02

Author Gopuraja Dharmalingam, Tom Carroll

Maintainer Tom Carroll <tc.infomatics@gmail.com>

Description The soGGi package provides a toolset to create genomic interval aggregate/summary plots of signal or motif occurrence from BAM and bigWig files as well as PWM, rlelist, GRanges and GAignments Bioconductor objects. soGGi allows for normalisation, transformation and arithmetic operation on and between summary plot objects as well as grouping and subsetting of plots by GRanges objects and user supplied metadata. Plots are created using the GGplot2 library to allow user defined manipulation of the returned plot object. Coupled together, soGGi features a broad set of methods to visualise genomics data in the context of groups of genomic intervals such as genes, superenhancers and transcription factor binding events.

biocViews Sequencing, ChIPSeq, Coverage

License GPL (>= 3)

LazyLoad yes

Depends R (>= 3.2.0), BiocGenerics, SummarizedExperiment

Imports methods, reshape2, ggplot2, S4Vectors, IRanges, GenomeInfoDb, GenomicRanges, Biostrings, Rsamtools, GenomicAlignments, rtracklayer, preprocessCore, chipseq, BiocParallel

Collate ’allClasses.r’ ’motifTools.R’ ’peakTransforms.r’ ’plots.R’ ’soggi.R’

VignetteBuilder knitr

Suggests testthat, BiocStyle, knitr

NeedsCompilation no

R topics documented:

c,ChIPprofile-method ..................................................  2
Join, subset and manipulate ChIPprofile objects

Description

Join, subset and manipulate ChIPprofile objects

Usage

## S4 method for signature 'ChIPprofile'
c(x, ..., recursive = FALSE)

## S4 method for signature 'ChIPprofile'
rbind(x, ..., deparse.level = 1)

## S4 method for signature 'ChIPprofile'
cbind(x, ..., deparse.level = 1)

## S4 method for signature 'ChIPprofile,ANY,missing'
x[[i, j, ...]]

## S4 method for signature 'ChIPprofile'
x$name

Arguments

j

Should be missing

... objects to be concatenated.

recursive logical. If recursive = TRUE, the function recursively descends through lists
(and pairlists) combining all their elements into a vector.

deparse.level See ?base::cbind for a description of this argument.

x object from which to extract element(s) or in which to replace element(s).
i indices specifying elements to extract or replace. Indices are numeric or character vectors or empty (missing) or NULL. Numeric values are coerced to integer as by `as.integer` (and hence truncated towards zero). Character vectors will be matched to the names of the object (or for matrices/arrays, the dimnames): see ‘Character indices’ below for further details.
For `[<-`-indexing only: i, j, ... can be logical vectors, indicating elements/slices to select. Such vectors are recycled if necessary to match the corresponding extent. i, j, ... can also be negative integers, indicating elements/slices to leave out of the selection.
When indexing arrays by [ a single argument i can be a matrix with as many columns as there are dimensions of x; the result is then a vector with elements corresponding to the sets of indices in each row of i.
An index value of NULL is treated as if it were integer(0).

name A literal character string or a name (possibly backtick quoted). For extraction, this is normally (see under ‘Environments’) partially matched to the names of the object.

Value
A ChIPprofile object

Examples
```r
data(chipExampleBig)
x <- c(chipExampleBig[[1]], chipExampleBig[[2]])
y <- rbind(chipExampleBig[[1]], chipExampleBig[[2]])
```

Description
This dataset contains peaks from ChIP-signal over genes

Usage
```r
data(chipExampleBig)
```

Details
- ChIPprofiles

Value
A ChIPprofile object
ChIPprofile-class

The soggi function and ChIPprofile object.

Description

Manual for soggi and ChIPprofile object

The soggi function is the constructor for ChIPprofile objects.

Usage

regionPlot(bamFile, testRanges, samplename = NULL, nOfWindows = 100,
  FragmentLength = 150, style = "point", distanceAround = NULL,
  distanceUp = NULL, distanceDown = NULL, distanceInRegionStart = NULL,
  distanceOutRegionStart = NULL, distanceInRegionEnd = NULL,
  distanceOutRegionEnd = NULL, paired = FALSE, normalize = "RPM",
  plotBy = "coverage", removeDup = FALSE, verbose = TRUE,
  format = "bam", seqlengths = NULL, forceFragment = NULL,
  method = "bin", genome = NULL, cutoff = 80, downSample = NULL,
  minFragmentLength = NULL, maxFragmentLength = NULL)

Arguments

bamFile Character vector for location of BAM file or bigWig, an rleList or PWM matrix.
testRanges GRanges object or character vector of BED file location of regions to plot.
samplename Character vector of sample name. Default is NULL.
nOfWindows Number of windows to bin regions into for coverage calculations (Default 100)
FragmentLength Integer vector Predicted or expected fragment length.
style "Point" for per base pair plot, "percentOfRegion" for normalised length and "re-

gion" for combined plot
distanceAround Distance around centre of region to be used for plotting
distanceUp Distance upstream from centre of region to be used for plotting
distanceDown Distance downstream from centre of region to be used for plotting
distanceInRegionStart Distance into region start (5’ for Watson/positive strand or notspecified strand Regions,3’ for Crick/negatie strand regions) for plotting.
distanceOutRegionStart Distance out from region start (5’ for Watson/positive strand or notspecified strand Regions,3’ for Crick/negatie strand regions) for plotting.
distanceInRegionEnd Distance into region end (3’ for Watson/positive strand or notspecified strand Regions,5’ for Crick/negatie strand regions) for plotting.
distanceOutRegionEnd Distance out from region end (3’ for Watson/positive strand or notspecified strand Regions,5’ for Crick/negatie strand regions) for plotting.
paired Is data paired end
normalize Calculate coverage as RPM. Presently only RPM available.
findconsensusRegions

plotBy Score to be used for plotting. Presently only coverage.
removeDup Remove duplicates before calculating coverage.
verbose TRUE or FALSE
format character vector of "BAM", "BigWig", "RleList" or "PWM"
seqlengths Chromosomes to be used. If missing will report all.
forceFragment Centre fragment and force consistent fragment width.
method Character vector of value "bp", "bin" or "spline". The bin method divides a region of interest into equal sized bins of number specified in nOfWindows. Coverage or counts are then summarised within these windows. The spline method creates a spline with the number of spline points as specified in nOfWindows argument.
downSample Down sample BAM reads to this proportion of original.
genome BSGenome object to be used when using PWM input.
cutoff Cut-off for identifying motifs when using PWM input.
minFragmentLength Remove fragments smaller than this.
maxFragmentLength Remove fragments larger than this.

Value

ChIPprofile A ChIPprofile object.

References

See http://bioinformatics.csc.mrc.ac.uk for more details on soGQi workflows

Examples

data(chipExampleBig)
chipExampleBig

findconsensusRegions  Plot coverage of points or regions.

Description

Plot coverage of points or regions.
Returns summits and summmit scores after optional fragment length prediction and read extension

Usage

findconsensusRegions(testRanges, bamFiles = NULL, method = "majority", summit = "mean", resizepeak = "asw", overlap = "any", fragmentLength = NULL, NonPrimaryPeaks = list(withinsample = "drop", betweenesample = "mean"))

summitPipeline(reads, peakfile, fragmentLength, readlength)
Arguments

- **testRanges**: Named character vector of region locations
- **bamFiles**: Named character vector of bamFile locations
- **method**: Method to select reproducible summits to merge.
- **summit**: Only mean available
- **resizepeak**: Only asw available
- **overlap**: Type of overlap to consider for finding consensus sites
- **fragmentLength**: Predicted fragment length. Set to NULL to auto-calculate
- **NonPrimaryPeaks**: A list of parameters to deal with non primary peaks in consensus regions.
- **peakfile**: GRanges of genomic intervals to summit.
- **reads**: Character vector of bamFile location or GAlignments object
- **readlength**: Read length of alignments.

Value

- **groupedGRanges**: A named GRangesList object.
- **Consensus**: A GRanges object of consensus regions with consensus summits.
- **Summits**: A GRanges object of summits and summit scores.

Description

Create GRangeslist from all combinations of GRanges

Usage

```r
groupByOverlaps(testRanges)
```

Arguments

- **testRanges**: A named list of GRanges or a named GRangesList

Value

- **groupedGRanges**: A named GRangesList object.

Examples

```r
data(ik_Example)
gts <- groupByOverlaps(ik_Example)
```
**ik_Example**

---

### Description

This dataset contains peaks from Ikaros ChIP by two antibodies

### Usage

```r
data(ik_Example)
```

### Details

- Ikpeaksets

### Value

A list containing two GRanges objects

---

**ik_Profiles**

---

### Description

This dataset contains signal over peaks from Ikaros ChIP by two antibodies

### Usage

```r
data(ik_Profiles)
```

### Details

- ik_Profiles

### Value

A ChIPprofile object
normalise

Normalise ChIP profiles

Description

Various normalisation methods for ChIPprofile objects

Usage

### S4 method for signature 'ChIPprofile'

```r
normalise(object)
```

```r
## S4 method for signature 'ChIPprofile,character,numeric'

normalise(object = "ChIPprofile",
          method = "rpm", normFactors = NULL)
```

Arguments

- `object`: A ChIPprofile object
- `method`: A character vector specifying normalisation method. Currently "rpm" for normalising signal for BAM to total reads, "quantile" to quantile normalise across samples, "signalInRegion" to normalise to proportion of signal within intervals, "normaliseSample" to normalise across samples and "normaliseRegions" to apply a normalisation across intervals.
- `normFactors`: A numeric vector used to scale columns or rows.

Value

A ChIPprofile object

Author(s)

Thomas Carroll

Examples

```r
data(chipExampleBig)
normalise(chipExampleBig,method="quantile",normFactors=1)
```

normaliseQuantiles

Normalise quantile

Description

Quantile normalisation across bins/regions.
Usage

## S4 method for signature 'ChIPprofile'
normaliseQuantiles(object)

## S4 method for signature 'ChIPprofile'
normaliseQuantiles(object = "ChIPprofile")

Arguments

object A ChIPprofile object

Value

A ChIPprofile object containing normalised data

Author(s)

Thomas Carroll

Examples

data(chipExampleBig)
normaliseQuantiles(chipExampleBig)

Description

Arithmetic operations

Usage

## S4 method for signature 'ChIPprofile,ChIPprofile'
Ops(e1, e2)

## S4 method for signature 'ChIPprofile,numeric'
Ops(e1, e2)

## S4 method for signature 'numeric,ChIPprofile'
Ops(e1, e2)

## S4 method for signature 'ChIPprofile'
mean(x, ...)

## S4 method for signature 'ChIPprofile'
log2(x)

## S4 method for signature 'ChIPprofile'
log(x, base = exp(1))
orientBy

Arguments

e1 ChIPprofile object
e2 ChIPprofile object
x objects.
... further arguments passed to methods.
base a positive or complex number: the base with respect to which logarithms are computed. Defaults to $e = \exp(1)$.

Value

A ChIPprofile object of result of arithmetic operation.

Examples

data(chipExampleBig)
chipExampleBig[[1]] + chipExampleBig[[2]]

orientBy

Set strand by overlapping or nearest anchor GRanges

Description

Set strand by overlapping or nearest anchor GRanges

Usage

orientBy(testRanges, anchorRanges)

Arguments

testRanges The GRanges object to anchor.
anchorRanges A GRanges object by which to anchor strand orientation.

Value

newRanges A GRanges object.

Examples

data(ik_Example)
strand(ik_Example[[1]]) <- "+
anchoredGRanges <- orientBy(ik_Example[[2]], ik_Example[[1]])
plotRegion

Plot regions

Description
A function to plot regions

Usage

## S4 method for signature 'ChIPprofile'
plotRegion(object, gts, sampleData, groupData, summariseBy, colourBy, lineBy, groupBy, plotregion, outliers, freeScale)

## S4 method for signature 'ChIPprofile'
plotRegion(object = "ChIPprofile", gts = NULL, sampleData = NULL, groupData = NULL, summariseBy = NULL, colourBy = NULL, lineBy = NULL, groupBy = NULL, plotregion = "full", outliers = NULL, freeScale = FALSE)

Arguments

object A ChIPprofile object
gts A list of character vectors or GRangesList
plotregion region to plot. For combined plots with style "region", may be "start" or "end" to show full resolution of plot of edges.
groupData Dataframe of metadata for groups
sampleData Dataframe of metadata for sample
summariseBy Column names from GRanges elementMetadata. Formula or character vector of column names to use to collapse genomic ranges to summarised profiles. summariseBy can not be used injuction with groups specified by gts argument.
colourBy Character vector or formula of either column names from colData(object) containing sample metadata or character vector "group" to colour by groups in gts
lineBy Character vector or formula of either column names from colData(object) containing sample metadata or character vector "group" to set line type by groups in gts
groupBy Character vector or formula of either column names from colData(object) containing sample metadata or character "group" to colour by groups in gts
outliers A numeric vector of length 1 containing proportion from limits to windsorise.
freeScale TRUE or FALSE to set whether ggplot 2 facets have their own scales. Useful for comparing multiple samples of differing depths without normalisation. Default is FALSE.

Value
A gg object from ggplot2
Author(s)

Thomas Carroll

Examples

data(chipExampleBig)
plotRegion(chipExampleBig[[2]])

pwmCov  Example motif coverage

Description

This dataset contains an rlelist of motif coverage

Usage

data(pwmCov)

Details

• pwmCov

Value

A rlelist of motif coverage

pwmToCoverage  PWM hits and motif scores as an RLElist

Description

Creates rlelist of pwm hits.

Motif score as an RLElist

Usage

pwmToCoverage(pwm, genome, min = "70\%", removeRand = FALSE,
chrsOfInterest = NULL)

makeMotifScoreRle(pwm, regions, genome, extend, removeRand = FALSE,
strandScore = "mean", atCentre = FALSE)
**singleGRange**

**Arguments**

- **pwm**: A PWM matrix object.
- **genome**: A BSgenome object.
- **min**: Pwm score (as percentage of maximum score) cutoff.
- **removeRand**: Remove contigs with rand string.
- **chrsOfInterest**: Chromosomes to use.
- **regions**: GRanges object to include in pwm rlelist.
- **extend**: Bps to extend regions by.
- **strandScore**: Method for averaging strand. Options are max, mean, sum, bothstrands.
- **atCentre**: TRUE/FALSE. TRUE assigns score onto 1bp position at centre of motif. FALSE assigns every basepair the sum of scores of all overlapping motifs.

**Value**

A RLElist of motif density per base pair to be used as input to main soggi function.

**Author(s)**

Thomas Carroll

**Examples**

```r
data(pwmCov)
data(singleGRange)
```

---

**Description**

This dataset contains an rlelist of motif coverage.

**Usage**

```r
data(singleGRange)
```

**Details**

- singleGRange

**Value**

A single GRanges used in motif coverage example.
Index

*Topic **datasets**
  chipExampleBig, 3
  ik_Example, 7
  ik_Profiles, 7
  pwmCov, 12
  singleGRange, 13
  [[,ChIPprofile,ANY,missing-method
    (c,ChIPprofile-method), 2
  $,ChIPprofile-method
    (c,ChIPprofile-method), 2
  as.integer, 3
  backtick, 3
  c,ChIPprofile-method, 2
  cbind, 2
  cbind,ChIPprofile-method
    (c,ChIPprofile-method), 2
  chipExampleBig, 3
  ChIPprofile(ChIPprofile-class), 4
  ChIPprofile-ChIPprofile
    (ChIPprofile-class), 4
  ChIPprofile-class, 4
  dimnames, 3
  findconsensusRegions, 5
  groupByOverlaps, 6
  ik_Example, 7
  ik_Profiles, 7
  log,ChIPprofile-method
    (Ops,ChIPprofile,ChIPprofile-method), 9
  log2,ChIPprofile-method
    (Ops,ChIPprofile,ChIPprofile-method), 9
  makeMotifScoreRle (pwmToCoverage), 12
  mean,ChIPprofile-method
    (Ops,ChIPprofile,ChIPprofile-method), 9
  name, 3
  names, 3
  normalise, 8
  normalise,ChIPprofile,character,numeric-method
    (normalise), 8
  normalise,ChIPprofile-method
    (normalise), 8
  normalise,ChIPprofile(normalise), 8
  normaliseQuantiles, 8
  normaliseQuantiles,ChIPprofile-method
    (normaliseQuantiles), 8
  normaliseQuantiles.ChIPprofile
    (normaliseQuantiles), 8
  Ops,ChIPprofile,ChIPprofile-method, 9
  Ops,ChIPprofile,numeric-method
    (Ops,ChIPprofile,ChIPprofile-method), 9
  Ops,numeric,ChIPprofile-method
    (Ops,ChIPprofile,ChIPprofile-method), 9
  orientBy, 10
  plotRegion, 11
  plotRegion,ChIPprofile-method
    (plotRegion), 11
  plotRegion.ChIPprofile(plotRegion), 11
  pwmCov, 12
  pwmToCoverage, 12
  rbind,ChIPprofile-method
    (c,ChIPprofile-method), 2
  regionPlot (ChIPprofile-class), 4
  singleGRange, 13
  soggi (ChIPprofile-class), 4
  summitPipeline (findconsensusRegions), 5