

Package ‘VplotR’

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Title Set of tools to make V-plots and compute footprint profiles

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Description The pattern of digestion and protection from DNA nucleases such as DNase I, micrococcal nuclease, and Tn5 transposase can be used to infer the location of associated proteins. This package contains useful functions to analyze patterns of paired-end sequencing fragment density. VplotR facilitates the generation of V-plots and footprint profiles over single or aggregated genomic loci of interest.

URL <https://github.com/js2264/VplotR>

BugReports <https://github.com/js2264/VplotR/issues>

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ABF1_sacCer3

ABF1_sacCer3

Description

Genomic loci with a REB1 binding motifs according to <http://jaspar.genereg.net/api/v1/matrix/MA0265.1.jaspar>. PWM and scanning done with TFBSTools.

Usage

```
data(ABF1_sacCer3)
```

Format

An object of class "GRanges".

References

Rossi, Lai & Pugh 2018 Genome Research

Examples

```
data(ABF1_sacCer3)
ABF1_sacCer3
```

alignToTSS

A function to re-align a GRanges object to TSSs

Description

This function re-aligns ranges (typically regulatory elements) to a set of coordinates, either the TSS column or the TSS.fwd and TSS.rev columns. If none are found, the function assumes the ranges are promoters and that the end or the ranges are the TSSs.

Usage

```
alignToTSS(granges, upstream = 0, downstream = 1)
```

Arguments

granges	A stranded GRanges object with a TSS column or TSS.rev and TSS.fwd columns
upstream	How many bases upstream of the TSS should the GRanges object by extended by? [Default: 0]
downstream	How many bases downstream of the TSS should the GRanges object by extended by? [Default: 1]

Value

GRanges aligned to the TSS column or to TSS.rev and TSS.fwd columns, and extended by upstream/downstream bp.

Examples

```
data(ce11_proms)
ce11_proms
alignToTSS(ce11_proms)
```

```
ATAC_ce11_Serizay2020  ATAC_ce11_Serizay2020
```

Description

A sample of ATAC-seq fragments from individual worm tissues (Serizay et al. 2020, "Tissue-specific profiling reveals distinctive regulatory architectures for ubiquitous, germline and somatic genes", BiorXiv)

Usage

```
data(ATAC_ce11_Serizay2020)
```

Format

An object of class "list".

Examples

```
data(ATAC_ce11_Serizay2020)
ATAC_ce11_Serizay2020
```

```
bam_test          bam_test
```

Description

A .bam file sample

Usage

```
data(bam_test)
```

Format

An object of class "GRanges".

Examples

```
data(bam_test)
bam_test
```

ce11_all_REs	<i>ce11_all_REs</i>
--------------	---------------------

Description

Regulatory elements annotated in *C. elegans* (ce11) according to Serizay et al. 2020, "Tissue-specific profiling reveals distinctive regulatory architectures for ubiquitous, germline and somatic genes", BiorXiv.

Usage

```
data(ce11_all_REs)
```

Format

GRanges

Source

[BiorXiv](#)

References

Serizay et al. 2020, "Tissue-specific profiling reveals distinctive regulatory architectures for ubiquitous, germline and somatic genes", BiorXiv. ([DOI](#))

Examples

```
data(ce11_all_REs)
table(ce11_all_REs$regulatory_class)
table(ce11_all_REs$which.tissues)
```

`ce11_proms`*ce11_proms*

Description

Promoters annotated in *C. elegans* (ce11) according to Serizay et al. 2020, "Tissue-specific profiling reveals distinctive regulatory architectures for ubiquitous, germline and somatic genes", BiorXiv.

Usage

```
data(ce11_proms)
```

Format

An object of class "GRanges".

Source

[BiorXiv](#)

References

Serizay et al. 2020, "Tissue-specific profiling reveals distinctive regulatory architectures for ubiquitous, germline and somatic genes", BiorXiv. ([DOI](#))

Examples

```
data(ce11_proms)
table(ce11_proms$which.tissues)
```

`computeNucleosomeEnrichmentOverBackground`*Internal function*

Description

A function to compute nucleosome enrichment of a Vmat

Usage

```
computeNucleosomeEnrichmentOverBackground(
  Vmat,
  background = NULL,
  plus1_nuc_only = FALSE,
  minus1_nuc = list(c(xmin = -150, xmax = -70), c(ymin = 165, ymax = 260)),
  minus1_nuc_neg = list(c(xmin = -150, xmax = -70), c(ymin = 60, ymax = 145)),
  plus1_nuc = list(c(xmin = 70, xmax = 150), c(ymin = 165, ymax = 260)),
  plus1_nuc_neg = list(c(xmin = 70, xmax = 150), c(ymin = 50, ymax = 145)),
  ...
)
```

Arguments

Vmat	A Vmat computed by nucleosomeEnrichment function
background	a background Vmat
plus1_nuc_only	Boolean Should compute nucleosome enrichment only for +1 nucleosome?
minus1_nuc	list where the -1 nucleosome is located
minus1_nuc_neg	where the background of the -1 nucleosome is located
plus1_nuc	where the +1 nucleosome is located
plus1_nuc_neg	where the background of the +1 nucleosome is located
...	additional parameters

Value

list

computeVmat	<i>A function to compute Vplot matrix</i>
-------------	---

Description

This function computes the underlying matrix shown as a heatmap in Vplots. For each pair of coordinates (x: distance from fragment midpoint to center of GRanges of interest; y: fragment size), the function computes how many fragments there are.

Usage

```
computeVmat(
  bam_granges,
  granges,
  cores = 1,
  xlims = c(-250, 250),
  ylims = c(50, 300)
)
```

Arguments

<code>bam_granges</code>	GRanges, paired-end fragments
<code>granges</code>	GRanges, regions to map the fragments onto
<code>cores</code>	Integer, nb of threads to parallelize fragments subsetting
<code>xlims</code>	The x limits of the computed Vmat
<code>ylims</code>	The y limits of the computed Vmat

Value

A table object

Examples

```
data(bam_test)
data(ce11_all_REs)
Vmat <- computeVmat(bam_test, ce11_all_REs)
dim(Vmat)
Vmat[seq(1,5), seq(1,10)]
```

CTCF_hg38

CTCF_hg38

Description

high-score CTCF binding motifs, obtained from JASPAR

Usage

```
data(CTCF_hg38)
```

Format

An object of class "GRanges".

Examples

```
data(CTCF_hg38)
CTCF_hg38
```

`deconvolveBidirectionalPromoters`*A function to duplicate bi-directional GRanges*

Description

This function splits bi-directional ranges into + and - stranded ranges. It duplicates the ranges which are '*'.

Usage

```
deconvolveBidirectionalPromoters(granges)
```

Arguments

`granges` A stranded GRanges object

Value

GRanges with only '+' and '-' strands. GRanges with '*' strand have been duplicated and split into forward and reverse strands.

Examples

```
data(ce11_all_REs)
library(GenomicRanges)
proms <- ce11_all_REs[grepl('prom', ce11_all_REs$regulatory_class)]
proms
table(strand(proms))
proms <- deconvolveBidirectionalPromoters(proms)
proms
table(strand(proms))
```

`getCuts`*Internal function*

Description

Function to extract cuts (i.e. extremities) of fragments stored as GRanges.

Usage

```
getCuts(gr)
```

Arguments

`gr` GRanges Paired-end fragments used to extract their extremities

Value

GRanges

getFragmentsDistribution

*A function to compute sizes distribution for paired-end fragments***Description**

This function takes fragments and compute the distribution of their sizes over a set or multiple sets of GRanges.

Usage

```
getFragmentsDistribution(
  fragments,
  granges_list = NULL,
  extend_granges = c(-500, 500),
  limits = c(0, 600),
  roll = 3,
  cores = 1
)
```

Arguments

fragments	GRanges object containing paired-end fragments. See importPEBamFiles for more details on how to create such object.
granges_list	GRanges, can be a list of different sets of GRanges.
extend_granges	numeric vector of length 2, how the GRanges should be extended.
limits	numeric vector of length 2, only consider fragments within this window of sizes.
roll	Integer, apply a moving average of this size
cores	Integer, number of threads used to compute fragment size distribution

Value

A list of tbl, one for each .bam file.

Examples

```
data(bam_test)
data(cell_proms)
df <- getFragmentsDistribution(
  bam_test,
  cell_proms,
  extend_granges = c(-500, 500)
)
head(df)
which.max(df$y)
```

importPEBamFiles	<i>A function to import paired end bam files as GRanges</i>
------------------	---

Description

This function takes bam file paths and read them into GRanges objects. Note: Can be quite lengthy for .bam files with 5+ millions fragments.

Usage

```
importPEBamFiles(
  files,
  genome = NULL,
  where = NULL,
  max_insert_size = 1000,
  shift_ATAC_fragments = FALSE,
  cores = 10,
  verbose = TRUE
)
```

Arguments

files	character vector, each element of the vector is the path of an individual .bam file.
genome	character, genome ID (e.g. "sacCer3", "ce11", "dm6", "mm10" or "hg38").
where	GRanges, only import the fragments mapping to the input GRanges (can fasten the import process a lot).
max_insert_size	Integer, filter out fragments larger than this size.
shift_ATAC_fragments	Boolean, if the fragments come from ATAC-seq, one might want to shift the extremities by +5 / -4 bp.
cores	Integer, number of cores to use when indexing bam files
verbose	Boolean

Value

A GRanges object containing fragments from the input .bam file.

Examples

```
bamfile <- system.file("extdata", "ex1.bam", package = "Rsamtools")
fragments <- importPEBamFiles(
  bamfile,
  shift_ATAC_fragments = TRUE
)
fragments
```

MNase_sacCer3_Henikoff2011

MNase_sacCer3_Henikoff2011

Description

A sample of MNase-seq fragments from yeast (Henikoff et al. 2011, "Epigenome characterization at single base-pair resolution", PNAS)

Usage

```
data(MNase_sacCer3_Henikoff2011)
```

Format

An object of class "GRanges".

Examples

```
data(MNase_sacCer3_Henikoff2011)
MNase_sacCer3_Henikoff2011
```

MNase_sacCer3_Henikoff2011_subset

MNase_sacCer3_Henikoff2011_subset

Description

A sample of fragments from multiple MNase-seq experiments performed in yeast (Henikoff et al. 2011, "Epigenome characterization at single base-pair resolution", PNAS), mapping over chrXV:186,400-187,400.

Usage

```
data(MNase_sacCer3_Henikoff2011_subset)
```

Format

An object of class "GRanges".

Examples

```
data(MNase_sacCer3_Henikoff2011_subset)
MNase_sacCer3_Henikoff2011_subset
```

normalizeVmat	<i>A function to normalized a Vmat</i>
---------------	--

Description

This function normalizes a Vmat. Several different approaches have been implemented to normalize the Vmats.

Usage

```
normalizeVmat(  
  Vmat,  
  bam_granges,  
  granges,  
  normFun = c("zscore"),  
  s = 0.99,  
  roll = 1,  
  verbose = TRUE  
)
```

Arguments

Vmat	A Vmat, usually output of computeVmat
bam_granges	GRanges, the paired-end fragments
granges	GRanges, the regions to map the fragments onto
normFun	character. A Vmat should be scaled either by: • 'libdepth+nloci', e.g. the library depth and the number of loci used to compute the Vmat; • zscore, if relative patterns of fragment density are more important than density per se; • Alternatively, the Vmat can be scaled to a chosen quantile ('quantile') or to the max Vmat value ('max').
s	A float indicating which quantile to use if 'quantile' normalization is chosen
roll	integer, to use as the window to smooth the Vmat rows by rolling mean.
verbose	Boolean

Value

A normalized Vmat object

Examples

```
data(bam_test)
data(ce11_all_REs)
Vmat <- computeVmat(bam_test, ce11_all_REs)
Vmat <- normalizeVmat(
  Vmat,
  bam_test,
  ce11_all_REs,
  normFun = c('libdepth+nloci')
)
```

nucleosomeEnrichment *A function to compute nucleosome enrichment over a set of GRanges*

Description

A function to compute nucleosome enrichment over a set of GRanges

Usage

```
nucleosomeEnrichment(x, ...)
```

Arguments

x	a GRanges or Vmat
...	additional parameters

Value

list

Examples

```
data(bam_test)
data(ce11_proms)
n <- nucleosomeEnrichment(bam_test, ce11_proms)
n$fisher_test
n$plot
```

`nucleosomeEnrichment.GRanges`*A function to compute nucleosome enrichment over a set of GRanges*

Description

A function to compute nucleosome enrichment over a set of GRanges

Usage

```
## S3 method for class 'GRanges'
nucleosomeEnrichment(x, granges, plus1_nuc_only = FALSE, verbose = TRUE, ...)
```

Arguments

<code>x</code>	GRanges, paired-end fragments
<code>granges</code>	GRanges, loci to map the fragments onto
<code>plus1_nuc_only</code>	Boolean, should compute nucleosome enrichment only for +1 nucleosome?
<code>verbose</code>	Boolean
<code>...</code>	additional parameters

Value

list

Examples

```
data(bam_test)
data(ce11_proms)
n <- nucleosomeEnrichment(bam_test, ce11_proms)
n$fisher_test
n$plot
```

`nucleosomeEnrichment.Vmat`*A function to compute nucleosome enrichment over a Vmat*

Description

A function to compute nucleosome enrichment over a Vmat

Usage

```
## S3 method for class 'Vmat'
nucleosomeEnrichment(x, background, plus1_nuc_only = FALSE, ...)
```

Arguments

x a computed Vmat. Should be un-normalized.
background a background Vmat. Should be un-normalized.
plus1_nuc_only Boolean, should compute nucleosome enrichment only for +1 nucleosome?
... additional parameters

Value

list

Examples

```

data(bam_test)
data(cell_proms)
V <- plotVmat(
  bam_test,
  cell_proms,
  normFun = '',
  return_Vmat = TRUE
)
V_bg <- plotVmat(
  bam_test,
  sampleGRanges(cell_proms),
  normFun = '',
  return_Vmat = TRUE
)
n <- nucleosomeEnrichment(V, V_bg)
n$fisher_test
n$plot

```

plotFootprint

A function to plot footprint of paired-end data at given loci

Description

This function takes paired-end fragments, extract the "cuts" (i.e. extremities) and plot the footprint profile over a set of GRanges.

Usage

```

plotFootprint(
  frags,
  targets,
  split_strand = FALSE,
  plot_central = TRUE,
  xlim = c(-75, 75),
  bin = 1,
  verbose = 1
)

```

Arguments

frags	GRanges, the paired-end fragments
targets	GRanges, the loci to map the fragments onto
split_strand	Boolean, should the + and - strand be splitted?
plot_central	plot grey rectangle over the loci
xlim	numeric vector of length 2, the x limits of the computed Vmat
bin	Integer, bin used to smooth the footprint profile
verbose	Integer

Value

A footprint ggplot

Examples

```
data(bam_test)
data(cell_proms)
plotFootprint(bam_test, cell_proms)
```

plotProfile

A function to generate a Vplot along chromosome coordinates

Description

The paired-end fragments overlapping a locus of interest (e.g., binding sites, provided in the ‘loci’ argument) are shown in red while the remaining fragments mapping to the genomic window are displayed in black. Marginal curves are also plotted on the side of the distribution plot. They highlight the smoothed distribution of the position of paired-end fragment midpoints (top) or of the paired-end fragment length (right)

Usage

```
plotProfile(
  fragments,
  window = loc,
  loci = NULL,
  annots = NULL,
  min = 50,
  max = 200,
  alpha = 0.5,
  size = 1,
  with_densities = TRUE,
  verbose = TRUE
)
```

Arguments

fragments	GRanges
window	character, chromosome location
loci	GRanges, optional genomic locus. Fragments overlapping this locus will be in red.
annots	GRanges, optional gene annotations
min	integer, minimum fragment size
max	integer, maximum fragment size
alpha	float, transparency value
size	float, dot size
with_densities	Boolean, should the densities be plotted?
verbose	Boolean

Value

A ggplot

Examples

```
data(bam_test)
data(cell_proms)
V <- plotProfile(
  bam_test,
  'chrI:10000-12000',
  loci = cell_proms,
  min = 80,
  max = 200
)
```

plotVmat

A function to generate a Vplot

Description

See individual methods for further detail

Usage

```
plotVmat(x, ...)
```

Arguments

x	GRanges or list or Vmat
...	additional parameters

Value

A Vmat ggplot

Examples

```
data(bam_test)
data(cell_proms)
V <- plotVmat(
  bam_test,
  cell_proms,
  normFun = 'libdepth+nloci'
)
```

plotVmat.default

A function to plot a computed Vmat

Description

The default plotVmat method generates a ggplot representing a heatmap of fragment density.

Usage

```
## Default S3 method:
plotVmat(
  x,
  hm = 90,
  colors = COLORSCALE_VMAT,
  breaks = NULL,
  xlim = c(-250, 250),
  ylim = c(50, 300),
  main = "",
  xlab = "Distance from center of elements",
  ylab = "Fragment length",
  key = "Score",
  ...
)
```

Arguments

x	A computed Vmat (ideally, should be normalized)
hm	Integer, should be between 0 and 100. Used to automatically scale the range of colors (best to keep between 90 and 100)
colors	a vector of colors
breaks	a vector of breaks. length(breaks) == length(colors) + 1
xlim	vector of two integers, x limits
ylim	vector of two integers, y limits

main	character, title of the plot
xlab	character, x-axis label
ylab	character, y-axis label
key	character, legend label
...	additional parameters

Value

A Vmat ggplot

Examples

```
data(bam_test)
data(cell_proms)
V <- plotVmat(
  bam_test,
  cell_proms,
  normFun = 'libdepth+nloci',
  return_Vmat = TRUE
)
plotVmat(V)
```

plotVmat.GRanges	<i>A function to compute (and plot) a Vmat</i>
------------------	--

Description

The plotVmat.GRanges() method computes and normalizes a Vmat before passing it to plotVmat.Vmat() method.

Usage

```
## S3 method for class 'GRanges'
plotVmat(
  x,
  granges,
  xlims = c(-250, 250),
  ylims = c(50, 300),
  normFun = "",
  s = 0.95,
  roll = 3,
  cores = 1,
  return_Vmat = FALSE,
  verbose = 1,
  ...
)
```

Arguments

x	GRanges, paired-end fragments
granges	GRanges, loci to map the fragments onto
xlims	x limits of the computed Vmat
ylims	y limits of the computed Vmat
normFun	character. A Vmat should be scaled either by: • 'libdepth+nloci', e.g. the library depth and the number of loci used to compute the Vmat; • zscore, if relative patterns of fragment density are more important than density per se; • Alternatively, the Vmat can be scaled to a chosen quantile ('quantile') or to the max Vmat value ('max').
s	A float indicating which quantile to use if 'quantile' normalization is chosen
roll	integer, to use as the window to smooth the Vmat rows by rolling mean.
cores	Integer, number of threads to parallelize fragments subsetting
return_Vmat	Boolean, should the function return the computed Vmat rather than the plot?
verbose	Boolean
...	additional parameters

Value

A Vmat ggplot

Examples

```
data(bam_test)
data(cell_proms)
V <- plotVmat(
  bam_test,
  cell_proms,
  normFun = 'libdepth+nloci',
  roll = 5
)
```

plotVmat.list

A function to compute (and plot) several Vmats.

Description

The plotVmat.GRanges() method computes and normalizes multiple Vmats before passing them to plotVmat.VmatList() method.

Usage

```
## S3 method for class 'list'
plotVmat(
  x,
  cores = 1,
  cores_subsetting = 1,
  nrow = NULL,
  ncol = NULL,
  xlims = c(-250, 250),
  ylims = c(50, 300),
  normFun = "libdepth+nloci",
  s = 0.95,
  roll = 3,
  return_Vmat = FALSE,
  verbose = 1,
  ...
)
```

Arguments

x	list Each element of the list should be a list containing paired-end fragments and GRanges of interest.
cores	Integer, number of cores to parallelize the plots
cores_subsetting	Integer, number of threads to parallelize fragments subsetting
nrow	Integer, how many rows in facet?
ncol	Integer, how many cols in facet?
xlims	x limits of the computed Vmat
ylims	y limits of the computed Vmat
normFun	character. A Vmat should be scaled either by: • 'libdepth+nloci', e.g. the library depth and the number of loci used to compute the Vmat; • zscore, if relative patterns of fragment density are more important than density per se; • Alternatively, the Vmat can be scaled to a chosen quantile ('quantile') or to the max Vmat value ('max').
s	A float indicating which quantile to use if 'quantile' normalization is chosen
roll	integer, to use as the window to smooth the Vmat rows by rolling mean.
return_Vmat	Boolean, should the function return the computed Vmat rather than the plot?
verbose	Boolean
...	additional parameters

Value

A list of Vmat ggplots

Examples

```

data(bam_test)
data(cell_proms)
list_params <- list(
  'germline' = list(
    bam_test,
    cell_proms[cell_proms$which.tissues == 'Germline']
  ),
  'muscle' = list(
    bam_test,
    cell_proms[cell_proms$which.tissues == 'Muscle']
  )
)
V <- plotVmat(
  list_params,
  normFun = 'libdepth+nloci',
  roll = 5
)

```

plotVmat.Vmat

A function to plot a computed Vmat

Description

The plotVmat.Vmat() method forwards the Vmat to plotVmat.default().

Usage

```

## S3 method for class 'Vmat'
plotVmat(x, ...)

```

Arguments

x	A computed Vmat (ideally, should be normalized)
...	additional parameters

Value

A Vmat ggplot

Examples

```

data(bam_test)
data(cell_proms)
V <- plotVmat(
  bam_test,
  cell_proms,
  normFun = 'libdepth+nloci',
  return_Vmat = TRUE
)

```

```
)
plotVmat(V)
```

plotVmat.VmatList	<i>A function to plot a computed VmatList</i>
-------------------	---

Description

The plotVmat.VmatList() method forwards the Vmat to plotVmat.default().

Usage

```
## S3 method for class 'VmatList'
plotVmat(x, nrow = NULL, ncol = NULL, dir = "v", ...)
```

Arguments

x	A VmatList (output of plotVmat.list())
nrow	Integer, how many rows in facet?
ncol	Integer, how many cols in facet?
dir	str, direction of facets?
...	additional parameters

Value

A Vmat ggplot

Examples

```
data(bam_test)
data(cell_proms)
list_params <- list(
  'germline' = list(
    bam_test,
    cell_proms[cell_proms$which.tissues == 'Germline']
  ),
  'muscle' = list(
    bam_test,
    cell_proms[cell_proms$which.tissues == 'Muscle']
  )
)
V <- plotVmat(
  list_params,
  normFun = 'libdepth+nloci',
  roll = 5
)
```

`REB1_sacCer3`*REB1_sacCer3*

Description

Genomic loci with a REB1 binding motifs according to <http://jaspar.genereg.net/api/v1/matrix/MA0363.1.jaspar>. PWM and scanning done with TFBSTools.

Usage

```
data(REB1_sacCer3)
```

Format

An object of class "GRanges".

References

Rossi, Lai & Pugh 2018 Genome Research

Examples

```
data(REB1_sacCer3)
REB1_sacCer3
```

`sampleGRanges`*A function to sample GRanges from GRanges*

Description

This function takes a given GRanges and returns another GRanges object. The new GRanges has the same number of ranges and the same chromosome, width and strand distributions than the original GRanges.

Usage

```
sampleGRanges(
  x,
  n = NULL,
  width = NULL,
  exclude = FALSE,
  avoid_overlap = FALSE
)
```

Arguments

x	GRanges object
n	Integer, number of sampled GRanges
width	Integer, width of sampled GRanges
exclude	Boolean, should the original GRanges be excluded?
avoid_overlap	Boolean, should the sampled GRanges not be overlapping?

Value

A GRanges object of length n

Examples

```
data(ce11_proms)
sampleGRanges(ce11_proms, 100)
```

sampleGRanges.GRanges *A function to sample GRanges within GRanges*

Description

This function takes a given GRanges and returns another GRanges object. The new GRanges has the same number of ranges and the same chromosome, width and strand distributions than the original GRanges.

Usage

```
## S3 method for class 'GRanges'
sampleGRanges(
  x,
  n = NULL,
  width = NULL,
  exclude = FALSE,
  avoid_overlap = FALSE
)
```

Arguments

x	GRanges object
n	Integer, number of sampled GRanges
width	Integer, width of sampled GRanges
exclude	Boolean, should the original GRanges be excluded?
avoid_overlap	Boolean, should the sampled GRanges not be overlapping?

Value

A GRanges object of length n

Examples

```
data(cell_proms)
sampleGRanges(cell_proms, 100)
```

shiftATACGranges	<i>A function to shift GRanges fragments by 5/-4. This is useful when dealing with fragments coming from ATAC-seq.</i>
------------------	--

Description

A function to shift GRanges fragments by 5/-4. This is useful when dealing with fragments coming from ATAC-seq.

Usage

```
shiftATACGranges(g, pos_shift = 4, neg_shift = 5)
```

Arguments

g	GRanges of ATAC-seq fragments
pos_shift	Integer. How many bases should fragments on direct strand be shifted by?
neg_shift	Integer. How many bases should fragments on negative strand be shifted by?

Value

A GRanges object containing fragments from the input .bam file.

Examples

```
data(bam_test)
shiftATACGranges(bam_test)
```

shuffleVmat	<i>A function to shuffle a Vmat</i>
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Description

This function works on a Vmat (the output of computeVmat()). It shuffles the matrix to randomize the fragment densities.

Usage

```
shuffleVmat(Vmat)
```

Arguments

Vmat	A Vmat, usually output of computeVmat
------	---------------------------------------

Value

A shuffled Vmat object

Examples

```
data(bam_test)
data(cell_all_REs)
Vmat <- computeVmat(bam_test, cell_all_REs)
Vmat <- shuffleVmat(Vmat)
```

theme_ggplot2	<i>Personal ggplot2 theming function, adapted from roboto-condensed at https://github.com/hrbrmstr/hrbrthemes/</i>
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Description

Personal ggplot2 theming function, adapted from roboto-condensed at <https://github.com/hrbrmstr/hrbrthemes/>

Usage

```
theme_ggplot2(
  grid = TRUE,
  border = TRUE,
  base_family = "",
  base_size = 8,
  plot_title_family = base_family,
  plot_title_size = 12,
  plot_title_face = "plain",
  plot_title_margin = 5,
```

```

    subtitle_size = 11,
    subtitle_face = "plain",
    subtitle_margin = 5,
    strip_text_family = base_family,
    strip_text_size = 10,
    strip_text_face = "bold",
    caption_size = 9,
    caption_face = "plain",
    caption_margin = 3,
    axis_text_size = base_size,
    axis_title_family = base_family,
    axis_title_size = 9,
    axis_title_face = "plain",
    axis_title_just = "rt",
    panel_spacing = grid::unit(2, "lines"),
    grid_col = "#cccccc",
    plot_margin = margin(12, 12, 12, 12),
    axis_col = "#cccccc",
    axis = FALSE,
    ticks = FALSE
  )

```

Arguments

grid	panel grid ('TRUE', 'FALSE', or a combination of 'X', 'x', 'Y', 'y')
border	border if 'TRUE' add border
base_family, base_size	base font family and size
plot_title_family, plot_title_face	plot title family, face
plot_title_size, plot_title_margin	plot title size and margin
subtitle_face, subtitle_size	plot subtitle family, face and size
subtitle_margin	plot subtitle margin bottom (single numeric value)
strip_text_family, strip_text_face, strip_text_size	facet label font family, face and size
caption_face, caption_size, caption_margin	plot caption family, face, size and margin
axis_text_size	font size of axis text
axis_title_family, axis_title_face, axis_title_size	axis title font family, face and size
axis_title_just	axis title font justificationk one of '[blmcr]'
panel_spacing	panel spacing (use 'unit()')

grid_col	grid color
plot_margin	plot margin (specify with [ggplot2::margin])
axis_col	axis color
axis	add x or y axes? 'TRUE', 'FALSE', "'xy'"
ticks	ticks if 'TRUE' add ticks

Value

theme A ggplot theme

Examples

```
library(ggplot2)

ggplot(mtcars, aes(mpg, wt)) +
  geom_point() +
  labs(x="Fuel efficiency (mpg)", y="Weight (tons)",
       title="Seminal ggplot2 scatterplot example") +
  theme_ggplot2()
```

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