Package ‘motifmatchr’

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Type Package
Title Fast Motif Matching in R
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Description Quickly find motif matches for many motifs and many sequences. Wraps C++ code from the MOODS motif calling library, which was developed by Pasi Rastas, Janne Korhonen, and Petri Martimäki.
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### Description

A few example motifs from JASPAR 2016 for trying out motifmatchr

### Usage

```r
data(example_motifs)
```

### Value

**PFMatrixList** of length 3

### Examples

```r
data(example_motifs, package = "motifmatchr")
```

## Description

Find motif matches
**matchMotifs**

**Usage**

```r
matchMotifs(pwms, subject, ...)
```

## S4 method for signature 'PWMatrixList,DNAStringSet'

```r
matchMotifs(pwms, subject,
  genome = NULL, bg = c("subject", "genome", "even"),
  out = c("matches", "scores", "positions"),
  p.cutoff = 5e-05, w = 7, ranges = NULL)
```

## S4 method for signature 'PWMatrixList,character'

```r
matchMotifs(pwms, subject, genome = NULL,
  bg = c("subject", "genome", "even"),
  out = c("matches", "scores", "positions"),
  p.cutoff = 5e-05, w = 7, ranges = NULL)
```

## S4 method for signature 'PWMatrixList,DNAString'

```r
matchMotifs(pwms, subject, genome = NULL,
  bg = c("subject", "genome", "even"),
  out = c("matches", "scores", "positions"),
  p.cutoff = 5e-05, w = 7, ranges = NULL)
```

## S4 method for signature 'PWMatrixList,GenomicRanges'

```r
matchMotifs(pwms, subject,
  genome = GenomeInfoDb::genome(subject),
  bg = c("subject", "genome", "even"),
  out = c("matches", "scores", "positions"),
  p.cutoff = 5e-05, w = 7)
```

## S4 method for signature 'PWMatrixList,RangedSummarizedExperiment'

```r
matchMotifs(pwms, subject,
  genome = GenomeInfoDb::genome(subject),
  bg = c("subject", "genome", "even"),
  out = c("matches", "scores", "positions"),
  p.cutoff = 5e-05, w = 7)
```

## S4 method for signature 'PWMatrixList,BSgenomeViews'

```r
matchMotifs(pwms, subject,
  bg = c("subject", "genome", "even"),
  out = c("matches", "scores", "positions"),
  p.cutoff = 5e-05, w = 7)
```

## S4 method for signature 'PFMatrixList,ANY'

```r
matchMotifs(pwms, subject, ...)
```

## S4 method for signature 'PWMatrix,ANY'

```r
matchMotifs(pwms, subject, ...)
```

## S4 method for signature 'PFMatrix,ANY'

```r
matchMotifs(pwms, subject, ...)
```

**Arguments**

- **pwms**: either `PFMatrix`, `PFMatrixList`, `PWMatrix`, `PWMatrixList`
- **subject**: either `GenomicRanges`, `DNAStringSet`, `DNAString`, or character vector
matchMotifs

... additional arguments depending on inputs

genome BSgenome object, DNAStringSet, or FaFile, or short string signifying genome build recognized by getBSgenome. Only required if subject is GenomicRanges or RangedSummarizedExperiment or if bg is set to "genome"

bg background nucleotide frequencies. Default is to compute based on subject, i.e. the specific set of sequences being evaluated. See Details.

out what to return? see return section

p.cutoff p-value cutoff for returning motifs

w parameter controlling size of window for filtration; default is 7

ranges if subject is not GenomicRanges or RangedSummarizedExperiment, these ranges can be used to specify what ranges the input sequences correspond to. These ranges will be incorporated into the SummarizedExperiment output if out is "matches" or "scores" or will be used to give absolute positions of motifs if out is "positions"

Details

Background nucleotide frequencies can be set to "subject" to use the subject sequences or ranges for computing the nucleotide frequencies, "genome" for using the genomic frequencies (in which case a genome must be specified), "even" for using 0.25 for each base, or a numeric vector with A, C, G, and T frequencies.

Value

Either returns a SummarizedExperiment with a sparse matrix with values set to TRUE for a match (if out == 'matches'), a SummarizedExperiment with a matches matrix as well as matrices with the maximum motif score and total motif counts (if out == 'scores'), or a GenomicRangesList or a list of IRangesList with all the positions of matches (if out == 'positions')

Methods (by class)

- pwms = PWMatrixList, subject = DNAStringSet: PWMatrixList/DNAStringSet
- pwms = PWMatrixList, subject = character: PWMatrixList/character
- pwms = PWMatrixList, subject = DNAString: PWMatrixList/DNAString
- pwms = PWMatrixList, subject = GenomicRanges: PWMatrixList/GenomicRanges
- pwms = PWMatrixList, subject = RangedSummarizedExperiment: PWMatrixList/RangedSummarizedExperiment
- pwms = PWMatrixList, subject = BSgenomeViews: PWMatrixList/BSGenomeViews
- pwms = PFMatrixList, subject = ANY: PFMatrixList/ANY
- pwms = PWMatrix, subject = ANY: PWMatrix/ANY
- pwms = PFMatrix, subject = ANY: PFMatrix/ANY
Examples

data(example_motifs, package = "motifmatchr")

# Make a set of peaks
peaks <- GenomicRanges::GRanges(seqnames = c("chr1", "chr2", "chr2"),
                               ranges = IRanges::IRanges(start = c(76585873, 42772928,
                                                         100183786),
                               width = 500))

# Get motif matches for example motifs
motif_ix <- matchMotifs(example_motifs, peaks, genome = "BSgenome.Hsapiens.UCSC.hg19")

motifCounts

Description

get motif counts from SummarizedExperiment object

Usage

motifCounts(object)

## S4 method for signature 'SummarizedExperiment'

motifCounts(object)

Arguments

object SummarizedExperiment object with counts assay

Value

matrix with counts

Methods (by class)

  • SummarizedExperiment: method for SummarizedExperiment

Examples

data(example_motifs, package = "motifmatchr")

# Make a set of peaks
peaks <- GenomicRanges::GRanges(seqnames = c("chr1", "chr2", "chr2"),
                               ranges = IRanges::IRanges(start = c(76585873, 42772928,
                                                         100183786),
                               width = 500))
# Get motif matches for example motifs
motif_ix <- matchMotifs(example_motifs, peaks,
    genome = "BSgenome.Hsapiens.UCSC.hg19",
    out = "scores")

motifCounts(motif_ix)

## Description

get motif matches from SummarizedExperiment object

## Usage

motifMatches(object)

## Arguments

object SummarizedExperiment object with matches assay

## Value

matrix with scores

## Methods (by class)

- SummarizedExperiment: method for SummarizedExperiment

## Examples

data(example_motifs, package = "motifmatchr")

# Make a set of peaks
peaks <- GenomicRanges::GRanges(seqnames = c("chr1", "chr2", "chr2"),
    ranges = IRanges::IRanges(start = c(76585873, 42772928,
    100183786),
    width = 500))

# Get motif matches for example motifs
motif_ix <- matchMotifs(example_motifs, peaks,
    genome = "BSgenome.Hsapiens.UCSC.hg19")

motifMatches(motif_ix)
Description
The motifmatchr package is designed for analyzing many sequences and many motifs to find which sequences contain which motifs.

Details
motifmatchr uses the MOODS C++ library (developed by Pasi Rastas, Janne Korhonen, and Petri Martinnak) internally for motif matching.

The primary method of motifmatchr is `matchMotifs`, which takes in motif PWMs/PFMs and genomic ranges or sequences and returns either which ranges/sequences match which motifs or the positions of the matches.

Compared with alternative motif matching functions available in Bioconductor (e.g. `matchPWM` in Biostrings or `searchSeq` in TFBSTools), motifmatchr is designed specifically for the use case of determining whether many different sequences/ranges contain many different motifs.

Author(s)
Alicia Schep

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*Deprecated functions in motifmatchr*

Description
motifmatchr has moved functions and methods to camelCase from snake_case. The following functions have been deprecated and replaced with a different name:

- `motif_matches` is now `motifMatches`
- `motif_counts` is now `motifCounts`
- `motif_scores` is now `motifScores`
- `match_motifs` is now `matchMotifs`

Usage

```r
motif_matches(...)  
motif_counts(...)  
motif_scores(...)  
match_motifs(...)```
Arguments

... arguments passed to new function

Value

calls the replacement function

Author(s)

Alicia Schep

Description

get motif scores from SummarizedExperiment object

Usage

motifScores(object)

## S4 method for signature 'SummarizedExperiment'
motifScores(object)

Arguments

object SummarizedExperiment object with scores assay

Value

matrix with scores

Methods (by class)

• SummarizedExperiment: method for SummarizedExperiment

Examples

data(example_motifs, package = "motifmatchr")

# Make a set of peaks
peaks <- GenomicRanges::GRanges(seqnames = c("chr1","chr2","chr2"),
ranges = IRanges::IRanges(start = c(76585873,42772928,100183786),
width = 500))

# Get motif matches for example motifs
motif_ix <- matchMotifs(example_motifs, peaks,
pwmType

```r
generate = "BSgenome.Hsapiens.UCSC.hg19",
out = "scores")

motifScores(motif_ix)
```

<table>
<thead>
<tr>
<th>pwmType</th>
<th>pwmType</th>
</tr>
</thead>
</table>

**Description**

Determines type of PWM

**Usage**

```r
pwmType(pwm)
```

**Arguments**

- `pwm` PWMatrix object

**Value**

'log', 'log2', or 'frequency' depending on type of pwm

**Examples**

```r
data(example_motifs, package = "motifmatchr")
pwmType(TFBSTools::toPWM(example_motifs[[1]])
pwmType(TFBSTools::toPWM(example_motifs[[1]], type = "prob"))
```
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