

Package ‘methrix’

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Title Fast and efficient summarization of generic bedGraph files from Bisulfite sequencing

Version 1.18.0

Description Bedgraph files generated by Bisulfite pipelines often come in various flavors. Critical downstream step requires summarization of these files into methylation/coverage matrices. This step of data aggregation is done by Methrix, including many other useful downstream functions.

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Encoding UTF-8

LazyData false

Depends R (>= 3.6), data.table (>= 1.12.4), SummarizedExperiment

Imports rtracklayer, DelayedArray, HDF5Array, BSgenome, DelayedMatrixStats, parallel, methods, ggplot2, S4Vectors, matrixStats, graphics, stats, utils, GenomicRanges, IRanges

RoxygenNote 7.1.1

Suggests knitr, rmarkdown, DSS, bsseq, plotly, BSgenome.Mmusculus.UCSC.mm9, MafDb.1Kgenomes.phase3.GRCh38, MafDb.1Kgenomes.phase3.hs37d5, BSgenome.Hsapiens.UCSC.hg19, GenomicScores, Biostrings, RColorBrewer, GenomeInfoDb, testthat (>= 2.1.0)

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| | |
|-----------------|--------------------------------|
| combine_methrix | <i>Combine methrix objects</i> |
|-----------------|--------------------------------|

Description

Combine methrix objects

Usage

```
combine_methrix(m1, m2, by = c("row", "col"))
```

Arguments

| | |
|----|--|
| m1 | Frist methrix object |
| m2 | Second methrix object |
| by | The direction of combine. 'column' (cbind) combines samples with same regions, 'row' combines different regions, e.g. different chromosomes. |

Details

Takes two [methrix](#) objects and combines them row- or column-wise

Value

An object of class [methrix](#)

| | |
|----------------------|---|
| convert_HDF5_methrix | <i>Converts HDF5 methrix object to standard in-memory object.</i> |
|----------------------|---|

Description

Converts HDF5 methrix object to standard in-memory object.

Usage

```
convert_HDF5_methrix(m = NULL)
```

Arguments

| | |
|---|--|
| m | An object of class methrix , HDF5 format |
|---|--|

Details

Takes a [methrix](#) object and returns with the same object with in-memory assay slots.

Value

An object of class `methrix`

Examples

```
data(methrix_data)
m2 <- convert_methrix(m=methrix_data)
m <- convert_HDF5_methrix(m=m2)
```

| | |
|-----------------|--|
| convert_methrix | <i>Converts an in-memory object to an on-disk HDF5 object.</i> |
|-----------------|--|

Description

Converts an in-memory object to an on-disk HDF5 object.

Usage

```
convert_methrix(m = NULL)
```

Arguments

`m` An object of class `methrix`

Details

Takes a `methrix` object and returns with the same object with delayed array assay slots with HDF5 backend. Might take long time!

Value

An object of class `methrix`, HDF5 format

Examples

```
data(methrix_data)
m2 <- convert_methrix(m=methrix_data)
```

| | |
|-----------------|------------------------------------|
| coverage_filter | <i>Filter matrices by coverage</i> |
|-----------------|------------------------------------|

Description

Filter matrices by coverage

Usage

```
coverage_filter(  
  m,  
  cov_thr = 1,  
  min_samples = 1,  
  prop_samples = 0,  
  group = NULL,  
  n_chunks = 1,  
  n_cores = 1  
)
```

Arguments

| | |
|--------------|---|
| m | methrix object |
| cov_thr | minimum coverage required to call a loci covered |
| min_samples | Minimum number of samples that should have a loci with coverage \geq cov_thr. If group is given, then this applies per group. Only need one of prop_samples or min_samples. |
| prop_samples | Minimum proportion of samples that should have a loci with coverage \geq cov_thr. If group is given, then this applies per group. Only need one of prop_samples or min_samples. |
| group | a column name from sample annotation that defines groups. In this case, the number of min_samples will be tested group-wise. |
| n_chunks | Number of chunks to split the methrix object in case it is very large. Default = 1. |
| n_cores | Number of parallel instances. n_cores should be less than or equal to n_chunks. If n_chunks is not specified, then n_chunks is initialized to be equal to n_cores. Default = 1. |

Details

Takes [methrix](#) object and filters CpGs based on coverage statistics

Value

An object of class [methrix](#)

Examples

```
data('methrix_data')
#keep only CpGs which are covered by at-least 1 read across 3 samples
coverage_filter(m = methrix_data, cov_thr = 1, min_samples = 3)
```

| | |
|--------------|--|
| extract_CPGs | <i>Extracts all CpGs from a genome</i> |
|--------------|--|

Description

Extracts all CpGs from a genome

Usage

```
extract_CPGs(ref_genome = NULL)
```

Arguments

ref_genome BSgenome object or name of the installed BSgenome package. Example: BSgenome.Hsapiens.UCSC.hg19

Value

a list of data.table containing number of CpG's and contig lengths

Examples

```
## Not run:
hg19_cpgs = methrix::extract_CPGs(ref_genome = 'BSgenome.Hsapiens.UCSC.hg19')

## End(Not run)
```

| | |
|------------|---|
| get_matrix | <i>Extract methylation or coverage matrices</i> |
|------------|---|

Description

Extract methylation or coverage matrices

Usage

```
get_matrix(m, type = "M", add_loci = FALSE, in_granges = FALSE)
```

Arguments

| | |
|------------|---|
| m | methrix object |
| type | can be M or C. Default 'M' |
| add_loci | Default FALSE. If TRUE adds CpG position info to the matrix and returns as a data.table |
| in_granges | Do you want the outcome in GRanges? |

Details

Takes methrix object and returns user specified methylation or coverage matrix

Value

Coverage or Methylation matrix

Examples

```
data('methrix_data')
#Get methylation matrix
get_matrix(m = methrix_data, type = 'M')
#Get methylation matrix along with loci
get_matrix(m = methrix_data, type = 'M', add_loci = TRUE)
#' #Get methylation data as a GRanges object
get_matrix(m = methrix_data, type = 'M', add_loci = TRUE, in_granges=TRUE)
```

| | |
|--------------------|--|
| get_region_summary | <i>Extract and summarize methylation or coverage info by regions of interest</i> |
|--------------------|--|

Description

Extract and summarize methylation or coverage info by regions of interest

Usage

```
get_region_summary(  
  m,  
  regions = NULL,  
  type = "M",  
  how = "mean",  
  overlap_type = "within",  
  na_rm = TRUE,  
  elementMetadata.col = NULL,  
  verbose = TRUE,  
  n_chunks = 1,  
  n_cores = 1  
)
```

Arguments

| | |
|---------------------|---|
| m | methrix object |
| regions | genomic regions to be summarized. Could be a data.table with 3 columns (chr, start, end) or a GenomicRanges object |
| type | matrix which needs to be summarized. Could be 'M', 'C'. Default 'M' |
| how | mathematical function by which regions should be summarized. Can be one of the following: mean, sum, max, min. Default 'mean' |
| overlap_type | defines the type of the overlap of the CpG sites with the target region. Default value is 'within'. For detailed description, see the findOverlaps function of the IRanges package. |
| na_rm | Remove NA's? Default TRUE |
| elementMetadata.col | columns in rowData(methrix) which needs to be summarised. Default = NULL. |
| verbose | Default TRUE |
| n_chunks | Number of chunks to split the methrix object in case it is very large. Default = 1. |
| n_cores | Number of parallel instances. n_cores should be less than or equal to n_chunks. If n_chunks is not specified, then n_chunks is initialized to be equal to n_cores. Default = 1. |

Details

Takes [methrix](#) object and summarizes regions

Value

a coverage or methylation matrix

Examples

```
data('methrix_data')
get_region_summary(m = methrix_data,
  regions = data.table(chr = 'chr21', start = 27867971, end = 27868103),
  type = 'M', how = 'mean')
```

get_stats

Estimate descriptive statistics

Description

Estimate descriptive statistics

Usage

```
get_stats(m, per_chr = TRUE)
```


Arguments

`m` [methrix](#) object
`per_chr` Estimate stats per chromosome. Default TRUE

Details

Calculate descriptive statistics

Value

data.table of summary stats

See Also

[plot_stats](#)

Examples

```
data('methrix_data')  
get_stats(methrix_data)
```

load_HDF5_methrix *Loads HDF5 methrix object*

Description

Loads HDF5 methrix object

Usage

```
load_HDF5_methrix(dir = NULL, ...)
```

Arguments

`dir` The directory to read in from. Default NULL
`...` Parameters to pass to loadHDF5SummarizedExperiment

Details

Takes directory with a previously saved HDF5Array format [methrix](#) object and loads it

Value

An object of class [methrix](#)

Examples

```
data('methrix_data')
methrix_data_h5 <- convert_methrix(m=methrix_data)
target_dir = paste0(getwd(), '/temp1/')
save_HDF5_methrix(methrix_data_h5, dir = target_dir, replace = TRUE)
load_HDF5_methrix(target_dir)
```

| | |
|--------------|---|
| mask_methrix | <i>Masks too high or too low coverage</i> |
|--------------|---|

Description

Masks too high or too low coverage

Usage

```
mask_methrix(m, low_count = NULL, high_quantile = 0.99, n_cores = 1)
```

Arguments

| | |
|---------------|--|
| m | <code>methrix</code> object |
| low_count | The minimal coverage allowed. Everything below, will get masked. Default = NULL, nothing gets masked. |
| high_quantile | The quantile limit of coverage. Quantiles are calculated for each sample and everything that belongs to a higher quantile than the defined will be masked. Default = 0.99. |
| n_cores | Number of parallel instances. Can only be used if <code>methrix</code> is in HDF5 format. Default = 1. |

Details

Takes `methrix` object and masks sites with too high or too low coverage by putting NA for coverage and beta value. The sites will remain in the object.

Value

An object of class `methrix`

Examples

```
data('methrix_data')
mask_methrix(m = methrix_data, low_count = 5, high_quantile = 0.99 )
```

| | |
|---------------|----------------------|
| methrix-class | <i>Class methrix</i> |
|---------------|----------------------|

Description

S4 class Methrix

Slots

assays A list of two matrices containing 'Methylation' and 'Coverage' information
 elementMetadata A DataFrame describing rows in corresponding assay matrices.
 colData genome: the name of the BSgenome that was used to extract CpGs, isHDF5: is it stored
 in HDF5 Array format
 metadata a list of meta data associated with the assays
 NAMES NULL

| | |
|---------------|--|
| methrix2bsseq | <i>Convert methrix to bsseq object</i> |
|---------------|--|

Description

Convert `methrix` to bsseq object

Usage

```
methrix2bsseq(m)
```

Arguments

m `methrix` object

Details

Takes `methrix` object and returns a bsseq object

Value

An object of class bsseq

Examples

```
## Not run:
data('methrix_data')
methrix2bsseq(m = methrix_data)

## End(Not run)
```

`methrix_data`*WGBS for colon cancer, chr21 and chr22*

Description

This is a subset of original 'bsseqData' converted to 'methrix' containing Whole-genome bisulfite sequencing data (WGBS) for colon cancer on chromosome 21 and 22.

Usage

```
data('methrix_data')
```

Format

An object of class 'methrix'

References

Hansen, K. D. et al. (2011) Increased methylation variation in epigenetic domains across cancer types. *Nature Genetics* 43, 768-775.

Examples

```
data('methrix_data')
methrix_data
```

`methrix_pca`*Principal Component Analysis*

Description

Principal Component Analysis

Usage

```
methrix_pca(  
  m,  
  var = "top",  
  top_var = 1000,  
  ranges = NULL,  
  pheno = NULL,  
  do_plot = TRUE,  
  n_pc = 2  
)
```

Arguments

| | |
|---------|---|
| m | Input <code>methrix</code> object |
| var | Choose between random CpG sites ('rand') or most variable CpGs ('top'). |
| top_var | Number of variable CpGs to use. Default 1000 Set it to NULL to use all CpGs (which is not recommended due to memory requirements). This option is mutually exclusive with ranges. |
| ranges | genomic regions to be summarized. Could be a data.table with 3 columns (chr, start, end) or a GenomicRanges object |
| pheno | Column name of colData(m). Default NULL. Will be used as a factor to color different groups |
| do_plot | Should a plot be generated? |
| n_pc | Default 2. |

Value

PCA results

Examples

```
data('methrix_data')
methrix_pca(methrix_data, do_plot = FALSE)
```

| | |
|-----------------------------|---|
| <code>methrix_report</code> | <i>Creates a detailed interactive html summary report from Methrix object</i> |
|-----------------------------|---|

Description

Creates a detailed interactive html summary report from Methrix object. If the directory contains required files (from previous run), it directly proceeds to generate html report.

Usage

```
methrix_report(
  meth,
  output_dir = NULL,
  recal_stats = FALSE,
  plot_beta_dist = TRUE,
  beta_nCpG = 10000,
  prefix = NULL,
  n_thr = 4
)
```

Arguments

| | |
|----------------|--|
| meth | methrix object |
| output_dir | Output directory name where the files should be saved. If NULL creates a tempdir |
| recal_stats | Whether summary statistics should be recalculated? If you are using subsetted methrix object set this to TRUE. |
| plot_beta_dist | Default TRUE. Can be time consuming. |
| beta_nCpG | Number of CpGs rto use for estimating beta value distribution. Default 10000 |
| prefix | If provided, the name of the report and the intermediate files will start with the prefix. |
| n_thr | Default 4. Only used if plot_beta_dist is TRUE |

Value

an interactive html report

Examples

```
## Not run:
data('methrix_data')
methrix::methrix_report(meth = methrix_data)

## End(Not run)
```

| | |
|-------------|-----------------------------------|
| order_by_sd | <i>Order mathrix object by SD</i> |
|-------------|-----------------------------------|

Description

Order mathrix object by SD

Usage

```
order_by_sd(m)
```

Arguments

| | |
|---|--------------------------------|
| m | methrix object |
|---|--------------------------------|

Details

Takes [methrix](#) object and reorganizes the data by standard deviation

Value

An object of class [methrix](#)

Examples

```
data('methrix_data')
order_by_sd(m = methrix_data)
```

plot_coverage *Coverage QC Plots*

Description

Coverage QC Plots

Usage

```
plot_coverage(
  m,
  type = c("hist", "dens"),
  pheno = NULL,
  perGroup = FALSE,
  lim = 100,
  size.lim = 1e+06,
  col_palette = "RdYlGn"
)
```

Arguments

| | |
|-------------|--|
| m | Input <code>methrix</code> object |
| type | Choose between 'hist' (histogram) or 'dens' (density plot). |
| pheno | Column name of <code>colData(m)</code> . Will be used as a factor to color different groups in the plot. |
| perGroup | Color the plots in a sample-wise manner? |
| lim | Maximum coverage value to be plotted. |
| size.lim | The maximum number of observations (<code>sites*samples</code>) to use. If the dataset is larger than this, random sites will be selected from the genome. |
| col_palette | Name of the <code>RColorBrewer</code> palette to use for plotting. |

Value

ggplot2 object

Examples

```
data('methrix_data')
plot_coverage(m = methrix_data)
```

| | |
|--------------|--|
| plot_density | <i>Density Plot of β-Values</i> |
|--------------|--|

Description

Density Plot of β -Values

Usage

```
plot_density(  
  m,  
  ranges = NULL,  
  n_cpgs = 25000,  
  pheno = NULL,  
  col_palette = "RdYlGn"  
)
```

Arguments

| | |
|-------------|--|
| m | Input <code>methrix</code> object |
| ranges | genomic regions to be summarized. Could be a <code>data.table</code> with 3 columns (chr, start, end) or a <code>GenomicRanges</code> object |
| n_cpgs | Use these many random CpGs for plotting. Default 25000. Set it to NULL to use all - which can be memory expensive. |
| pheno | Column name of <code>colData(m)</code> . Will be used as a factor to color different groups in the violin plot. |
| col_palette | Name of the <code>RColorBrewer</code> palette to use for plotting. |

Value

`ggplot2` object

Examples

```
data('methrix_data')  
plot_density(m = methrix_data)
```

`plot_pca`*Plot PCA results*

Description

Plot PCA results

Usage

```
plot_pca(  
  pca_res,  
  m = NULL,  
  col_anno = NULL,  
  shape_anno = NULL,  
  pc_x = "PC1",  
  pc_y = "PC2",  
  show_labels = FALSE  
)
```

Arguments

| | |
|--------------------------|--|
| <code>pca_res</code> | Results from methrix_pca |
| <code>m</code> | optinal methrix object. Default NULL |
| <code>col_anno</code> | Column name of colData(m). Default NULL. Will be used as a factor to color different groups. Required methrix object |
| <code>shape_anno</code> | Column name of colData(m). Default NULL. Will be used as a factor to shape different groups. Required methrix object |
| <code>pc_x</code> | Default 'PC1' |
| <code>pc_y</code> | Default 'PC2' |
| <code>show_labels</code> | Default FLASE |

Value

ggplot2 object

Examples

```
data('methrix_data')  
mpc = methrix_pca(methrix_data, do_plot = FALSE)  
plot_pca(mpc)
```

| | |
|------------|------------------------------------|
| plot_stats | <i>Plot descriptive statistics</i> |
|------------|------------------------------------|

Description

Plot descriptive statistics

Usage

```
plot_stats(  
  plot_dat,  
  what = "M",  
  stat = "mean",  
  ignore_chr = NULL,  
  samples = NULL,  
  n_col = NULL,  
  n_row = NULL  
)
```

Arguments

| | |
|------------|---|
| plot_dat | results from get_stats |
| what | Can be M or C. Default M |
| stat | Can be mean or median. Default mean |
| ignore_chr | Chromosomes to ignore. Default NULL |
| samples | Use only these samples. Default NULL |
| n_col | number of columns. Passed to 'facet_wrap' |
| n_row | number of rows. Passed to 'facet_wrap' |

Details

plot descriptive statistics results from [get_stats](#)

Value

ggplot2 object

See Also

[get_stats](#)

Examples

```
data('methrix_data')  
gs = get_stats(methrix_data)  
plot_stats(gs)
```

| | |
|-------------|--|
| plot_violin | <i>Violin Plot for β-Values</i> |
|-------------|--|

Description

Violin Plot for β -Values

Usage

```
plot_violin(  
  m,  
  ranges = NULL,  
  n_cpgs = 25000,  
  pheno = NULL,  
  col_palette = "RdYlGn"  
)
```

Arguments

| | |
|-------------|--|
| m | Input <code>methrix</code> object |
| ranges | genomic regions to be summarized. Could be a <code>data.table</code> with 3 columns (chr, start, end) or a <code>GenomicRanges</code> object |
| n_cpgs | Use these many random CpGs for plotting. Default 25000. Set it to <code>NULL</code> to use all - which can be memory expensive. |
| pheno | Column name of <code>colData(m)</code> . Will be used as a factor to color different groups in the violin plot. |
| col_palette | Name of the <code>RColorBrewer</code> palette to use for plotting. |

Value

`ggplot2` object

Examples

```
data('methrix_data')  
plot_violin(m = methrix_data)
```

| | |
|----------------|-----------------------------------|
| read_bedgraphs | <i>Versatile BedGraph reader.</i> |
|----------------|-----------------------------------|

Description

Versatile BedGraph reader.

Usage

```
read_bedgraphs(
  files = NULL,
  pipeline = NULL,
  zero_based = TRUE,
  stranded = FALSE,
  collapse_strands = FALSE,
  ref_cpgs = NULL,
  ref_build = NULL,
  contigs = NULL,
  vect = FALSE,
  vect_batch_size = NULL,
  coldata = NULL,
  chr_idx = NULL,
  start_idx = NULL,
  end_idx = NULL,
  beta_idx = NULL,
  M_idx = NULL,
  U_idx = NULL,
  strand_idx = NULL,
  cov_idx = NULL,
  synced_coordinates = FALSE,
  n_threads = 1,
  h5 = FALSE,
  h5_dir = NULL,
  h5temp = NULL,
  verbose = TRUE
)
```

Arguments

| | |
|------------|---|
| files | bedgraph files. |
| pipeline | Default NULL. Currently supports "Bismark_cov", "MethylDackel", "MethylcTools", "BisSNP", "BSseeker2_CGmap" If not known use idx arguments for manual column assignments. |
| zero_based | Are bedgraph regions zero based ? Default TRUE |
| stranded | Default FALSE |

| | |
|--------------------|---|
| collapse_strands | If TRUE collapses CpGs on different crick strand into watson. Deafult FALSE |
| ref_cpgs | BSgenome object, or name of the installed BSgenome package, or an output from extract_CPGs . Example: BSgenome.Hsapiens.UCSC.hg19 |
| ref_build | reference genome for bedgraphs. Default NULL. Only used for additional details. Doesnt affect in any way. |
| contigs | contigs to restrict genomic CpGs to. Default all autosomes and allosomes - ignoring extra contigs. |
| vect | To use vectorized code. Default FALSE. Set to TRUE if you don't have large number of BedGraph files. |
| vect_batch_size | Default NULL. Process samples in batches. Applicable only when vect = TRUE |
| coldata | An optional DataFrame describing the samples. Row names, if present, become the column names of the matrix. If NULL, then a DataFrame will be created with basename of files used as the row names. |
| chr_idx | column index for chromosome in bedgraph files |
| start_idx | column index for start position in bedgraph files |
| end_idx | column index for end position in bedgraph files |
| beta_idx | column index for beta values in bedgraph files |
| M_idx | column index for read counts supporting Methylation in bedgraph files |
| U_idx | column index for read counts supporting Un-methylation in bedgraph files |
| strand_idx | column index for strand information in bedgraph files |
| cov_idx | column index for total-coverage in bedgraph files |
| synced_coordinates | Are the start and end coordinates of a stranded bedgraph are synchronized between + and - strands? Possible values: FALSE (default), TRUE if the start coordinates are the start coordinates of the C on the plus strand. |
| n_threads | number of threads to use. Default 1. Be-careful - there is a linear increase in memory usage with number of threads. This option is does not work with Windows OS. |
| h5 | Should the coverage and methylation matrices be stored as 'HDF5Array' |
| h5_dir | directory to store H5 based object |
| h5temp | temporary directory to store hdf5 |
| verbose | Be little chatty ? Default TRUE. |

Details

Reads BedGraph files and generates methylation and coverage matrices. Optionally arrays can be serialized as on-disk HDFS5 arrays.

Value

An object of class [methrix](#)

Examples

```
## Not run:
bdg_files = list.files(path = system.file('extdata', package = 'methrix'),
pattern = '*\\.bedGraph\\.gz$', full.names = TRUE)
hg19_cpgs = methrix::extract_CPGs(ref_genome = 'BSgenome.Hsapiens.UCSC.hg19')
meth = methrix::read_bedgraphs( files = bdg_files, ref_cpgs = hg19_cpgs,
chr_idx = 1, start_idx = 2, M_idx = 3, U_idx = 4,
stranded = FALSE, zero_based = FALSE, collapse_strands = FALSE)

## End(Not run)
```

| | |
|---------------|----------------------------------|
| region_filter | <i>Filter matrices by region</i> |
|---------------|----------------------------------|

Description

Filter matrices by region

Usage

```
region_filter(m, regions, type = "within")
```

Arguments

| | |
|---------|---|
| m | methrix object |
| regions | genomic regions to filter-out. Could be a <code>data.table</code> with 3 columns (chr, start, end) or a <code>GenomicRanges</code> object |
| type | defines the type of the overlap of the CpG sites with the target regions. Default value is 'within'. For detailed description, see the <code>foverlaps</code> function of the data.table package. |

Details

Takes [methrix](#) object and filters CpGs based on supplied regions in `data.table` or `GRanges` format

Value

An object of class [methrix](#)

Examples

```
data('methrix_data')
region_filter(m = methrix_data,
regions = data.table(chr = 'chr21', start = 27867971, end = 27868103))
```

| | |
|-------------|---|
| remove_snps | <i>Removes CpG sites from the object if they overlap with common SNPs</i> |
|-------------|---|

Description

Removes CpG sites from the object if they overlap with common SNPs

Usage

```
remove_snps(
  m,
  populations = NULL,
  maf_threshold = 0.01,
  reduce_filtering = FALSE,
  forced = FALSE,
  keep = FALSE,
  n_chunks = 1,
  n_cores = 1
)
```

Arguments

| | |
|------------------|--|
| m | <code>methrix</code> object |
| populations | Populations to use. Default is all. |
| maf_threshold | The frequency threshold, above which the SNPs will be removed. Default is 0.01 |
| reduce_filtering | If TRUE, the SNPs with a MAF < 0.1 will be evaluated and only the highly variable ones will be removed. Default FALSE. |
| forced | the <code>reduce_filtering</code> is not recommended with less than 10 samples, but can be forced. Default is FALSE. |
| keep | Do you want to keep the sites that were filtered out? In this case, the function will return with a list of two <code>methrix</code> objects. |
| n_chunks | Number of chunks to split the <code>methrix</code> object in case it is very large. Can only be used if input data is in HDF5 format. Default = 1. |
| n_cores | Number of parallel instances. Can only be used if input data is in HDF5 format. <code>n_cores</code> should be less than or equal to <code>n_chunks</code> . If <code>n_chunks</code> is not specified, then <code>n_chunks</code> is initialized to be equal to <code>n_cores</code> . Default = 1. |

Details

Takes `methrix` object and removes common SNPs. SNPs overlapping with a CpG site and have a minor allele frequency (MAF) above a threshold in any of the populations used will be selected and the corresponding CpG sites will be removed from the `methrix` object. With the `reduce_filtering` option, SNPs with MAF < 0.1 will be further evaluated. If they show low variance in the dataset, there is probably no genotype variability in the population, therefore the corresponding CpG site won't be removed. Please keep in mind that variance thresholds are

Value

methrix object or a list of methrix objects

Examples

```
data('methrix_data')
remove_snps(m = methrix_data, maf_threshold=0.01)
```

| | |
|------------------|--|
| remove_uncovered | <i>Remove loci that are uncovered across all samples</i> |
|------------------|--|

Description

Remove loci that are uncovered across all samples

Usage

```
remove_uncovered(m)
```

Arguments

m [methrix](#) object

Details

Takes [methrix](#) object and removes loci that are uncovered across all samples

Value

An object of class [methrix](#)

Examples

```
data('methrix_data')
remove_uncovered(m = methrix_data)
```

save_HDF5_methrix *Saves HDF5 methrix object*

Description

Saves HDF5 methrix object

Usage

```
save_HDF5_methrix(m = NULL, dir = NULL, replace = FALSE, ...)
```

Arguments

| | |
|---------|--|
| m | methrix object |
| dir | The directory to use. Created, if not existing. Default NULL |
| replace | Should it overwrite the pre-existing data? FALSE by default. |
| ... | Parameters to pass to saveHDF5SummarizedExperiment |

Details

Takes [methrix](#) object and saves it

Value

Nothing

Examples

```
data('methrix_data')
methrix_data_h5 <- convert_methrix(m=methrix_data)
target_dir = paste0(getwd(), '/temp/')
save_HDF5_methrix(methrix_data_h5, dir = target_dir, replace = TRUE)
```

subset_methrix *Subsets [methrix](#) object based on given conditions.*

Description

Subsets [methrix](#) object based on given conditions.

Usage

```
subset_methrix(  
  m,  
  regions = NULL,  
  contigs = NULL,  
  samples = NULL,  
  overlap_type = "within"  
)
```

Arguments

| | |
|--------------|--|
| m | methrix object |
| regions | genomic regions to subset by. Could be a <code>data.table</code> with 3 columns (chr, start, end) or a <code>GenomicRanges</code> object |
| contigs | chromosome names to subset by |
| samples | sample names to subset by |
| overlap_type | defines the type of the overlap of the CpG sites with the target region. Default value is 'within'. For detailed description, see the <code>foverlaps</code> function of the data.table package. |

Details

Takes [methrix](#) object and filters CpGs based on coverage statistics

Value

An object of class [methrix](#)

Examples

```
data('methrix_data')  
#Subset to chromosome 1  
subset_methrix(methrix_data, contigs = 'chr21')
```

| | |
|-----------------|---|
| write_bedgraphs | <i>Writes bedGraphs from methrix object</i> |
|-----------------|---|

Description

Writes bedGraphs from methrix object

Usage

```
write_bedgraphs(
  m,
  output_dir = NULL,
  rm_NA = TRUE,
  force = FALSE,
  n_thr = 4,
  compress = TRUE,
  SeqStyle = "UCSC",
  multiBed = NULL,
  metilene = FALSE,
  phenoCol = NULL,
  add_coverage = FALSE
)
```

Arguments

| | |
|--------------|---|
| m | methrix object |
| output_dir | Output directory name where the files should be saved. If NULL creates a tempdir |
| rm_NA | remove NAs |
| force | forces to create files if they are existing |
| n_thr | Default 4. |
| compress | Whether to compress the output. Default TRUE |
| SeqStyle | Default 'UCSC' with 'chr' prefix. |
| multiBed | Default NULL. If provided a filename, a single bedGraph file with all samples included is generated. |
| metilene | Default FALSE. If TRUE outputs bedgraphs in 'metilene' format that can be directly used for DMR calling with 'metilene'. This option works only when multiBed = TRUE. |
| phenoCol | Default NULL. 'condition' column from colData. Only applicable if metilene = TRUE |
| add_coverage | Should the output file contain information on coverage? Default FALSE |

Value

writes bedgraph files to output

Examples

```
data('methrix_data')
write_bedgraphs(m = methrix_data, output_dir = './temp')
#Export to metline format for DMR calling with metline
write_bedgraphs(m = methrix_data, output_dir = "./temp", rm_NA = FALSE,
  metilene = TRUE, multiBed = "metline_ip", phenoCol = "Condition")
```

| | |
|---------------|--|
| write_bigwigs | <i>Exports methrix object as bigWigs</i> |
|---------------|--|

Description

Exports methrix object as bigWigs

Usage

```
write_bigwigs(m, output_dir = getwd(), samp_names = NULL)
```

Arguments

| | |
|------------|--|
| m | methrix object |
| output_dir | Output directory name where the files should be saved. Default getwd() |
| samp_names | sample names to export |

Examples

```
data('methrix_data')  
write_bigwigs(m = methrix_data, output_dir = './temp')
```

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