Package ‘dagLogo’

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Type Package

Title dagLogo: a Bioconductor package for visualizing conserved amino acid sequence pattern in groups based on probability theory

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Description
Visualize significant conserved amino acid sequence pattern in groups based on probability theory.

License GPL (>=2)

Depends R (>= 3.0.1), methods, grid

Imports pheatmap, Biostrings, UniProt.ws, BiocGenerics, utils, biomaRt, motifStack, httr

Suggests XML, grImport, grImport2, BiocStyle, knitr, rmarkdown, testthat

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dagLogo-package

Visualize significant conserved peptide sequence pattern in groups based on the probability theory

Description

dagLogo provides differential analysis of grouped/ungrouped amino acid usage between an input set of aligned peptide sequences and a background set of aligned peptide sequences which can be generated in different ways. Results of Fisher’s exact test and/or Z-test are visualized using a heatmap or DAG Logo.
DAG: Differential Amino acid Group

There are several differences between dagLogo from iceLogo:
1. The sequence patterns can be grouped by charge, chemistry, hydrophobicity and etc.
2. dagLogo accepts different length of unaligned amino acid sequences.
3. Except that random, regional (called anchored) and terminal (called restricted in dagLogo) background model built from the whole proteome, the background set could be generated using subsequences from regions of the protein sequences matching the input set and complementary set of the input set.

Author(s)
Jianhong Ou, Haibo Liu, Julie Lihua Zhu
Maintainer: Jianhong Ou <jianhong.ou@duke.edu>

Examples
```
data("seq.example")
data("proteome.example")
bg <- buildBackgroundModel(seq.example, proteome=proteome.example, numSubsamples=10L)
t <- testDAU(seq.example, bg)
dagLogo(t)
```

Usage
```r
addScheme(
  color = vector("character"),
  symbol = vector("character"),
  group = NULL
)
```

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>color</td>
<td>A named vector of character. This vector specifies different colors for visualizing the different amino acids or amino acid groups.</td>
</tr>
<tr>
<td>symbol</td>
<td>A named vector of character. This vector specifies the different symbols for visualizing the different amino acids or amino acid groups.</td>
</tr>
<tr>
<td>group</td>
<td>A list or NULL. If only coloring amino acids of similar property is desired, set group to NULL; otherwise group should be a list with same names as those of color and symbol.</td>
</tr>
</tbody>
</table>
Value

Add the custom coloring or grouping scheme to the environment cacheEnv.

Examples

```r
## Add a grouping scheme based on the BLOSUM50 level 3
color = c(LVIMC = "#33FF00", AGSTP = "#CCFF00",
         FYW = '#00FF66', EDNQKRH = "#FF0066")
symbol = c(LVIMC = "L", AGSTP = "A", FYW = "F", EDNQKRH = "E")
group = list(
  LVIMC = c("L", "V", "I", "M", "C"),
  AGSTP = c("A", "G", "S", "T", "P"),
  FYW = c("F", "Y", "W"),
  EDNQKRH = c("E", "D", "N", "Q", "K", "R", "H"))
addScheme(color = color, symbol = symbol, group = group)
```

availableSchemes

Get all predefined coloring and grouping schemes

Description

List all predefined coloring and grouping schemes stored in the environment 'cacheEnv'

Usage

```r
availableSchemes()
```

Value

A vector of names of predefined coloring and grouping schemes stored in the environment 'cacheEnv'.

Author(s)

Haibo Liu

buildBackgroundModel

Build background models for DAU tests

Description

A method used to build background models for testing differential amino acid usage
Usage

buildBackgroundModel(
  dagPeptides,
  background = c("wholeProteome", "inputSet", "nonInputSet"),
  model = c("any", "anchored"),
  targetPosition = c("any", "Nterminus", "Cterminus"),
  uniqueSeq = FALSE,
  numSubsamples = 300L,
  rand.seed = 1,
  replacement = FALSE,
  testType = c("ztest", "fisher"),
  proteome
)

Arguments

dagPeptides  An object of dagPeptides-class containing peptide sequences as the input set.
background  A character vector with options: "wholeProteome", "inputSet", and "nonInputSet", indicating what set of peptide sequences should be considered to generate a background model.
model  A character vector with options: "any" and "anchored", indicating whether an anchoring position should be applied to generate a background model.
targetPosition  A character vector with options: "any", "Nterminus" and "Cterminus", indicating which part of protein sequences of choice should be used to generate a background model.
uniqueSeq  A logical vector indicating whether only unique peptide sequences are included in a background model for sampling.
umSubsamples  An integer, the number of random sampling.
rand.seed  An integer, the seed used to perform random sampling.
replacement  A logical vector of length 1, indicating whether replacement is allowed for random sampling.
testType  A character vector of length 1. Available options are "ztest" and "fisher".
proteome  An object of Proteome, output of prepareProteome

Details

The background could be generated from wholeProteome, inputSet or nonInputSet. Case 1: If background = "wholeProteome" and model = "any": The background set is composed of randomly selected subsequences from the wholeProteome with each subsequence of the same length as input sequences.

Case 2: If background = "wholeProteome and model = "anchored": The background set is composed of randomly selected subsequences from the wholeProteome with each subsequence of same length as input sequences. Additionally, the amino acids at the anchoring positions must be the same amino acid as that defined in the dagPeptides object, such as "K" for lysine.
Case 3: If background = "inputSet" and model = "any": similar to Case 1, but the full length protein sequences matching the protein sequence IDs in the inputSet are used for build background model after excluding the subsequences specified in the inputSet from the full length sequences.

Case 4: If background = "inputSet" and model = "anchored": similar to Case 2, but the full-length protein sequences matching the protein sequence IDs in the inputSet are used for build background model after excluding the subsequences specified in the inputSet from the full length sequences.

Case 5: If background = "nonInputSet" and model = "any": The background set is composed of randomly selected subsequences from the wholeProteome, not including the sequences corresponding to the inputSet sequences with each subsequence of same length as input sequences.

Case 6: If background = "nonInputSet" and model = "anchored": similar to Case 5, but the amino acids at the anchoring positions must be the same amino acid as that defined in the dagPeptides object, such as "K" for lysine.

Value

An object of dagBackground-class.

Author(s)

Jianhong Ou, Haibo Liu

Examples

dat <- unlist(read.delim(system.file("extdata", "grB.txt", package = "dagLogo"),
        header = FALSE, as.is = TRUE))

# prepare an object of Proteome Class from a fasta file
proteome <- prepareProteome(fasta = system.file("extdata",
        "HUMAN.fasta",
        package = "dagLogo"),
        species = "Homo sapiens")

# prepare an object of dagPeptides Class
seq <- formatSequence(seq = dat, proteome = proteome, upstreamOffset = 14,
        downstreamOffset = 15)

bg_fisher <- buildBackgroundModel(seq, background = "wholeProteome",
        proteome = proteome, testType = "fisher")

bg_ztest <- buildBackgroundModel(seq, background = "wholeProteome",
        proteome = proteome, testType = "ztest")

buildZTestBackgroundModel

Build a background model for Z-test.

Description

Build a background model for Z-test.
**Usage**

```r
buildZTestBackgroundModel(
    dagPeptides,
    matches,
    numSubsamples = 30L,
    rand.seed = 1,
    testType = "ztest",
    replacement = FALSE
)
```

**Arguments**

- `dagPeptides`: An object of `dagPeptides-class` containing peptide sequences as the input set.
- `matches`: A character vector with the matched subsequences.
- `numSubsamples`: An integer, the number of random sampling.
- `rand.seed`: An integer, the seed used to perform random sampling.
- `replacement`: A logical vector of length 1, indicating whether replacement is allowed for random sampling.

**Value**

An object of `dagBackground-class`.

**Author(s)**

Jianhong Ou, Haibo Liu

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**cleanPeptides**

`clean up peptides`

**Description**

`cleanPeptides` cleans up the input peptide subsequences. The function removes peptides which do NOT contain any anchoring amino acid. Adds peptide for each additional anchor in each peptide, and allows multiple anchoring amino acids.

**Usage**

```r
cleanPeptides(dat, anchors)
```

**Arguments**

- `dat`: input data. The input data contains columns `symbol`, protein ID, and `peptides`, peptide sequence. The anchoring amino acid must be in lower case.
- `anchors`: A vector of character, anchoring amino acid must be in lower case.
A data.frame with columns: 'symbol', 'peptides' and 'anchor'

Jianhong Ou, Julie Zhu

dat <- read.csv(system.file("extdata", "peptides2filter.csv", package="dagLogo"))
dat
dat.new <- cleanPeptides(dat, anchors = c("s", "t"))

Color sets for visualization.

Create color encoding for visualization of a peptide sequence logo.

colorsets(colorScheme = ls(envir = cachedEnv))

A character vector of length 1, determining the color scheme based on amino acid classification methods. The available colorScheme are "no", "bulkiness_Zimmerman", "hydrophobicity_HW", "hydrophobicity_HK", "isoelectric_point_Zimmerman", "contact_potential_Maiorov", "chemistry_property_Mahler", "consensus_similarity_SF", "volume_Bigelow", "structure_alignments_Mirny", "polarity_Grantham", "sequence_alignment_Dayhoff", "bulkiness_Zimmerman_group", "hydrophobicity_KD_group", "hydrophobicity_HW_group", "charge_group", "contact_potential_Maiorov_group", "chemistry_property_Mahler_group", "consensus_similarity_SF_group", "volume_Bigelow_group", "structure_alignments_Mirny_group", "polarity_Grantham_group", "sequence_alignment_Dayhoff_group", "custom" and "custom_group". If "custom" or "custom_group" are used, users must define a grouping scheme using a list containing sublist named as "color", and "symbol" using the function addScheme, with group set as "NULL" or a list with same names as those of color and symbol. No grouping was applied for the first 12 schemes. It is used to color AAs based on similarities or group amino acids into groups of similarities.

A named character vector of colors
**colorsets2**

**Author(s)**

Jianhong Ou, Haibo Liu

**See Also**

`addScheme`

**Examples**

```r
colorsets("polarity_Grantham_group")
```

---

**Description**

retrieve prepared color setting for logo

**Usage**

```r
colorsets2(
  colorScheme = c("null", "classic", "charge", "chemistry", "hydrophobicity")
)
```

**Arguments**

- `colorScheme`: A vector of length 1, the option could be 'null', 'charge', 'chemistry', 'classic' or 'hydrophobicity'

**Value**

A character vector of color scheme

**Author(s)**

Jianhong Ou
dagBackground-class

Class dagBackground.

Description
An S4 class to represent a background composed of a formatted, aligned peptides for dagLogo analysis.

Slots
background A list of data frame, each of which represents one subset of the background set. Within each n-by-1 dataframe is a the aligned peptides of same length.
numSubsamples An integer. That is the length of the background list
testType An character. The type of statistic testing for dagLogo analysis of differential usage of amino acids.

Author(s)
Jianhong Ou, Haibo Liu

dagHeatmap

Visualize daglogo using a heatmap.

Description
Using a heatmap to visualize results of testing differential amino acid usage.

Usage
dagHeatmap(testDAUresults, type = c("diff", "statistics"), ...)

Arguments
testDAUresults An object of testDAUresults-class, which contains results of testing differential amino acid usage.
type A character vector of length 1, the type of metrics to display on y-axis. The available options are "diff" and "statistics", which are differences in amino acid usage at each position between the inputSet and the backgroundSet, and the Z-scores or odds ratios when Z-test or Fisher’s exact test is performed to test the differential usage of amino acid at each position between the two sets.

Value
The output from the pheatmap function.
Author(s)

Jianhong Ou, Haibo Liu

Examples

data("seq.example")
data("proteome.example")
bg <- buildBackgroundModel(seq.example, proteome=proteome.example,
numSubsamples=10)
t0 <- testDAU(seq.example, bg)
dagHeatmap(testDAUresults = t0, type = "diff")

---

**Description**

Create sequence logo for visualizing results of testing differential usage of amino acids.

**Usage**

dagLogo(
  testDAUresults,
  type = c("diff", "zscore"),
  pvalueCutoff = 0.05,
  groupingSymbol = getGroupingSymbol(testDAUresults@group),
  font = "Helvetica",
  fontface = "bold",
  fontsize = 8,
  title = NULL,
  legend = FALSE,
  labelRelativeToAnchor = FALSE,
  labels = NULL,
  alpha = 1,
  markers = list()
)

**Arguments**

- `testDAUresults`: An object of `testDAUresults-class`, which contains results of testing differential amino acid usage.
- `type`: A character vector of length 1. Type of statistics to be displayed on y-axis. Available choices are "diff" or "zscore".
- `pvalueCutoff`: A numeric vector of length 1. A cutoff of p-values.
- `groupingSymbol`: A named character vector.
- `font`: A character vector of length 1. Font type for displaying sequence Logo.
fontface  An integer, fontface of text for axis annotation and legends.

fontsize  An integer, fontsize of text for axis annotation and legends.

title  A character vector of length 1, main title for a plot.

legend  A logical vector of length 1, indicating whether to show the legend.

labelRelativeToAnchor  A logical vector of length 1, indicating whether x-axis label should be adjusted relative to the anchoring position.

labels  A character vector, x-axis labels.

alpha  Alpha channel for transparency of low affinity letters.

markers  A list of marker-class.

Value

A sequence Logo is plotted without returned values.

Author(s)

Jianhong Ou, Haibo Liu

Examples

data('seq.example')
data('proteome.example')
bg <- buildBackgroundModel(seq.example, proteome=proteome.example,
   numSubsamples=10, testType = "ztest")
t0 <- testDAU(seq.example, bg)
t1 <- testDAU(dagPeptides = seq.example, dagBackground = bg,
   groupingScheme = "hydrophobicity_KD")
t2 <- testDAU(dagPeptides = seq.example, dagBackground = bg,
   groupingScheme = "charge_group")
t3 <- testDAU(dagPeptides = seq.example, dagBackground = bg,
   groupingScheme = "chemistry_property_Mahler")
t4 <- testDAU(dagPeptides = seq.example, dagBackground = bg,
   groupingScheme = "hydrophobicity_KD_group")
dagLogo(t0, markers = list(new("marker", type="rect", start=c(5, 8),
   gp=gpar(lty=3, fill=NA)),
   new("marker", type="text", start=9, label="*",
   gp=gpar(col=3)))))
dagLogo(t1, groupingSymbol = getGroupingSymbol(t1@group))
dagLogo(t2, groupingSymbol = getGroupingSymbol(t2@group))
dagLogo(t3, groupingSymbol = getGroupingSymbol(t3@group))
dagLogo(t4, groupingSymbol = getGroupingSymbol(t4@group))
**dagPeptides-class**

Class *dagPeptides*. An S4 class to represent formatted, aligned peptides for *dagLogo* analysis.

---

**Description**

Class *dagPeptides*. An S4 class to represent formatted, aligned peptides for *dagLogo* analysis.

**Slots**

- **data** A data frame with column names: IDs, anchorAA, anchorPos, peptide and anchor.
- **peptides** A matrix of character, each element is a single-character symbol for an amino acid.
- **upstreamOffset** An integer, the upstream offset relative to the anchoring position.
- **downstreamOffset** An integer, the downstream offset relative to the anchoring position.
- **type** A character vector of length 1. Available options: "UniProt", and "fasta" if the *dagPeptides* object is generated using the function *formatSequence*, or "entrezgene" and "uniprotswissprot" if generated by the function *fetchSequence*.

**Objects from the Class**

Objects can be created by calls of the form

```r
new("dagPeptides", data, peptides, upstreamOffset, downstreamOffset, type).
```

**Author(s)**

Jianhong Ou

---

**ecoli.proteome**

An object of *Proteome-class* representing the *Escherichia coli* proteome.

---

**Description**

A dataset containing the *E. coli* proteome.

**Usage**

```r
ecoli.proteome
```
**Format**

An object of `Proteome-class` for Escherichia coli proteome. The format is: A list with one data frame and an character.

- **proteome**: 'data.frame': 13780 obs. of 4 variables
  - type: 'character': "UniProt"
  - species: 'character': "Escherichia coli"

The format of proteome is:
- **ENTREZ_GENE**: a character vector, records entrez gene id
- **SEQUENCE**: a character vector, peptide sequences
- **ID**: a character vector, Uniprot ID
- **LEN**: a character vector, length of peptides

**Details**

used as an example dataset

Annotation data obtained by:

```r
library(UniProt.ws)
taxId(UniProt.ws) <- 562
proteome <- prepareProteome(UniProt.ws, species="Escherichia coli")
```

**Source**

http://www.uniprot.org/

**Examples**

```r
data(ecoli.proteome)
head(ecoli.proteome@proteome)
ecoli.proteome@type
```

---

### `fetchSequence`

*Fetch protein/peptide sequences and create a `dagPeptides-class` object.*

**Description**

This function fetches protein/peptide sequences from a Biomart database or from a `Proteome-class` object based on protein/peptide IDs and create a `dagPeptides-class` object following restriction as specified by parameters: anchorAA or anchorPos, upstreamOffset and downstreamOffset.

**Usage**

```r
fetchSequence(
  IDs,
  type = "entrezgene",
  anchorAA = NULL,
  anchorPos,
  upstreamOffset, 
  downstreamOffset,
  mart,
)```
fetchSequence

proteome, upstreamOffset, downstreamOffset
)

Arguments

IDs A character vector containing protein/peptide IDs used to fetch sequences from a Biomart database or a Proteome-class object.
type A character vector of length 1. The available options are "entrezgene" and "uniprotswissprot" if parameter mart is missing; otherwise it can be any type of IDs available in Biomart databases.
anchorAA A character vector of length 1 or the same length as that of anchorPos, each element of which is a single letter symbol of amino acids, for example, "K" for lysine.
anchorPos A character or numeric vector. Each element of which is (1) a single-letter symbol of amino acid followed by the position of the anchoring amino acid in the target peptide/protein sequence, for example, "K123" for lysine at position 123 or the position of the anchoring amino acid in the target peptide/protein sequence, for example, "123" for an amino acid at position 123; or (2) a vector of subsequences containing the anchoring AAs.
mart A Biomart database name you want to connect to. Either of parameters mart or proteome should be provided.
proteome An object of Proteome-class. Either of parameters mart or Proteome-class should be provided.
upstreamOffset An integer, the upstream offset relative to the anchoring position.
downstreamOffset An integer, the downstream offset relative to the anchoring position.

Value

An object of class dagPeptides-class

Examples

## Case 1: You have both positions of the anchoring AAs and the identifiers of their enclosing peptide/protein sequences for fetching sequences using the fetchSequence function via the Biomart.

if (interactive())
{
  try{
    mart <- useMart("ensembl")
    fly_mart <-
      useDataset(mart = mart, dataset = "dmelanogaster_gene_ensembl")
    dat <- read.csv(system.file("extdata", "dagLogoTestData.csv", package = "dagLogo"))
    seq <- fetchSequence(}
IDs = as.character(dat$entrez_geneid),
anchorPos = as.character(dat$NCBI_site),
mart = fly_mart,
upstreamOffset = 7,
downstreamOffset = 7)
head(seq@peptides)
})

## Case 2: You don’t have the exactly position information, but you have the
## interesting peptide subsequences and the identifiers of their enclosing
## peptide/protein sequences for fetching sequences using the fetchSequence
## function via the Biomart. In the following examples, the anchoring AAs
## are marked by asterisks.
if (interactive())
{
  try({
    mart <- useMart("ensembl")
    fly_mart <-
      useDataset(mart = mart, dataset = "dmelanogaster_gene_ensembl")
    dat <- read.csv(system.file("extdata", "dagLogoTestData.csv",
      package = "dagLogo"))
    seq <- fetchSequence(
      IDs = as.character(dat$entrez_geneid),
anchorAA = "]",
anchorPos = as.character(dat$peptide),
mart = fly_mart,
upstreamOffset = 7,
downstreamOffset = 7
    )
    head(seq@peptides)
  })
}

## In the following example, the anchoring AAs are lower-case "s" for amino acid
## serine.
if(interactive())
{
  try({
    dat <- read.csv(system.file("extdata", "peptides4dagLogo.csv",
      package = "dagLogo"))
    mart <- useMart("ensembl")
    human_mart <-
      useDataset(mart = mart, dataset = "hsapiens_gene_ensembl")
    seq <- fetchSequence(IDs = toupper(as.character(dat$symbol)),
      type = "hgnnc_symbol",
anchorAA = "s",
anchorPos = as.character(dat$peptide),
mart = human_mart,
upstreamOffset = 7,
downstreamOffset = 7
    )
    head(seq@peptides)
  })
formatSequence

Format already aligned peptide sequences.

Description
Convert already aligned peptide sequences into an object of dagPeptides-class.

Usage
formatSequence(seq, proteome, upstreamOffset, downstreamOffset)

Arguments
- seq: A vector of aligned peptide sequences of the same length
- proteome: An object of Proteome-class.
- upstreamOffset: An integer, the upstream offset relative to the anchoring position.
- downstreamOffset: An integer, the downstream offset relative to the anchoring position.

Value
An object of dagPeptides-class Class

Author(s)
Jianhong Ou, Haibo Liu

Examples
## Suppose you already have the aligned peptides sequences at hands. Then you can use
## the formatSequence function to prepare an object of dagPeptides. Befor doing
## that, you need prepare a Proteome object by the prepareProteome function.

dat <- unlist(read.delim(system.file(
    "extdata", "grB.txt", package = "dagLogo"),
    header = FALSE, as.is = TRUE))

## prepare an object of Proteome Class from a fasta file
proteome <- prepareProteome(fasta = system.file("extdata",
    "HUMAN.fasta",
    package = "dagLogo"),
    species = "Homo sapiens")
## prepare an object of dagPeptides Class from a Proteome object

```r
seq <- formatSequence(seq = dat, proteome = proteome, upstreamOffset = 14,
                      downstreamOffset = 15)
```

---

### getData

*Get the data for visualization.*

**Description**

A helper function to get the data and the label for visualization.

**Usage**

```r
getData(type, testDAUresults)
```

**Arguments**

- `type` A character vector of length 1, the type of metrics to display on y-axis. The available options are "diff" and "statistics", which are differences in amino acid usage at each position between the inputSet and the backgroundSet, and the Z-scores or odds ratios when Z-test or Fisher's exact test is performed to test the differential usage of amino acid at each position between the two sets.

- `testDAUresults` An object of `testDAUresults-class`, which contains results of testing differential amino acid usage.

**Value**

A list containing the following components:

- `label` A character vector of length 1. The type of data for visualization.
- `dat` A matrix of numeric data for visualization.

**Author(s)**

Haibo Liu

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### getGroupingSymbol

*Get character symbols for grouped amino acids*

**Description**

Get character symbols for grouped amino acids

**Usage**

```r
getGroupingSymbol(groupingScheme = ls(envir = cachedEnv))
```
Arguments
groupingScheme A character vector of length 1, determining the character symbols used to repre-
sent amino acids grouped by their physical and chemical properties. The available groupingScheme are "no", "bulkiness_Zimmerman", "hydrophobicity_KD", "hydrophobicity_HW", "isoelectric_point_Zimmerman", "contact_potential_Maiorov", "chemistry_property_Mahler", "consensus_similarity_SF", "volume_Bigelow", "structure_alignments_Mirny", "polarity_Grantham", "sequence_alignment_Dayhoff", "bulkiness_Zimmerman_group", "hydrophobicity_KD_group", "hydrophobicity_HW_group", "charge_group", "contact_potential_Maiorov_group", "chemistry_property_Mahler_group", "consensus_similarity_SF_group", "volume_Bigelow_group", "structure_alignments_Mirny_group", "polarity_Grantham_group", "sequence_alignment_Dayhoff_group", and "custom". If "custom" is used, users must define a grouping scheme using a list containing sublists named as "color", "symbol" and "group" using the function addScheme. No grouping was applied for the first 12 schemes.

Value
A named character vector of character symbols if grouping is applied; otherwise NULL.

Author(s)
Jianhong Ou, Haibo Liu

See Also
addScheme

Examples
getGroupingSymbol("polarity_Grantham_group")

initiateBackgroundModel
Create a new dagBackground-class object for testDAU.

Description
Create a new dagBackground-class object for testDAU.

Usage
initiateBackgroundModel(background, numSubsamples = 1L, testType)

Arguments
background A list, each element of which is a vector of aligned peptide sequences of the same length.
numSubsamples An integer, the number of random samplings to get background sequence set.
testType An character, the type of statistic testing : "ztest" or "fisher".
prepareProteome

Value
An object of \texttt{dagBackground-class}.

Author(s)
Haibo Liu

\begin{verbatim}
nameHash
\end{verbatim}

\textit{convert group name to a single character}

Description
convert group name to a single character to shown in a logo

Usage
\begin{verbatim}
nameHash(nameScheme = c("classic", "charge", "chemistry", "hydrophobicity"))
\end{verbatim}

Arguments
\begin{verbatim}
nameScheme \hspace{2cm} \text{could be "classic", "charge", "chemistry", "hydrophobicity"}
\end{verbatim}

Value
A character vector of name scheme

Author(s)
Jianhong Ou

\begin{verbatim}
prepareProteome
\end{verbatim}

\textit{prepare proteome for background building}

Description
prepare proteome from UniProt webserver or a fasta file

Usage
\begin{verbatim}
prepareProteome(source, fasta, species = "unknown", ...)
\end{verbatim}

Arguments
\begin{verbatim}
source \hspace{2cm} \text{An object of \texttt{UniProt.ws} or A character "UniProt".}
fasta \hspace{2cm} \text{fasta file name or an object of AAStringSet}
species \hspace{2cm} \text{an character to assign the species of the proteome}
... \hspace{2cm} \text{parameters could be passed to \texttt{prepareProteomeByFTP}.}
\end{verbatim}
prepareProteomeByFTP

Value

an object of Proteome which contain protein sequence information.

Author(s)

Jianhong Ou

See Also

formatSequence, buildBackgroundModel

Examples

if(interactive()){
  library(UniProt.ws)
  availableUniprotSpecies("Drosophila melanogaster")
  UniProt.ws <- UniProt.ws(taxId=7227)
  proteome <- prepareProteome(UniProt.ws, species="Drosophila melanogaster")
}

prepareProteomeByFTP  

Create an object of Proteome Class.

Description

Create an object of Proteome Class by downloading a whole proteome data from UniProt for a given organism of an NCBI taxonomy ID or species’ scientific name, or by using peptide sequences in a fasta file.

Usage

prepareProteomeByFTP(
  source = "UniProt",
  taxonID = NULL,
  species = NULL,
  destDir = tempdir(check = TRUE),
  fastaFile,
  ...
)

Arguments

source  

A character vector of length 1 or NULL. A database source from which the proteome sequences are to be downloaded. By default, currently it is "UniProt". If it is NULL, then fastaFile has to be specified. The priority of source is higher than fastaFile.
prepareProteomeByUniProtWS

Prepare a Proteome object for background building

Description

Create an object of Proteome Class by query the UniProt database of an organism of a given species' scientific name, or by using peptide sequences in a fasta file or in an AASTringSet object.

Usage

prepareProteomeByUniProtWS(UniProt.ws, fasta, species = "unknown")
Arguments

UniProt.ws An object of UniProt.ws.
fasta A fasta file name or an object of AAStringSet.
species An character vector of length (1) to designate the species of the proteome

Value

An object of Proteome which contain protein sequence information.

Author(s)

Jianhong Ou

See Also

formatSequence, buildBackgroundModel

Examples

if(interactive()){
  library(UniProt.ws)
  availableUniprotSpecies("Drosophila melanogaster")
  UniProt.ws <- UniProt.ws(taxId=7227)
  proteome <- prepareProteomeByUniProtWS(UniProt.ws, species="Drosophila melanogaster")
}

Proteome-class

Class Proteome.

Description

An S4 class to represent a whole proteome for dagLogo analysis.

Slots

proteome A data frame.
  type A character vector of length 1. Available options :"UniProt", and "fasta".
  species A character vector of length 1, such as a conventional Latin name for a species.

Objects from the Class

Objects can be created by calls of the form
new("Proteome", proteome, type, species).

Author(s)

Jianhong Ou
proteome.example  

An object of Proteome-class representing the subset of Drosophila melanogaster proteome.

---

**Description**

The subset Proteome-class of fruit fly.

**Usage**

proteome.example

**Format**

An object of Proteome-class for fly subset proteome. The format is: A list with one data frame and an character.

- `proteome`: 'data.frame': 1406 obs. of 4 variables
  - `type`: 'character': "UniProt"  
  - `species`: 'character': "Drosophila melanogaster"

The format of proteome is

- `ENTREZ_GENE`: a character vector, records entrez gene id
- `SEQUENCE`: a character vector, peptide sequences
- `ID`: a character vector, Uniprot ID
- `LEN`: a character vector, length of peptides

**Details**

used as an example dataset

Annotation data obtained by:

```r
library(UniProt.ws)
taxId(UniProt.ws) <- 7227
proteome <- prepareProteome(UniProt.ws)
proteome@proteome <- proteome@proteome[sample(1:19902, 1406), ]
```

**Source**

http://www.uniprot.org/

**Examples**

data(proteome.example)
head(proteome.example@proteome)
proteome.example@type
An object of \texttt{dagPeptides-class} representing acetylated lysine-containing peptides.

Description

A dataset containing the acetylated lysine-containing peptides from \textit{Drosophila melanogaster}.

Usage

\texttt{seq.example}

Format

An object of \texttt{dagPeptides-class} Class The format is: A list.

*‘data’: ‘data.frame’: 732 obs. of 7 variables *‘peptides’: ‘matrix’: amino acid in each position
*‘upstreamOffset’: an integer, upstream offset position *‘downstreamOffset’: an integer, downstream offset position *‘type’: “character”, type of identifiers

The format of data is

*‘IDs’: a character vector, input identifiers *‘anchorAA’: a character vector, anchor amino acid provided in inputs *‘anchorPos’: a numeric vector, anchor position in the protein *‘peptide’: a character vector, peptide sequences *‘anchor’: a character vector, anchor amino acid in the protein
*‘upstream’: a character vector, upstream peptides *‘downstream’: a character vector, downstream peptides

Details

used as an example dataset

seq obtained by:

```
mart <- useMart("ensembl", "dmelanogaster_gene_ensembl")
dat <- read.csv(system.file("extdata", "dagLogoTest1Data.csv", package="dagLogo"))
seq <- fetchSequence(as.character(dat$entrez_geneid),
anchorPos=as.character(dat$NCBI_site),
mart=mart,
upstreamOffset=7,
downstreamOffset=7)
```

Examples

```r
data(seq.example)
head(seq.example@peptides)
seq.example@upstreamOffset
seq.example@downstreamOffset
```
testDAU  

Differential usage test of amino acids or amino acid groups.

Description

Test differential usage of amino acids with or without grouping between experimental sets and background sets.

Usage

testDAU(
  dagPeptides,
  dagBackground,
  groupingScheme = ls(envir = cachedEnv),
  bgNoise = NA,
  method = "none"
)

Arguments

dagPeptides  An object of Class dagPeptides-class.
dagBackground  An object of Class dagBackground-class.
groupingScheme  A character vector of length 1. Available choices are "no", "bulkiness_Zimmerman", "hydrophobicity_KD", "hydrophobicity_HW", "isoelectric_point_Zimmerman", "contact_potential_Maiorov", "chemistry_property_Mahler", "consensus_similarity_SF", "volume_Bigelow", "structure_alignments_Mirny", "polarity_Grantham", "sequence_alignment_Dayhoff", "bulkiness_Zimmerman_group", "hydrophobicity_KD_group", "hydrophobicity_HW_group", "charge_group", "contact_potential_Maiorov_group", "chemistry_property_Mahler_group", "consensus_similarity_SF_group", "volume_Bigelow_group", "structure_alignments_Mirny_group", "polarity_Grantham_group", "sequence_alignment_Dayhoff_group", "custom" and "custom_group". If "custom" or "custom_group" are used, users must define a grouping scheme using a list containing sublist named as "color", and "symbol" using the function addScheme, with group set as "NULL" or a list with same names as those of color and symbol. No grouping was applied for the first 12 schemes. It is used to color AAs based on similarities or group amino acids into groups of similarities.

bgNoise  A numeric vector of length 1 if not NA. It should be in the interval of (0, 1) when not NA.

method  A character vector of length 1, specifying the method used for p-value adjustment to correct for multiple testing. it can be "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", or "none". For more details, see p.adjust.methods and p.adjust.

Value

An object of Class testDAUresults-class.
Author(s)
Jianhong Ou, Haibo Liu

Examples

dat <- unlist(read.delim(system.file("extdata", "grB.txt", package = "dagLogo"),
        header = FALSE, as.is = TRUE))

## prepare an object of Proteome Class from a fasta file
proteome <- prepareProteome(fasta = system.file("extdata",
        "HUMAN.fasta",
        package = "dagLogo"),
        species = "Homo sapiens")

## prepare an object of dagPeptides Class
seq <- formatSequence(seq = dat, proteome = proteome, upstreamOffset = 14,
        downstreamOffset = 15)

bg_fisher <- buildBackgroundModel(seq, background = "wholeProteome",
        proteome = proteome, testType = "fisher")

bg_ztest <- buildBackgroundModel(seq, background = "wholeProteome",
        proteome = proteome, testType = "ztest")

## no grouping and distinct coloring scheme, adjust p-values using the
## "BH" method.
t0 <- testDAU(seq, dagBackground = bg_ztest, method = "BY")

## grouped by polarity index (Grantham, 1974)
t1 <- testDAU(dagPeptides = seq, dagBackground = bg_ztest,
        groupingScheme = "polarity_Grantham_group")

## grouped by charge.
t2 <- testDAU(dagPeptides = seq, dagBackground = bg_ztest,
        groupingScheme = "charge_group")

## grouped on the basis of the chemical property of side chains.
t3 <- testDAU(dagPeptides = seq, dagBackground = bg_ztest,
        groupingScheme = "chemistry_property_Mahler_group")

## grouped on the basis of hydrophobicity (Kyte and Doolittle, 1982)
t4 <- testDAU(dagPeptides = seq, dagBackground = bg_ztest,
        groupingScheme = "hydrophobicity_KD_group")

testDAUresults-class  Class testDAUresults.

Description
An S4 class to represent a DAU statistical test result from dagLogo analysis.
Slots

group A character vector of length 1, the type of method for grouping amino acid.

testType A character vector of length 1, the type of statistic testing. The available options are "fisher" and "z-test".

difference A numeric matrix consisting of differences of amino acid proportions between the test set and the background set of aligned, formatted peptides at each position.

statistics A numeric matrix consisting of Z-scores or odds ratios for Z-test and Fisher’s exact test, respectively.

pvalue A numeric matrix consisting of p-values.

background A numeric matrix consisting of amino acid proportions in the background set of aligned, formatted peptides at each position.

motif A numeric matrix consisting of amino acid proportions at each position for visualization by dagLogo.

upstreamOffset A positive integer, the upstream offset relative to the anchoring position.

downstreamOffset A positive integer, the upstream offset relative to the anchoring position.

Author(s)

Jianhong Ou, Haibo Liu
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