

Package ‘HiCool’

November 27, 2023

Version 1.2.0

Date 2022-11-04

Title HiCool

Description HiCool provides an R interface to process and normalize Hi-C paired-end fastq reads into .(m)cool files. .(m)cool is a compact, indexed HDF5 file format specifically tailored for efficiently storing HiC-based data. On top of processing fastq reads, HiCool provides a convenient reporting function to generate shareable reports summarizing Hi-C experiments and including quality controls.

License MIT + file LICENSE

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

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

Depends R (>= 4.2), HiCExperiment

Imports BiocIO, S4Vectors, GenomicRanges, IRanges, InteractionSet, vroom, basilisk, reticulate, rmarkdown, rmdformats, plotly, dplyr, stringr, sessioninfo, utils

Suggests HiContacts, HiContactsData, AnnotationHub, BiocFileCache, BiocStyle, testthat, knitr, rmarkdown

biocViews HiC, DNA3DStructure, DataImport

Encoding UTF-8

VignetteBuilder knitr

LazyData false

Roxygen list(markdown = TRUE)

RoxygenNote 7.2.3

Config/testthat/edition 3

StagedInstall no

git_url <https://git.bioconductor.org/packages/HiCool>

git_branch RELEASE_3_18

git_last_commit 7fe5520

git_last_commit_date 2023-10-24

Repository Bioconductor 3.18

Date/Publication 2023-11-27

Author Jacques Serizay [aut, cre]

Maintainer Jacques Serizay <jacquesserizay@gmail.com>

R topics documented:

getLoops	2
HiCool	3
HiCReport	5
Index	7

getLoops	<i>Finding loops in contact map</i>
----------	-------------------------------------

Description

Find loops using chromosight

Usage

```
getLoops(
  x,
  resolution = NULL,
  output_prefix = file.path("chromosight", "chromo"),
  norm = "auto",
  max.dist = "auto",
  min.dist = "auto",
  min.separation = "auto",
  n.mads = 5L,
  pearson = "auto",
  nreads = "no",
  ncores = 1L
)
```

Arguments

x	A HiCExperiment object
resolution	Which resolution to use to search loops
output_prefix	Prefix to chromosight output (default: "chromosight/chromo")
norm	Normalization parameter for chromosight

<code>min.dist, max.dist</code>	Min and max distance to use to filter for significant loops
<code>min.separation</code>	Minimum separation between anchors of potential loops
<code>n.mads</code>	Number of MADs to use to filter relevant bins to search for loops
<code>pearson</code>	Minimum Pearson correlation score to use to filter for significant loops
<code>nreads</code>	Number of reads to subsample to before searching for loops
<code>ncores</code>	Number of cores for chromosight

Value

A `HiCExperiment` object with a new "loops" `topologicalFeatures` storing significant interactions identified by `chromosight`, and an additional `chromosight_args` metadata entry.

Examples

```
contacts_yeast <- contacts_yeast()
contacts_yeast <- getLoops(contacts_yeast)
S4Vectors::metadata(contacts_yeast)$chromosight_args
topologicalFeatures(contacts_yeast, 'loops')
```

Description

`HiCool::HiCool()` automatically processes paired-end HiC sequencing files by performing the following steps:

1. Automatically setting up an appropriate conda environment using `basilisk`;
2. Mapping the reads to the provided genome reference using `hicstuff` and filtering of irrelevant pairs;
3. Filtering the resulting pairs file to remove unwanted chromosomes (e.g. `chrM`);
4. Binning the filtered pairs into a cool file at a chosen resolution;
5. Generating a multi-resolution mcool file;
6. Normalizing matrices at each resolution by iterative correction using `cooler`.

The filtering strategy used by `hicstuff` is described in Cournac et al., *BMC Genomics* 2012.

Usage

```

HiCool(
  r1,
  r2,
  genome,
  restriction = "DpnII,HinfI",
  resolutions = NULL,
  iterative = TRUE,
  balancing_args = " --min-nnz 10 --mad-max 5 ",
  threads = 1L,
  exclude_chr = "Mito|chrM|MT",
  output = "HiCool",
  keep_bam = FALSE,
  build_report = TRUE,
  scratch = tempdir()
)

importHiCoolFolder(output, hash, resolution = NULL)

getHiCoolArgs(log)

getHicStats(log)

```

Arguments

r1	Path to fastq file (R1 read)
r2	Path to fastq file (R2 read)
genome	Genome used to map the reads on, provided either as a fasta file (in which case the bowtie2 index will be automatically generated), or as a prefix to a bowtie2 index (e.g. mm10 for mm10.*.bt2 files). Genome can also be a unique ID for the following references: hg38, mm10, dm6, R64-1-1, GRZc10, WBce1235, Galgal4.
restriction	Restriction enzyme(s) used in HiC (Default: "DpnII,HinfI")
resolutions	Resolutions used to bin the final mcool file (Default: 5 levels of resolution automatically inferred according to genome size)
iterative	Should the read mapping be performed iteratively? (Default: TRUE)
balancing_args	Balancing arguments for cooler. See cooler documentation here for a list of all available balancing arguments. These defaults match those used by the 4DN consortium.
threads	Number of CPUs used for parallelization. (Default: 1)
exclude_chr	Chromosomes excluded from the final .mcool file. This will not affect the pairs file. (Default: "Mito chrM MT")
output	Output folder used by HiCool.
keep_bam	Should the bam files be kept? (Default: FALSE)
build_report	Should an automated report be computed? (Default: TRUE)
scratch	Path to temporary directory where processing will take place. (Default: tempdir())

hash	Unique 6-letter ID used to identify files from a specific HiCool processing run.
resolution	Resolution used to import the mcool file
log	Path to log file generated by hicstuff/hicool

Value

A CoolFile object with prefilled pairsFile and metadata slots.

HiCool utils

- `importHiCoolFolder(folder, hash)` automatically finds the different processed files associated with a specific `HiCool::HiCool()` processing hash ID.
- `getHiCoolArgs()` parses the log file generated by `HiCool::HiCool()` during processing to recover which arguments were used.
- `getHicStats()` parses the log file generated by `HiCool::HiCool()` during processing to recover pre-computed stats about pair numbers, filtering thresholds, etc.

Examples

```
r1 <- HiContactsData::HiContactsData(sample = 'yeast_wt', format = 'fastq_R1')
r2 <- HiContactsData::HiContactsData(sample = 'yeast_wt', format = 'fastq_R2')
hcf <- HiCool(r1, r2, genome = 'R64-1-1', output = './HiCool/')
hcf
getHiCoolArgs(S4Vectors::metadata(hcf)$log)
getHicStats(S4Vectors::metadata(hcf)$log)
readLines(S4Vectors::metadata(hcf)$log)
```

HiCReport

HiC processing report

Description

HiC processing report

Usage

```
HiCReport(x, output = NULL)
```

Arguments

x	an CoolFile object, generated from <code>HiCool::HiCool()</code> or <code>HiCool::importHiCoolFolder()</code> , or directly from calling <code>HiCExperiment::CoolFile()</code> .
output	Path to save output HTML file.

Value

String to the generated HTML report file

Examples

```
mcool_path <- HiContactsData::HiContactsData('yeast_wt', 'mcool')
pairs_path <- HiContactsData::HiContactsData('yeast_wt', 'pairs.gz')
log_path <- HiContactsData::HiContactsData(sample = 'yeast_wt', format = 'HiCool_log')
cf <- CoolFile(mcool_path, pairs = pairs_path, metadata = list(log = log_path))
HiCReport(cf)
```

Index

`getHiCoolArgs (HiCool)`, [3](#)

`getHicStats (HiCool)`, [3](#)

`getLoops`, [2](#)

`HiCool`, [3](#)

`HiCReport`, [5](#)

`importHiCoolFolder (HiCool)`, [3](#)