Package ‘Rcpi’

January 15, 2017

Type Package

Title Molecular Informatics Toolkit for Compound-Protein Interaction in Drug Discovery

Version 1.10.6

Date 2016-12-29

Description Rcpi offers a molecular informatics toolkit with a comprehensive integration of bioinformatics and chemoinformatics tools for drug discovery.

Maintainer Nan Xiao <me@nanx.me>

License Artistic-2.0

URL http://nanx.me/Rcpi/, https://github.com/road2stat/Rcpi

BugReports https://github.com/road2stat/Rcpi/issues

LazyData yes

Imports stats, utils, methods, RCurl, rjson, foreach, doParallel, Biostrings, GOSemSim, ChemmineR, fmcsR, rcdk (>= 3.3.8)

Suggests RUnit, BiocGenerics

Enhances ChemmineOB

biocViews Software, DataImport, DataRepresentation, FeatureExtraction, Cheminformatics, BiomedicalInformatics, Proteomics, GO, SystemsBiology

RoxygenNote 5.0.1

NeedsCompilation no

Author Nan Xiao [aut, cre], Dongsheng Cao [aut], Qingsong Xu [aut]

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Rcpi-package

Description

Rcpi offers a molecular informatics toolkit with a comprehensive integration of bioinformatics and chemoinformatics tools for drug discovery.

Details

The package vignette can be opened with `vignette('Rcpi')`.

```
Package: Rcpi
Type: Package
License: Artistic-2.0
```

Note

Bug reports and feature requests should be sent to https://github.com/road2stat/Rcpi/issues.

AA2DACOR

Description

2D Autocorrelations Descriptors for 20 Amino Acids calculated by Dragon

Usage

data(AA2DACOR)

Details

This dataset includes the 2D autocorrelations descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

Value

AA2DACOR data

Examples

data(AA2DACOR)
**AA3DMoRSE**  
3D-MoRSE Descriptors for 20 Amino Acids calculated by Dragon

**Description**
3D-MoRSE Descriptors for 20 Amino Acids calculated by Dragon

**Usage**
data(AA3DMoRSE)

**Details**
This dataset includes the 3D-MoRSE descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**
AA3DMoRSE data

**Examples**
data(AA3DMoRSE)

---

**AAACF**  
Atom-Centred Fragments Descriptors for 20 Amino Acids calculated by Dragon

**Description**
Atom-Centred Fragments Descriptors for 20 Amino Acids calculated by Dragon

**Usage**
data(AAACF)

**Details**
This dataset includes the atom-centred fragments descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**
AAACF data

**Examples**
data(AAACF)
**Description**

BLOSUM100 Matrix for 20 Amino Acids

**Usage**

data(AABLOSUM100)

**Details**

BLOSUM100 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.

**Value**

AABLOSUM100 data

**Examples**

data(AABLOSUM100)

---

**Description**

BLOSUM45 Matrix for 20 Amino Acids

**Usage**

data(AABLOSUM45)

**Details**

BLOSUM45 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.

**Value**

AABLOSUM45 data

**Examples**

data(AABLOSUM45)
**AABLOSUM50**

**BLOSUM50 Matrix for 20 Amino Acids**

**Description**

BLOSUM50 Matrix for 20 Amino Acids

**Usage**

data(AABLOSUM50)

**Details**

BLOSUM50 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.

**Value**

AABLOSUM50 data

**Examples**

data(AABLOSUM50)

---

**AABLOSUM62**

**BLOSUM62 Matrix for 20 Amino Acids**

**Description**

BLOSUM62 Matrix for 20 Amino Acids

**Usage**

data(AABLOSUM62)

**Details**

BLOSUM62 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.

**Value**

AABLOSUM62 data

**Examples**

data(AABLOSUM62)
**AABLOSUM80**

**BLOSUM80 Matrix for 20 Amino Acids**

**Description**

BLOSUM80 Matrix for 20 Amino Acids

**Usage**

data(AABLOSUM80)

**Details**

BLOSUM80 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.

**Value**

AABLOSUM80 data

**Examples**

data(AABLOSUM80)

---

**AABurden**

**Burden Eigenvalues Descriptors for 20 Amino Acids calculated by Dragon**

**Description**

Burden Eigenvalues Descriptors for 20 Amino Acids calculated by Dragon

**Usage**

data(AABurden)

**Details**

This dataset includes the Burden eigenvalues descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**

AABurden data

**Examples**

data(AABurden)
**Description**

Connectivity Indices Descriptors for 20 Amino Acids calculated by Dragon

**Usage**

data(AAConn)

**Details**

This dataset includes the connectivity indices descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**

AAConn data

**Examples**

data(AAConn)

---

**Description**

Constitutional Descriptors for 20 Amino Acids calculated by Dragon

**Usage**

data(AAConst)

**Details**

This dataset includes the constitutional descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**

AAConst data

**Examples**

data(AAConst)
CPSA Descriptors for 20 Amino Acids calculated by Discovery Studio

Description

CPSA Descriptors for 20 Amino Acids calculated by Discovery Studio

Usage

data(AACPSA)

Details

This dataset includes the CPSA descriptors of the 20 amino acids calculated by Discovery Studio (version 2.5) used for scales extraction in this package. All amino acid molecules had also been optimized with MOE 2011.10 (semiempirical AM1) before calculating these CPSA descriptors. The SDF file containing the information of the optimized amino acid molecules is included in this package. See OptAA3d for more information.

Value

AACPSA data

Examples

data(AACPSA)

All 2D Descriptors for 20 Amino Acids calculated by Dragon

Description

All 2D Descriptors for 20 Amino Acids calculated by Dragon

Usage

data(AADescAll)

Details

This dataset includes all the 2D descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

Value

AADescAll data

Examples

data(AADescAll)
### AAEigIdx

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<td>data(AAEigIdx)</td>
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**Description**

Functional Group Counts Descriptors for 20 Amino Acids calculated by Dragon

**Usage**

data(AAFGC)

**Details**

This dataset includes the functional group counts descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**

AAFGC data

**Examples**

data(AAFGC)

---

**Description**

Geometrical Descriptors for 20 Amino Acids calculated by Dragon

**Usage**

data(AAGeom)

**Details**

This dataset includes the geometrical descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**

AAGeom data

**Examples**

data(AAGeom)
Description

GETAWAY Descriptors for 20 Amino Acids calculated by Dragon

Usage

data(AAGETAWAY)

Details

This dataset includes the GETAWAY descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

Value

AAGETAWAY data

Examples

data(AAGETAWAY)

Description

AAindex Data of 544 Physicochemical and Biological Properties for 20 Amino Acids

Usage

data(AAindex)

Details

The data was extracted from the AAindex1 database ver 9.1 (ftp://ftp.genome.jp/pub/db/community/aaindex/aaindex1) as of November 2012 (Data Last Modified 2006-08-14). With this data, users could investigate each property’s accession number and other details. Visit http://www.genome.jp/dbget/aaindex.html for more information.

Value

AAindex data

Examples

data(AAindex)
**AAInfo**

### Information Indices Descriptors for 20 Amino Acids calculated by Dragon

**Description**
Information Indices Descriptors for 20 Amino Acids calculated by Dragon

**Usage**
data(AAInfo)

**Details**
This dataset includes the information indices descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**
AAInfo data

**Examples**
data(AAInfo)

---

**AAMetaInfo**

### Meta Information for the 20 Amino Acids

**Description**
Meta Information for the 20 Amino Acids

**Usage**
data(AAMetaInfo)

**Details**
This dataset includes the meta information of the 20 amino acids used for the 2D and 3D descriptor calculation in this package. Each column represents:

- **AAName** Amino Acid Name
- **Short** One-Letter Representation
- **Abbreviation** Three-Letter Representation
- **mol** SMILE Representation
- **PUBCHEM_COMPOUND_CID** PubChem CID for the Amino Acid
- **PUBCHEM_LINK** PubChem Link for the Amino Acid
Value

AAMetaInfo data

Examples

data(AAMetaInfo)

---

**AAMOE2D**

2D Descriptors for 20 Amino Acids calculated by MOE 2011.10

**Description**

2D Descriptors for 20 Amino Acids calculated by MOE 2011.10

**Usage**

data(AAMOE2D)

**Details**

This dataset includes the 2D descriptors of the 20 amino acids calculated by MOE 2011.10 used for scales extraction in this package.

**Value**

AAMOE2D data

**Examples**

data(AAMOE2D)

---

**AAMOE3D**

3D Descriptors for 20 Amino Acids calculated by MOE 2011.10

**Description**

3D Descriptors for 20 Amino Acids calculated by MOE 2011.10

**Usage**

data(AAMOE3D)

**Details**

This dataset includes the 3D descriptors of the 20 amino acids calculated by MOE 2011.10 used for scales extraction in this package. All amino acid molecules had also been optimized with MOE (semiempirical AM1) before calculating these 3D descriptors. The SDF file containing the information of the optimized amino acid molecules is included in this package. See OptAA3d for more information.
**AAMolProp**

**Value**

AAMOE3D data

**Examples**

`data(AAMOE3D)`

---

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<th>AAMolProp</th>
<th>Molecular Properties Descriptors for 20 Amino Acids calculated by Dragon</th>
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**Description**

Molecular Properties Descriptors for 20 Amino Acids calculated by Dragon

**Usage**

`data(AAMolProp)`

**Details**

This dataset includes the molecular properties descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

**Value**

AAMolProp data

**Examples**

`data(AAMolProp)`

---

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<th>PAM120 Matrix for 20 Amino Acids</th>
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**Description**

PAM120 Matrix for 20 Amino Acids

**Usage**

`data(AAPAM120)`

**Details**

PAM120 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.
Value
AAPAM120 data

Examples
data(AAPAM120)

AAPAM250  PAM250 Matrix for 20 Amino Acids

Description
PAM250 Matrix for 20 Amino Acids

Usage
data(AAPAM250)

Details
PAM250 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.

Value
AAPAM250 data

Examples
data(AAPAM250)

AAPAM30  PAM30 Matrix for 20 Amino Acids

Description
PAM30 Matrix for 20 Amino Acids

Usage
data(AAPAM30)

Details
PAM30 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.
### Description

PAM40 Matrix for 20 Amino Acids

### Usage

data(AAPAM40)

### Details

PAM40 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.

### Value

AAPAM40 data

### Examples

```r
data(AAPAM40)
```

---

### Description

PAM70 Matrix for 20 Amino Acids

### Usage

data(AAPAM70)

### Details

PAM70 Matrix for the 20 amino acids. The matrix was extracted from the Biostrings package of Bioconductor.

### Value

AAPAM70 data

### Examples

```r
data(AAPAM70)
```
Value

AAPAM70 data

Examples

data(AAPAM70)

---

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Description

Randic Molecular Profiles Descriptors for 20 Amino Acids calculated by Dragon

Usage

data(AARandic)

Details

This dataset includes the Randic molecular profiles descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

Value

AARandic data

Examples

data(AARandic)

---

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Description

RDF Descriptors for 20 Amino Acids calculated by Dragon

Usage

data(AARDF)

Details

This dataset includes the RDF descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.
AATopo

Value
AARDF data

Examples
data(AARDF)

AATopo

Topological Descriptors for 20 Amino Acids calculated by Dragon

Description
Topological Descriptors for 20 Amino Acids calculated by Dragon

Usage
data(AATopo)

Details
This dataset includes the topological descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

Value
AATopo data

Examples
data(AATopo)

AATopoChg

Topological Charge Indices Descriptors for 20 Amino Acids calculated by Dragon

Description
Topological Charge Indices Descriptors for 20 Amino Acids calculated by Dragon

Usage
data(AATopoChg)

Details
This dataset includes the topological charge indices descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.
Value

AATopoChg data

Examples

data(AATopoChg)

| AAWalk | Walk and Path Counts Descriptors for 20 Amino Acids calculated by Dragon |

Description

Walk and Path Counts Descriptors for 20 Amino Acids calculated by Dragon

Usage

data(AAWalk)

Details

This dataset includes the walk and path counts descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.

Value

AAWalk data

Examples

data(AAWalk)

| AAWHIM | WHIM Descriptors for 20 Amino Acids calculated by Dragon |

Description

WHIM Descriptors for 20 Amino Acids calculated by Dragon

Usage

data(AAWHIM)

Details

This dataset includes the WHIM descriptors of the 20 amino acids calculated by Dragon (version 5.4) used for scales extraction in this package.
Auto Cross Covariance (ACC) for Generating Scales-Based Descriptors of the Same Length

Usage

``` R
acc(mat, lag)
```

Arguments

- `mat`: A \( p \times n \) matrix. Each row represents one scale (total \( p \) scales), each column represents one amino acid position (total \( n \) amino acids).
- `lag`: The lag parameter. Must be less than the amino acids.

Details

This function calculates the auto covariance and auto cross covariance for generating scale-based descriptors of the same length.

Value

A length \( lag \times p^2 \) named vector, the element names are constructed by: the scales index (crossed scales index) and lag index.

Note

To know more details about auto cross covariance, see the references.

Author(s)

Nan Xiao <http://nanx.me>

References


See Also
See `extractPCMScales` for generalized scales-based descriptors. For more details, see `extractPCMDescScales` and `extractPCMPropScales`.

Examples

```r
p = 8  # p is the scales number
n = 200 # n is the amino acid number
lag = 7  # the lag parameter
mat = matrix(rnorm(p * n), nrow = p, ncol = n)
acc(mat, lag)
```

**calcDrugFPSim**

Calculate Drug Molecule Similarity Derived by Molecular Fingerprints

**Description**

Calculate Drug Molecule Similarity Derived by Molecular Fingerprints

**Usage**

```r
calcDrugFPSim(fp1, fp2, fptype = c("compact", "complete"),
               metric = c("tanimoto", "euclidean", "cosine", "dice", "hamming"))
```

**Arguments**

- `fp1`: The first molecule's fingerprints, could be extracted by `extractDrugMACCS()`, `extractDrugMACCSComplete()` etc.
- `fp2`: The second molecule's fingerprints.
- `fptype`: The fingerprint type, must be one of "compact" or "complete".
- `metric`: The similarity metric, one of "tanimoto", "euclidean", "cosine", "dice" and "hamming".

**Details**

This function calculate drug molecule fingerprints similarity. Define a as the features of object A, b is the features of object B, c is the number of common features to A and B:

- **Tanimoto**: aka Jaccard - \( c / (a + b + c) \)
- **Euclidean**: \( \sqrt{(a + b)} \)
- **Dice**: aka Sorensen, Czekanowski, Hodgkin-Richards - \( c / 0.5[(a + c) + (b + c)] \)
- **Cosine**: aka Ochiai, Carbo - \( c / \sqrt{(a + c)(b + c)} \)
- **Hamming**: aka Manhattan, taxi-cab, city-block distance - \( (a + b) \)

**Value**

The numeric similarity value.
Author(s)
Nan Xiao <http://nanx.me>

References

Examples
mols = readMolFromSDF(system.file('compseq/tyrphostin.sdf', package = 'Rcpi'))

fp1 = extractDrugEstate(mols[[1]])
fp2 = extractDrugEstate(mols[[2]])
calcDrugFPSim(fp1, fp2, fptype = 'compact', metric = 'tanimoto')
calcDrugFPSim(fp1, fp2, fptype = 'compact', metric = 'euclidean')
calcDrugFPSim(fp1, fp2, fptype = 'compact', metric = 'cosine')
calcDrugFPSim(fp1, fp2, fptype = 'compact', metric = 'dice')
calcDrugFPSim(fp1, fp2, fptype = 'compact', metric = 'hamming')

fp3 = extractDrugEstateComplete(mols[[1]])
fp4 = extractDrugEstateComplete(mols[[2]])
calcDrugFPSim(fp3, fp4, fptype = 'complete', metric = 'tanimoto')
calcDrugFPSim(fp3, fp4, fptype = 'complete', metric = 'euclidean')
calcDrugFPSim(fp3, fp4, fptype = 'complete', metric = 'cosine')
calcDrugFPSim(fp3, fp4, fptype = 'complete', metric = 'dice')
calcDrugFPSim(fp3, fp4, fptype = 'complete', metric = 'hamming')

calcDrugMCSSim

Calculate Drug Molecule Similarity Derived by Maximum Common Substructure Search

Description
Calculate Drug Molecule Similarity Derived by Maximum Common Substructure Search

Usage
calcDrugMCSSim(mol1, mol2, type = c("smile", "sdf"), plot = FALSE, a1 = 0,
    au = 0, bl = 0, bu = 0, matching.mode = "static", ...)

Arguments
mol1 The first molecule. R character string object containing the molecule. See examples.
mol2 The second molecule. R character string object containing the molecule. See examples.
type The input molecule format, ’smile’ or ’sdf’.
plot Logical. Should we plot the two molecules and their maximum common substructure?
a1 Lower bound for the number of atom mismatches. Default is 0.
calcParProtGOSim

### Description

Protein Sequence Similarity Calculation based on Gene Ontology (GO) Similarity

### Usage

```r
calcParProtGOSim(golist, type = c("go", "gene"), ont = "MF",
organisation = "human", measure = "Resnik", combine = "BMA")
```
Arguments
golist  A character vector, each component contains a character vector of GO terms or one Entrez Gene ID.
type    Input type of golist, ‘go’ for GO Terms, ‘gene’ for gene ID.
ton     Default is ‘MF’, could be one of ‘MF’, ‘BP’, or ‘CC’ subontologies.
measure Default is ‘Resnik’, could be one of ‘Resnik’, ‘Lin’, ‘Rel’, ‘Jiang’ or ‘Wang’.
combine Default is ‘BMA’, could be one of ‘max’, ‘average’, ‘rcmax’ or ‘BMA’ for combining semantic similarity scores of multiple GO terms associated with protein.

Details
This function calculates protein sequence similarity based on Gene Ontology (GO) similarity.

Value
A n x n similarity matrix.

Author(s)
Nan Xiao <http://nanx.me>

See Also
See `calcTwoProtGOSim` for calculating the GO semantic similarity between two groups of GO terms or two Entrez gene IDs. See `calcParProtSeqSim` for paralleled protein similarity calculation based on sequence alignment.

Examples
# by GO Terms
go1 = c('GO:0005215', 'GO:0005488', 'GO:0005515', 'GO:0005625', 'GO:0005802', 'GO:0005905') # AP4B1
go2 = c('GO:0005515', 'GO:0005634', 'GO:0005681', 'GO:0008380', 'GO:0031202') # BCAS2
go3 = c('GO:0003735', 'GO:0005622', 'GO:0005840', 'GO:0006412') # PDE4DIP
glist = list(go1, go2, go3)

gsimmat1 = calcParProtGOSim(glist, type='go', ont='CC')
print(gsimmat1)

# by Entrez gene id
genelist = list(c('150', '151', '152', '1814', '1815', '1816'))

gsimmat2 = calcParProtGOSim(genelist, type='gene')
print(gsimmat2)
calcParProtSeqSim  Parallelized Protein Sequence Similarity Calculation based on Sequence Alignment

Description

Parallelized Protein Sequence Similarity Calculation based on Sequence Alignment

Usage

calcParProtSeqSim(protlist, cores = 2, type = "local", submat = "BLOSUM62")

Arguments

- **protlist**: A length n list containing n protein sequences, each component of the list is a character string, storing one protein sequence. Unknown sequences should be represented as 'Var'.
- **cores**: Integer. The number of CPU cores to use for parallel execution, default is 2. Users could use the detectCores() function in the parallel package to see how many cores they could use.
- **type**: Type of alignment, default is 'local', could be 'global' or 'local', where 'global' represents Needleman-Wunsch global alignment; 'local' represents Smith-Waterman local alignment.
- **submat**: Substitution matrix, default is 'BLOSUM62', could be one of 'BLOSUM45', 'BLOSUM50', 'BLOSUM62', 'BLOSUM80', 'BLOSUM100', 'PAM30', 'PAM40', 'PAM70', 'PAM120', 'PAM250'.

Details

This function implemented the parallellized version for calculating protein sequence similarity based on sequence alignment.

Value

A n x n similarity matrix.

Author(s)

Nan Xiao <http://nanx.me>

See Also

See calcTwoProtSeqSim for protein sequence alignment for two protein sequences. See calcParProtGOSim for protein similarity calculation based on Gene Ontology (GO) semantic similarity.
calcTwoProtGOSim

Examples

```r
s1 = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
s2 = readFASTA(system.file('protseq/P08218.fasta', package = 'Rcpi'))[[1]]
s3 = readFASTA(system.file('protseq/P10323.fasta', package = 'Rcpi'))[[1]]
s4 = readFASTA(system.file('protseq/P20160.fasta', package = 'Rcpi'))[[1]]
s5 = readFASTA(system.file('protseq/Q9NZP8.fasta', package = 'Rcpi'))[[1]]
plist = list(s1, s2, s3, s4, s5)
psimmat = calcParProtSeqSim(plist, cores = 2, type = 'local',
                           submat = 'BLOSUM62')
print(psimmat)
```

Description

Protein Similarity Calculation based on Gene Ontology (GO) Similarity

Usage

```r
calcTwoProtGOSim(id1, id2, type = c("go", "gene"), ont = "MF",
                  organism = "human", measure = "Resnik", combine = "BMA")
```

Arguments

- **id1**: A character vector. length > 1: each element is a GO term; length = 1: the Entrez Gene ID.
- **id2**: A character vector. length > 1: each element is a GO term; length = 1: the Entrez Gene ID.
- **type**: Input type of id1 and id2, 'go' for GO Terms, 'gene' for gene ID.
- **ont**: Default is 'MF', could be one of 'MF', 'BP', or 'CC' subontologies.
- **organism**: Default is 'human', could be one of 'anopheles', 'arabidopsis', 'bovine',
  'canine', 'chicken', 'chimp', 'coelicolor', 'ecolik12', 'ecsakai', 'fly',
  'human', 'malaria', 'mouse', 'pig', 'rat', 'rhesus', 'worm', 'xenopus',
  'yeast' or 'zebrafish'.
- **measure**: Default is 'Resnik', could be one of 'Resnik', 'Lin', 'Rel', 'Jiang' or 'Wang'.
- **combine**: Default is 'BMA', could be one of 'max', 'average', 'rcmax' or 'BMA' for combining semantic similarity scores of multiple GO terms associated with protein.

Details

This function calculates the Gene Ontology (GO) similarity between two groups of GO terms or two Entrez gene IDs.

Value

A n x n matrix.
calcTwoProtSeqSim

Protein Sequence Alignment for Two Protein Sequences

Description

Protein Sequence Alignment for Two Protein Sequences

Usage

calcTwoProtSeqSim(seq1, seq2, type = "local", submat = "BLOSUM62")

Arguments

- seq1: A character string, containing one protein sequence.
- seq2: A character string, containing another protein sequence.
- type: Type of alignment, default is 'local', could be 'global' or 'local', where 'global' represents Needleman-Wunsch global alignment; 'local' represents Smith-Waterman local alignment.
- submat: Substitution matrix, default is 'BLOSUM62', could be one of 'BLOSUM45', 'BLOSUM50', 'BLOSUM62', 'BLOSUM80', 'BLOSUM100', 'PAM30', 'PAM40', 'PAM70', 'PAM120', 'PAM250'.

Details

This function implements the sequence alignment between two protein sequences.
checkProt

Value
An Biostrings object containing the scores and other alignment information.

Author(s)
Nan Xiao <http://nanx.me>

See Also
See calcParProtSeqSim for paralleled pairwise protein similarity calculation based on sequence alignment. See calcTwoProtGOSim for calculating the GO semantic similarity between two groups of GO terms or two Entrez gene IDs.

Examples
```
s1 = readFASTA(system.file("/quotesingle.Varprotseq/P00750.fasta", package = "Rcpi"))[1]
s2 = readFASTA(system.file("/quotesingle.Varprotseq/P10323.fasta", package = "Rcpi"))[1]

seqalign = calcTwoProtSeqSim(s1, s2)
seqalign
slot(seqalign, "score")
```

checkProt  Check if the protein sequence’s amino acid types are the 20 default types

Description
Check if the protein sequence’s amino acid types are the 20 default types

Usage
```
checkProt(x)
```

Arguments
x  A character vector, as the input protein sequence.

Details
This function checks if the protein sequence’s amino acid types are the 20 default types.

Value
Logical. TRUE if all of the amino acid types of the sequence are within the 20 default types.

Author(s)
Nan Xiao <http://nanx.me>
convMolFormat

Examples

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
checkProt(x)  # TRUE
checkProt(paste(x, 'Z', sep = ''))  # FALSE
```

convMolFormat

Chemical File Formats Conversion

Description

Chemical File Formats Conversion

Usage

```r
convMolFormat(infile, outfile, from, to)
```

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>infile</code></td>
<td>A character string. Indicating the input file location.</td>
</tr>
<tr>
<td><code>outfile</code></td>
<td>A character string. Indicating the output file location.</td>
</tr>
<tr>
<td><code>from</code></td>
<td>The format of <code>infile</code>. A character string supported by OpenBabel. See the note section for the supported formats.</td>
</tr>
<tr>
<td><code>to</code></td>
<td>The desired format of <code>outfile</code>. A character string supported by OpenBabel. See the note section for the supported formats.</td>
</tr>
</tbody>
</table>

Details

This function converts between various chemical file formats via OpenBabel. The complete supported file format list could be found at [http://openbabel.org/docs/dev/FileFormats/Overview.html](http://openbabel.org/docs/dev/FileFormats/Overview.html).

Value

`NULL`

Note

The supported formats include:

- `abinit` – ABINIT Output Format [Read-only]
- `acr` – ACR format [Read-only]
- `adf` – ADF cartesian input format [Write-only]
- `adfout` – ADF output format [Read-only]
- `alc` – Alchemy format
- `arc` – Accelrys/MSI Biosym/Insight II CAR format [Read-only]
- `axsf` – XCrySDen Structure Format [Read-only]
- `bgf` – MSI BGF format
- `box` – Dock 3.5 Box format
• bs – Ball and Stick format
• c3d1 – Chem3D Cartesian 1 format
• c3d2 – Chem3D Cartesian 2 format
• cac – CAChe MolStruct format [Write-only]
• caccrt – Cacao Cartesian format
• cache – CAChe MolStruct format [Write-only]
• cacint – Cacao Internal format [Write-only]
• can – Canonical SMILES format
• car – Accelrys/MSI Biosym/Insight II CAR format [Read-only]
• castep – CASTEP format [Read-only]
• ccc – CCC format [Read-only]
• cdx – ChemDraw binary format [Read-only]
• cdxml – ChemDraw CDXML format
• chl – Chemtool format [Write-only]
• cif – Crystallographic Information File
• ck – ChemKin format
• cml – Chemical Markup Language
• cmrl – CML Reaction format
• com – Gaussian 98/03 Input [Write-only]
• CONFIG – DL-POLY CONFIG
• CONTCAR – VASP format [Read-only]
• copy – Copy raw text [Write-only]
• crk2d – Chemical Resource Kit diagram(2D)
• crk3d – Chemical Resource Kit 3D format
• csr – Accelrys/MSI Quanta CSR format [Write-only]
• cssr – CSD CSSR format [Write-only]
• ct – ChemDraw Connection Table format
• cub – Gaussian cube format
• cube – Gaussian cube format
• dat – Generic Output file format [Read-only]
• dmol – DMol3 coordinates format
• dx – OpenDX cube format for APBS
• ent – Protein Data Bank format
• fa – FASTA format
• fasta – FASTA format
• fch – Gaussian formatted checkpoint file format [Read-only]
• fchk – Gaussian formatted checkpoint file format [Read-only]
• fck – Gaussian formatted checkpoint file format [Read-only]
• feat – Feature format
• fh – Fenske-Hall Z-Matrix format [Write-only]
• fhiaims – FHIaims XYZ format
• fix – SMILES FIX format [Write-only]
• fpt – Fingerprint format [Write-only]
• fract – Free Form Fractional format
• fs – Fastsearch format
• fsa – FASTA format
• g03 – Gaussian Output [Read-only]
• g09 – Gaussian Output [Read-only]
• g92 – Gaussian Output [Read-only]
• g94 – Gaussian Output [Read-only]
• g98 – Gaussian Output [Read-only]
• gal – Gaussian Output [Read-only]
• gam – GAMESS Output [Read-only]
• gamess – GAMESS Output [Read-only]
• gamin – GAMESS Input
• gamout – GAMESS Output [Read-only]
• gau – Gaussian 98/03 Input [Write-only]
• gjc – Gaussian 98/03 Input [Write-only]
• gif – Gaussian 98/03 Input [Write-only]
• got – GULP format [Read-only]
• gpr – GChemical format
• gr96 – GROMOS96 format [Write-only]
• gro – GRO format
• gukin – GAMESS-UK Input
• gukout – GAMESS-UK Output
• gzmat – Gaussian Z-Matrix Input
• hin – HyperChem HIN format
• HISTORY – DL-POLY HISTORY [Read-only]
• inchi – InChI format
• inchikey – InChIKey [Write-only]
• inp – GAMESS Input
• ins – ShelX format [Read-only]
• jin – Jaguar input format [Write-only]
• jout – Jaguar output format [Read-only]
• k – Compare molecules using InChI [Write-only]
• log – Generic Output file format [Read-only]
• mcdl – MCDL format
• mcif – Macromolecular Crystallographic Info
• mdl – MDL MOL format
• ml2 – Sybyl Mol2 format
• mmcif – Macromolecular Crystallographic Info
• mmd – MacroModel format
• mmod – MacroModel format
• mna – Multilevel Neighborhoods of Atoms (MNA) [Write-only]
• mol – MDL MOL format
• mol2 – Sybyl Mol2 format
• mold – Molden format
• molden – Molden format
• molf – Molden format
• molreport – Open Babel molecule report [Write-only]
• moo – MOPAC Output format [Read-only]
• mop – MOPAC Cartesian format
• mopcr – MOPAC Cartesian format
• mopin – MOPAC Internal
• mopout – MOPAC Output format [Read-only]
• mp – Molpro input format [Write-only]
• mpc – MOPAC Cartesian format
• mpd – MolPrint2D format [Write-only]
• mpo – Molpro output format [Read-only]
• mpqc – MPQC output format [Read-only]
• mpqcin – MPQC simplified input format [Write-only]
• mrv – Chemical Markup Language
• msi – Accelrys/MSI Cerius II MSI format [Read-only]
• msms – M.F. Sanner’s MSMS input format [Write-only]
• nul – Outputs nothing [Write-only]
• nw – NWChem input format [Write-only]
• nwo – NWChem output format [Read-only]
• out – Generic Output file format [Read-only]
• outmol – DMol3 coordinates format
• output – Generic Output file format [Read-only]
• pc – PubChem format [Read-only]
• pcm – PCModel Format
• pdb – Protein Data Bank format
• pdbqt – AutoDock PDQBT format
• png – PNG 2D depiction
• POSCAR – VASP format [Read-only]
• pov – POV-Ray input format [Write-only]
• pqr – PQR format
• pqs – Parallel Quantum Solutions format
• prep – Amber Prep format [Read-only]
• pwscf – PWscf format [Read-only]
• qcin – Q-Chem input format [Write-only]
• qcout – Q-Chem output format [Read-only]
• report – Open Babel report format [Write-only]
• res – ShelX format [Read-only]
• rsmi – Reaction SMILES format
• rxn – MDL RXN format
• sd – MDL MOL format
• sdf – MDL MOL format
• smi – SMILES format
• smiles – SMILES format
• svg – SVG 2D depiction [Write-only]
• sy2 – Sybyl Mol2 format
• t41 – ADF TAPE41 format [Read-only]
• tdd – Thermo format
• text – Read and write raw text
• therm – Thermo format
• tmol – TurboMole Coordinate format
• txt – Title format
• txyz – Tinker XYZ format
• unixyz – UniChem XYZ format
• vmol – ViewMol format
• xed – XED format [Write-only]
• xml – General XML format [Read-only]
• xsf – XCrySDen Structure Format [Read-only]
• xyz – XYZ cartesian coordinates format
• yob – YASARA.org YOB format
• zin – ZINDO input format [Write-only]

Author(s)
Nan Xiao <http://nanx.me>

Examples
```r
sdf = system.file('sysdata/OptAA3d.sdf', package = 'Rcpi')
# SDF to SMILES

convMolFormat(infile = sdf, outfile = 'aa.smi',
               from = 'sdf', to = 'smiles')
# SMILES to MOPAC Cartesian format

convMolFormat(infile = 'aa.smi', outfile = 'aa.mop',
               from = 'smiles', to = 'mop')
```
extractDrugAIO

Calculate All Molecular Descriptors in Rcpi at Once

Description

Calculate All Molecular Descriptors in Rcpi at Once

Usage

extractDrugAIO(molecules, silent = TRUE, warn = TRUE)

Arguments

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.
- **warn**: Logical. Whether the warning about some descriptors need the 3D coordinates should be shown or not after the calculation, default is TRUE.

Details

This function calculates all the molecular descriptors in the Rcpi package at once.

Value

A data frame, each row represents one of the molecules, each column represents one descriptor. Currently, this function returns total 293 descriptors composed of 48 descriptor types.

Note

Note that we need 3-D coordinates of the molecules to calculate some of the descriptors, if not provided, these descriptors values will be NA.

Author(s)

Nan Xiao <http://nanx.me>

Examples

# Load 20 small molecules that have 3D coordinates
sdf = system.file('sysdata/OptAA3d.sdf', package = 'Rcpi')

mol = readMolFromSDF(sdf)
dat = extractDrugAIO(mol, warn = FALSE)
extractDrugALOGP  

**Calculate Atom Additive logP and Molar Refractivity Values Descriptor**

**Description**

Calculate Atom Additive logP and Molar Refractivity Values Descriptor

**Usage**

```r
extractDrugALOGP(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is `TRUE`.

**Details**

Calculates ALOGP (Ghose-Crippen LogKow) and the Ghose-Crippen molar refractivity as described by Ghose, A.K. and Crippen, G.M. Note the underlying code in CDK assumes that aromaticity has been detected before evaluating this descriptor. The code also expects that the molecule will have hydrogens explicitly set. For SD files, this is usually not a problem since hydrogens are explicit. But for the case of molecules obtained from SMILES, hydrogens must be made explicit.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns three columns named `ALogP`, `ALogp2` and `AMR`.

**Author(s)**

Nan Xiao &lt;http://nanx.me&gt;

**References**


**Examples**

```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpp')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugALOGP(mol)
head(dat)
```
extractDrugAminoAcidCount

*Calculate the Number of Amino Acids Descriptor*

**Description**

Calculate the Number of Amino Acids Descriptor

**Usage**

```r
extractDrugAminoAcidCount(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

Calculates the number of each amino acids (total 20 types) found in the molecules.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 20 columns named nA, nR, nN, nD, nC, nF, nQ, nE, nG, nH, nI, nP, nL, nK, nM, nS, nT, nY, nV, nW.

**Author(s)**

Nan Xiao [http://nan.x.me](http://nan.x.me)

**Examples**

```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')

dat = extractDrugAminoAcidCount(mol)

head(dat)
```

extractDrugApol

*Calculate the Sum of the Atomic Polarizabilities Descriptor*

**Description**

Calculate the Sum of the Atomic Polarizabilities Descriptor

**Usage**

```r
extractDrugApol(molecules, silent = TRUE)
```
extractDrugAromaticAtomsCount

Description
Calculate the Number of Aromatic Atoms Descriptor

Usage
extractDrugAromaticAtomsCount(molecules, silent = TRUE)

Arguments
- molecules: Parsed molecule object.
- silent: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details
Calculates the number of aromatic atoms of a molecule.
**extractDrugAromaticBondsCount**

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `nAromAtom`.

**Author(s)**

Nan Xiao [http://nan.x.me](http://nan.x.me)

**Examples**

```r
smi = system.file('vignetteData/FOAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugAromaticBondsCount(mol)
head(dat)
```

---

**extractDrugAromaticBondsCount**

*Calculate the Number of Aromatic Bonds Descriptor*

**Description**

Calculate the Number of Aromatic Bonds Descriptor

**Usage**

```r
extractDrugAromaticBondsCount(molecules, silent = TRUE)
```

**Arguments**

- `molecules` Parsed molecule object.
- `silent` Logical. Whether the calculating process should be shown or not, default is `TRUE`.

**Details**

Calculates the number of aromatic bonds of a molecule.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `nAromBond`.

**Author(s)**

Nan Xiao [http://nan.x.me](http://nan.x.me)

**Examples**

```r
smi = system.file('vignetteData/FOAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugAromaticBondsCount(mol)
head(dat)
```
extractDrugAtomCount  
*Calculate the Number of Atom Descriptor*

**Description**

Calculate the Number of Atom Descriptor

**Usage**

```r
extractDrugAtomCount(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is `TRUE`.

**Details**

Calculates the number of atoms of a certain element type in a molecule. By default it returns the count of all atoms.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `nAtom`.

**Author(s)**

Nan Xiao <http://nanx.me>

**Examples**

```r
smi = system.file('vignettes/FOAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugAtomCount(mol)
head(dat)
```

---

extractDrugAutocorrelationCharge  
*Calculate the Moreau-Broto Autocorrelation Descriptors using Partial Charges*

**Description**

Calculate the Moreau-Broto Autocorrelation Descriptors using Partial Charges

**Usage**

```r
extractDrugAutocorrelationCharge(molecules, silent = TRUE)
```
extractDrugAutocorrelationMass

Arguments

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculates the ATS autocorrelation descriptor, where the weight equal to the charges.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 5 columns named ATSc1, ATSc2, ATSc3, ATSc4, ATSc5.

Author(s)

Nan Xiao <http://nanx.me>

Examples

```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugAutocorrelationCharge(mol)
head(dat)
```

extractDrugAutocorrelationMass

*Calculate the Moreau-Broto Autocorrelation Descriptors using Atomic Weight*

Description

Calculate the Moreau-Broto Autocorrelation Descriptors using Atomic Weight

Usage

```r
extractDrugAutocorrelationMass(molecules, silent = TRUE)
```

Arguments

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculates the ATS autocorrelation descriptor, where the weight equal to the scaled atomic mass.
Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 5 columns named ATSm1, ATSm2, ATSm3, ATSm4, ATSm5.

Author(s)

Nan Xiao <http://nanx.me>

References


Examples

```r
smi = system.file('vignettedata/FDAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugAutocorrelationMass(mol)
head(dat)
```

---

**extractDrugAutocorrelationPolarizability**

*Calculate the Moreau-Broto Autocorrelation Descriptors using Polarizability*

**Usage**

```r
extractDrugAutocorrelationPolarizability(molecules, silent = TRUE)
```

**Arguments**

- `molecules` Parsed molecule object.
- `silent` Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

Calculates the ATS autocorrelation descriptor using polarizability.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 5 columns named ATSp1, ATSp2, ATSp3, ATSp4, ATSp5.

**Author(s)**

Nan Xiao <http://nanx.me>
Examples

```r
smi = system.file('vignettes/AMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugAutocorrelationPolarizability(mol)
head(dat)
```

Description

BCUT – Eigenvalue Based Descriptor

Usage

```r
extractDrugBCUT(molecules, silent = TRUE)
```

Arguments

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Eigenvalue based descriptor noted for its utility in chemical diversity. Described by Pearlman et al. The descriptor is based on a weighted version of the Burden matrix which takes into account both the connectivity as well as atomic properties of a molecule. The weights are a variety of atom properties placed along the diagonal of the Burden matrix. Currently three weighting schemes are employed:

- Atomic Weight
- Partial Charge (Gasteiger Marsilli)
- Polarizability (Kang et al.)

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 6 columns:

- BCUTw-11, BCUTw-21 ... - n high lowest atom weighted BCUTS
- BCUTw-1h, BCUTw-2h ... - n low highest atom weighted BCUTS
- BCUTc-11, BCUTc-21 ... - n high lowest partial charge weighted BCUTS
- BCUTc-1h, BCUTc-2h ... - n low highest partial charge weighted BCUTS
- BCUTp-11, BCUTp-21 ... - n high lowest polarizability weighted BCUTS
- BCUTp-1h, BCUTp-2h ... - n low highest polarizability weighted BCUTS
Note

By default, the descriptor will return the highest and lowest eigenvalues for the three classes of descriptor in a single ArrayList (in the order shown above). However it is also possible to supply a parameter list indicating how many of the highest and lowest eigenvalues (for each class of descriptor) are required. The descriptor works with the hydrogen depleted molecule.

A side effect of specifying the number of highest and lowest eigenvalues is that it is possible to get two copies of all the eigenvalues. That is, if a molecule has 5 heavy atoms, then specifying the 5 highest eigenvalues returns all of them, and specifying the 5 lowest eigenvalues returns all of them, resulting in two copies of all the eigenvalues.

Note that it is possible to specify an arbitrarily large number of eigenvalues to be returned. However if the number (i.e., nhigh or nlow) is larger than the number of heavy atoms, the remaining eigenvalues will be NaN.

Given the above description, if the aim is to get all the eigenvalues for a molecule, you should set nlow to 0 and specify the number of heavy atoms (or some large number) for nhigh (or vice versa).

Author(s)

Nan Xiao <http://nanx.me>

References


Examples

```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpp')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugBCUT(mol)
head(dat)
```

---

**extractDrugBondCount**  
*Calculate the Descriptor Based on the Number of Bonds of a Certain Bond Order*

Description

Calculate the Descriptor Based on the Number of Bonds of a Certain Bond Order

Usage

```r
extractDrugBondCount(molecules, silent = TRUE)
```
extractDrugBPol

Arguments

molecules  
Parsed molecule object.

silent  
Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculates the descriptor based on the number of bonds of a certain bond order.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named nB.

Author(s)

Nan Xiao <http://nanx.me>

Examples

smi = system.file('vignetteData/FDAMDD.smi', package = 'Rcpp')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugBondCount(mol)
head(dat)

extractDrugBPol  
Calculate the Descriptor that Describes the Sum of the Absolute Value of the Difference between Atomic Polarizabilities of All Bonded Atoms in the Molecule

Description

Calculates the Descriptor that Describes the Sum of the Absolute Value of the Difference between Atomic Polarizabilities of All Bonded Atoms in the Molecule

Usage

extractDrugBPol(molecules, silent = TRUE)

Arguments

molecules  
Parsed molecule object.

silent  
Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

This descriptor calculates the sum of the absolute value of the difference between atomic polarizabilities of all bonded atoms in the molecule (including implicit hydrogens) with polarizabilities taken from http://www.sunysccc.edu/academic/mst/ptable/p-table2.htm. This descriptor assumes 2-centered bonds.
extractDrugCarbonTypes

Topological Descriptor Characterizing the Carbon Connectivity in Terms of Hybridization

Description
Topological Descriptor Characterizing the Carbon Connectivity in Terms of Hybridization

Usage
extractDrugCarbonTypes(molecules, silent = TRUE)

Arguments
molecules
Parsed molecule object.
silent
Logical. Whether the calculating process should be shown or not, default is TRUE.

Details
Calculates the carbon connectivity in terms of hybridization. The function calculates 9 descriptors in the following order:

- C1SP1 - triply bound carbon bound to one other carbon
- C2SP1 - triply bound carbon bound to two other carbons
- C1SP2 - doubly bound carbon bound to one other carbon
- C2SP2 - doubly bound carbon bound to two other carbons
- C3SP2 - doubly bound carbon bound to three other carbons
- C1SP3 - singly bound carbon bound to one other carbon
- C2SP3 - singly bound carbon bound to two other carbons
- C3SP3 - singly bound carbon bound to three other carbons
- C4SP3 - singly bound carbon bound to four other carbons

Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named bpol.

Author(s)
Nan Xiao <http://nan.x.me>

Examples
smi = system.file("/vignettes/FDA-MDD.smi", package = "Rcpi")
mol = readMolFromSmi(smi, type = "mol")
dat = extractDrugBPoMol(mol)
head(dat)
extractDrugChiChain

Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns 9 columns named C1SP1, C2SP1, C1SP2, C2SP2, C3SP2, C1SP3, C2SP3, C3SP3 and C4SP3.

Author(s)
Nan Xiao <http://nanx.me>

Examples
```r
smi = system.file('vignettes/RDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugCarbonTypes(mol)
head(dat)
```

extractDrugChiChain  Calculate the Kier and Hall Chi Chain Indices of Orders 3, 4, 5, 6 and 7

Description
Calculate the Kier and Hall Chi Chain Indices of Orders 3, 4, 5, 6 and 7

Usage
```r
extractDrugChiChain(molecules, silent = TRUE)
```

Arguments
- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details
Evaluates chi chain descriptors. The code currently evaluates the simple and valence chi chain descriptors of orders 3, 4, 5, 6 and 7. It utilizes the graph isomorphism code of the CDK to find fragments matching SMILES strings representing the fragments corresponding to each type of chain.

Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns 10 columns, in the following order:
- SCH.3 - Simple chain, order 3
- SCH.4 - Simple chain, order 4
- SCH.5 - Simple chain, order 5
- SCH.6 - Simple chain, order 6
- SCH.7 - Simple chain, order 7
• VCH.3 - Valence chain, order 3
• VCH.4 - Valence chain, order 4
• VCH.5 - Valence chain, order 5
• VCH.6 - Valence chain, order 6
• VCH.7 - Valence chain, order 7

Note
These descriptors are calculated using graph isomorphism to identify the various fragments. As a result calculations may be slow. In addition, recent versions of Molconn-Z use simplified fragment definitions (i.e., rings without branches etc.) whereas these descriptors use the older more complex fragment definitions.

Author(s)
Nan Xiao <http://nanx.me>

Examples

```r
smi = system.file(' vignettes/dFDAMDD.smi', package = 'Rcpp')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugChiChain(mol)
head(dat)
```

### extractDrugChiCluster

Evaluates the Kier and Hall Chi cluster indices of orders 3, 4, 5 and 6

#### Description
Evaluates the Kier and Hall Chi cluster indices of orders 3, 4, 5 and 6

#### Usage

```r
extractDrugChiCluster(molecules, silent = TRUE)
```

#### Arguments

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

#### Details
Evaluates chi cluster descriptors. It utilizes the graph isomorphism code of the CDK to find fragments matching SMILES strings representing the fragments corresponding to each type of chain.
*extractDrugChiPath*

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 8 columns, the order and names of the columns returned is:

- SC.3 - Simple cluster, order 3
- SC.4 - Simple cluster, order 4
- SC.5 - Simple cluster, order 5
- SC.6 - Simple cluster, order 6
- VC.3 - Valence cluster, order 3
- VC.4 - Valence cluster, order 4
- VC.5 - Valence cluster, order 5
- VC.6 - Valence cluster, order 6

**Note**

These descriptors are calculated using graph isomorphism to identify the various fragments. As a result calculations may be slow. In addition, recent versions of Molconn-Z use simplified fragment definitions (i.e., rings without branches etc.) whereas these descriptors use the older more complex fragment definitions.

**Author(s)**

Nan Xiao <http://nanx.me>

**Examples**

```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpp')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugChiCluster(mol)
head(dat)
```

---

**extractDrugChiPath**  
*Calculate the Kier and Hall Chi Path Indices of Orders 0 to 7*

**Description**

Calculate the Kier and Hall Chi Path Indices of Orders 0 to 7

**Usage**

```r
extractDrugChiPath(molecules, silent = TRUE)
```

**Arguments**

- **molecules**  
  Parsed molecule object.

- **silent**  
  Logical. Whether the calculating process should be shown or not, default is TRUE.
**extractDrugChiPathCluster**

**Details**

Evaluates chi path descriptors. This function utilizes the graph isomorphism code of the CDK to find fragments matching SMILES strings representing the fragments corresponding to each type of chain.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 16 columns, The order and names of the columns returned is:

- **SP.0, SP.1, ..., SP.7** - Simple path, orders 0 to 7
- **VP.0, VP.1, ..., VP.7** - Valence path, orders 0 to 7

**Note**

These descriptors are calculated using graph isomorphism to identify the various fragments. As a result calculations may be slow. In addition, recent versions of Molconn-Z use simplified fragment definitions (i.e., rings without branches etc.) whereas these descriptors use the older more complex fragment definitions.

**Author(s)**

Nan Xiao <http://nanx.me>

**Examples**

```r
smi = system.file('vignettes/R/VarFDAMDD.smi', package = 'Rcpp')
mol = readMolFromSMI(smi, type = 'mol')
dat = extractDrugChiPath(mol)
head(dat)
```

---

**extractDrugChiPathCluster**

*Calculate the Kier and Hall Chi Path Cluster Indices of Orders 4, 5 and 6*

**Description**

Calculate the Kier and Hall Chi Path Cluster Indices of Orders 4, 5 and 6

**Usage**

```r
extractDrugChiPathCluster(molecules, silent = TRUE)
```

**Arguments**

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.
Details
Evaluates chi path cluster descriptors. The code currently evaluates the simple and valence chi chain descriptors of orders 4, 5 and 6. It utilizes the graph isomorphism code of the CDK to find fragments matching SMILES strings representing the fragments corresponding to each type of chain.

Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns 6 columns named SPC.4, SPC.5, SPC.6, VPC.4, VPC.5, VPC.6:

- SPC.4 - Simple path cluster, order 4
- SPC.5 - Simple path cluster, order 5
- SPC.6 - Simple path cluster, order 6
- VPC.4 - Valence path cluster, order 4
- VPC.5 - Valence path cluster, order 5
- VPC.6 - Valence path cluster, order 6

Note
These descriptors are calculated using graph isomorphism to identify the various fragments. As a result calculations may be slow. In addition, recent versions of Molconn-Z use simplified fragment definitions (i.e., rings without branches etc.) whereas these descriptors use the older more complex fragment definitions.

Author(s)
Nan Xiao <http://nanx.me>

Examples
```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugChiPathCluster(mol)
head(dat)
```

---

**extractDrugCPSA**  
A Variety of Descriptors Combining Surface Area and Partial Charge Information

**Description**
A Variety of Descriptors Combining Surface Area and Partial Charge Information

**Usage**
```
extractDrugCPSA(molecules, silent = TRUE)
```
Arguments

molecules Parsed molecule object.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculates 29 Charged Partial Surface Area (CPSA) descriptors. The CPSA’s were developed by Stanton et al.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 29 columns:

- PPSA.1 - partial positive surface area – sum of surface area on positive parts of molecule
- PPSA.2 - partial positive surface area * total positive charge on the molecule
- PPSA.3 - charge weighted partial positive surface area
- PNSA.1 - partial negative surface area – sum of surface area on negative parts of molecule
- PNSA.2 - partial negative surface area * total negative charge on the molecule
- PNSA.3 - charge weighted partial negative surface area
- DPSA.1 - difference of PPSA.1 and PNSA.1
- DPSA.2 - difference of FPSA.2 and PNSA.2
- DPSA.3 - difference of PPSA.3 and PNSA.3
- FPSA.1 - PPSA.1 / total molecular surface area
- FPSA.2 - PPSA.2 / total molecular surface area
- FPSA.3 - PPSA.3 / total molecular surface area
- FNSA.1 - PNSA.1 / total molecular surface area
- FNSA.2 - PNSA.2 / total molecular surface area
- FNSA.3 - PNSA.3 / total molecular surface area
- WPSA.1 - PPSA.1 * total molecular surface area / 1000
- WPSA.2 - PPSA.2 * total molecular surface area / 1000
- WPSA.3 - PPSA.3 * total molecular surface area / 1000
- WNSA.1 - PNSA.1 * total molecular surface area / 1000
- WNSA.2 - PNSA.2 * total molecular surface area / 1000
- WNSA.3 - PNSA.3 * total molecular surface area / 1000
- RPCG - relative positive charge – most positive charge / total positive charge
- RNCG - relative negative charge – most negative charge / total negative charge
- RPCS - relative positive charge surface area – most positive surface area * RPCG
- RNCS - relative negative charge surface area – most negative surface area * RNCG
- THSA - sum of solvent accessible surface areas of atoms with absolute value of partial charges less than 0.2
- TPSA - sum of solvent accessible surface areas of atoms with absolute value of partial charges greater than or equal 0.2
- RHSA - THSA / total molecular surface area
- RPSA - TPSA / total molecular surface area
Author(s)

Nan Xiao <http://nanx.me>

References


Examples

```r
sdf = system.file('sysdata/OptAA3d.sdf', package = 'Rcpi')
mol = readMolFromSDF(sdf)
dat = extractDrugCPSA(mol)
head(dat)
```

**extractDrugDescOB**

*Calculate Molecular Descriptors Provided by OpenBabel*

**Description**

Calculate Molecular Descriptors Provided by OpenBabel

**Usage**

```r
extractDrugDescOB(molecules, type = c("smile", "sdf"))
```

**Arguments**

molecules: R character string object containing the molecules. See the example section for details.

type: 'smile' or 'sdf'.

**Details**

This function calculates 14 types of the *numerical* molecular descriptors provided in OpenBabel.

**Value**

A data frame, each row represents one of the molecules, each column represents one descriptor. This function returns 14 columns named abonds, atoms, bonds, dbonds, HBA1, HBA2, HB0, logP, MR, MW, nF, sbonds, tbonds, TPSA:

- abonds - Number of aromatic bonds
- atoms - Number of atoms
- bonds - Number of bonds
- dbonds - Number of double bonds
- HBA1 - Number of Hydrogen Bond Acceptors 1
- HBA2 - Number of Hydrogen Bond Acceptors 2
• HBD - Number of Hydrogen Bond Donors
• logP - Octanol/Water Partition Coefficient
• MR - Molar Refractivity
• MW - Molecular Weight Filter
• nF - Number of Fluorine Atoms
• sbonds - Number of single bonds
• tbonds - Number of triple bonds
• TPSA - Topological Polar Surface Area

Author(s)
Nan Xiao <http://nanx.me>

Examples
mol1 = 'CC(=O)NCC1=CNc2c1cc(OC)cc2' # one molecule SMILE in a vector
mol2 = c('OCCc1c(C)[n+]1(csc)Cc2cnc(C)c(N)2',
      'CC(c1)ccc2[n+]1ccc3c2Nc4c3cccc4',
      '[Cu+2].[O-]S(=O)(=O)[O-]') # multiple SMILES in a vector
mol3 = readChar(system.file('compseq/DB00860.sdf', package = 'Rcpi'),
                 nchars = 1e+6) # single molecule in a sdf file
mol4 = readChar(system.file('sysdata/OptAA3d.sdf', package = 'Rcpi'),
                 nchars = 1e+6) # multiple molecules in a sdf file

# Problem (core dump) under Ubuntu 16.04
smidesc0 = extractDrugDescOB(mol1, type = 'smile')
smidesc1 = extractDrugDescOB(mol2, type = 'smile')
sdfdesc0 = extractDrugDescOB(mol3, type = 'sdf')
sdfdesc1 = extractDrugDescOB(mol4, type = 'sdf')

extractDrugECI (Calculate the Eccentric Connectivity Index Descriptor)

Description
Calculate the Eccentric Connectivity Index Descriptor

Usage
extractDrugECI(molecules, silent = TRUE)

Arguments
molecules          Parsed molucule object.
silent             Logical. Whether the calculating process should be shown or not, default is TRUE.
Eccentric Connectivity Index (ECI) is a topological descriptor combining distance and adjacency information. This descriptor is described by Sharma et al. and has been shown to correlate well with a number of physical properties. The descriptor is also reported to have good discriminatory ability. The eccentric connectivity index for a hydrogen suppressed molecular graph is given by

\[ x_i^e = \sum_{i=1}^{n} E(i)V(i) \]

where \( E(i) \) is the eccentricity of the i-th atom (path length from the i-th atom to the atom farthest from it) and \( V(i) \) is the vertex degree of the i-th atom.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named ECCEN.

Author(s)

Nan Xiao <http://nanx.me>

References


Examples

```r
smi = system.file('vignettedata/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugECI(mol)
head(dat)
```
extractDrugEstateComplete

**Details**

79 bit fingerprints corresponding to the E-State atom types described by Hall and Kier.

**Value**

A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component’s name is the length of the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

extractDrugEstateComplete

**Examples**

```r
smi = system.file('vignette-data/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugEstate(mol)
head(fp)
```

---

**extractDrugEstateComplete**

*Calculate the E-State Molecular Fingerprints (in Complete Format)*

**Description**

Calculate the E-State Molecular Fingerprints (in Complete Format)

**Usage**

```r
extractDrugEstateComplete(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

79 bit fingerprints corresponding to the E-State atom types described by Hall and Kier.

**Value**

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.
extractDrugExtended

Author(s)
Nan Xiao <http://nanx.me>

See Also
extractDrugEstate

Examples

```r
csv = system.file('vignettes/FDAMDD.csv', package = 'Rcmdr')
mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugEstateComplete(mol)
dim(fp)
```

---

**extractDrugExtended**

*Calculate the Extended Molecular Fingerprints (in Compact Format)*

Description

Calculate the Extended Molecular Fingerprints (in Compact Format)

Usage

```r
extractDrugExtended(molecules, depth = 6, size = 1024, silent = TRUE)
```

Arguments

- `molecules`: Parsed molecule object.
- `depth`: The search depth. Default is 6.
- `size`: The length of the fingerprint bit string. Default is 1024.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculate the extended molecular fingerprints. Considers paths of a given length, similar to the standard type, but takes rings and atomic properties into account into account. This is hashed fingerprints, with a default length of 1024.

Value

A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component’s name is the length of the fingerprints.

Author(s)

Nan Xiao <http://nanx.me>
See Also

extractDrugExtendedComplete

Examples

smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugExtended(mol)
head(fp)

extractDrugExtendedComplete

*Calculate the Extended Molecular Fingerprints (in Complete Format)*

Description

Calculate the Extended Molecular Fingerprints (in Complete Format)

Usage

extractDrugExtendedComplete(molecules, depth = 6, size = 1024,
silent = TRUE)

Arguments

- **molecules**: Parsed molecule object.
- **depth**: The search depth. Default is 6.
- **size**: The length of the fingerprint bit string. Default is 1024.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculate the extended molecular fingerprints. Considers paths of a given length, similar to the standard type, but takes rings and atomic properties into account into account. This is hashed fingerprints, with a default length of 1024.

Value

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.

Author(s)

Nan Xiao <http://nanx.me>

See Also

extractDrugExtended
**Examples**

```r
smi = system.file('vignettedata/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugExtendedComplete(mol)
dim(fp)
```

**extractDrugFMF**

*Calculate the FMF Descriptor*

**Description**

Calculate the FMF Descriptor

**Usage**

```r
extractDrugFMF(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is `TRUE`.

**Details**

Calculates the FMF descriptor characterizing molecular complexity in terms of its Murcko framework. This descriptor is the ratio of heavy atoms in the framework to the total number of heavy atoms in the molecule. By definition, acyclic molecules which have no frameworks, will have a value of 0. Note that the authors consider an isolated ring system to be a framework (even though there is no linker).

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `FMF`.

**Author(s)**

Nan Xiao &lt;http://nanx.me&gt;

**References**


**Examples**

```r
smi = system.file('vignettedata/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugFMF(mol)
head(dat)
```
extractDrugFragmentComplexity

*Calculate Complexity of a System*

**Description**
Calculate Complexity of a System

**Usage**
```
extractDrugFragmentComplexity(molecules, silent = TRUE)
```

**Arguments**
- `molecules` : Parsed molecule object.
- `silent` : Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**
This descriptor calculates the complexity of a system. The complexity is defined in Nilakantan, R. et al. as:

\[ C = \text{abs} (B^2 - A^2 + A) + \frac{H}{100} \]

where C is complexity, A is the number of non-hydrogen atoms, B is the number of bonds and H is the number of heteroatoms.

**Value**
A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `fragC`.

**Author(s)**
Nan Xiao <http://nanx.me>

**References**
Nilakantan, R. and Nunn, D.S. and Greenblatt, L. and Walker, G. and Haraki, K. and Mobilio, D.,

**Examples**
```
smi = system.file('vignettes/R/ADAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugFragmentComplexity(mol)
head(dat)
```
**extractDrugGraph**  
*Calculate the Graph Molecular Fingerprints (in Compact Format)*

**Description**

Calculate the Graph Molecular Fingerprints (in Compact Format)

**Usage**

```r
extractDrugGraph(molecules, depth = 6, size = 1024, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `depth`: The search depth. Default is 6.
- `size`: The length of the fingerprint bit string. Default is 1024.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

Calculate the graph molecular fingerprints. Similar to the standard type by simply considers connectivity. This is hashed fingerprints, with a default length of 1024.

**Value**

A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component's name is the length of the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

- `extractDrugGraphComplete`

**Examples**

```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcepi')
mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugGraph(mol)
head(fp)
```
**extractDrugGraphComplete**

*Calculate the Graph Molecular Fingerprints (in Complete Format)*

**Description**

Calculate the Graph Molecular Fingerprints (in Complete Format)

**Usage**

`extractDrugGraphComplete(molecules, depth = 6, size = 1024, silent = TRUE)`

**Arguments**

- `molecules`: Parsed molecule object.
- `depth`: The search depth. Default is 6.
- `size`: The length of the fingerprint bit string. Default is 1024.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

Calculate the graph molecular fingerprints. Similar to the standard type by simply considers connectivity. This is hashed fingerprints, with a default length of 1024.

**Value**

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

`extractDrugGraph`

**Examples**

```r
smi = system.file('vignetteData/FOAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')

fp = extractDrugGraphComplete(mol)

dim(fp)
```
**extractDrugGravitationalIndex**

*Descriptor Characterizing the Mass Distribution of the Molecule.*

**Description**

Descriptor Characterizing the Mass Distribution of the Molecule.

**Usage**

```r
extractDrugGravitationalIndex(molecules, silent = TRUE)
```

**Arguments**

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is `TRUE`.

**Details**

Descriptor characterizing the mass distribution of the molecule described by Katritzky et al. For modelling purposes the value of the descriptor is calculated both with and without H atoms. Furthermore the square and cube roots of the descriptor are also generated as described by Wessel et al.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 9 columns:

- **GRAV.1** - gravitational index of heavy atoms
- **GRAV.2** - square root of gravitational index of heavy atoms
- **GRAV.3** - cube root of gravitational index of heavy atoms
- **GRAVH.1** - gravitational index - hydrogens included
- **GRAVH.2** - square root of hydrogen-included gravitational index
- **GRAVH.3** - cube root of hydrogen-included gravitational index
- **GRAV.4** - grav1 for all pairs of atoms (not just bonded pairs)
- **GRAV.5** - grav2 for all pairs of atoms (not just bonded pairs)
- **GRAV.6** - grav3 for all pairs of atoms (not just bonded pairs)

**Author(s)**

Nan Xiao <http://nanx.me>
References

Examples
sdf = system.file('sysdata/OptAA3d.sdf', package = 'Rcpl')
mol = readMolFromSDF(sdf)
dat = extractDrugGravitationalIndex(mol)
head(dat)

extractDrugHBondAcceptorCount

Number of Hydrogen Bond Acceptors

Description
Number of Hydrogen Bond Acceptors

Usage
extractDrugHBondAcceptorCount(molecules, silent = TRUE)

Arguments
molecules Parsed molecule object.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details
This descriptor calculates the number of hydrogen bond acceptors using a slightly simplified version of the PHACIR atom types. The following groups are counted as hydrogen bond acceptors: any oxygen where the formal charge of the oxygen is non-positive (i.e. formal charge <= 0) except

1. an aromatic ether oxygen (i.e. an ether oxygen that is adjacent to at least one aromatic carbon)
2. an oxygen that is adjacent to a nitrogen

and any nitrogen where the formal charge of the nitrogen is non-positive (i.e. formal charge <= 0) except a nitrogen that is adjacent to an oxygen.

Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named nHBAcc.
extractDrugHBondDonorCount

Author(s)

Nan Xiao <http://nanx.me>

Examples

```r
smi = system.file('vignette/DA/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugHBondDonorCount(mol)
head(dat)
```

---

### Description

**Number of Hydrogen Bond Donors**

### Usage

```r
extractDrugHBondDonorCount(molecules, silent = TRUE)
```

### Arguments

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

### Details

This descriptor calculates the number of hydrogen bond donors using a slightly simplified version of the PHACIR atom types ([http://www.chemie.uni-erlangen.de/model2001/abstracts/rester.html](http://www.chemie.uni-erlangen.de/model2001/abstracts/rester.html)). The following groups are counted as hydrogen bond donors:

- Any-OH where the formal charge of the oxygen is non-negative (i.e. formal charge \(\geq 0\))
- Any-NH where the formal charge of the nitrogen is non-negative (i.e. formal charge \(\geq 0\))

### Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `nHBDon`.

### Author(s)

Nan Xiao <http://nanx.me>

### Examples

```r
smi = system.file('vignette/DA/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugHBondDonorCount(mol)
head(dat)
```
extractDrugHybridization

*Calculate the Hybridization Molecular Fingerprints (in Compact Format)*

**Description**

Calculate the Hybridization Molecular Fingerprints (in Compact Format)

**Usage**

```r
extractDrugHybridization(molecules, depth = 6, size = 1024, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `depth`: The search depth. Default is 6.
- `size`: The length of the fingerprint bit string. Default is 1024.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

Calculate the hybridization molecular fingerprints. Similar to the standard type, but only consider hybridization state. This is hashed fingerprints, with a default length of 1024.

**Value**

A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component’s name is the length of the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

- `extractDrugHybridizationComplete`

**Examples**

```r
smi = system.file('vignettes/Rd/Rd/Var', package = 'Rcpp')

mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugHybridization(mol)
head(fp)
```
Calculate the Hybridization Molecular Fingerprints (in Complete Format)

**Usage**

```r
extractDrugHybridizationComplete(molecules, depth = 6, size = 1024, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `depth`: The search depth. Default is 6.
- `size`: The length of the fingerprint bit string. Default is 1024.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

Calculate the hybridization molecular fingerprints. Similar to the standard type, but only consider hybridization state. This is hashed fingerprints, with a default length of 1024.

**Value**

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

- `extractDrugHybridization`

**Examples**

```r
smi = system.file("vignettes/FDAMDD.smi", package = "Rcpp")

mol = readMolFromSmi(smi, type = "mol")
fp = extractDrugHybridizationComplete(mol)
dim(fp)
```
extractDrugHybridizationRatio

Descriptor that Characterizing Molecular Complexity in Terms of Carbon Hybridization States

Description

Descriptor that Characterizing Molecular Complexity in Terms of Carbon Hybridization States

Usage

extractDrugHybridizationRatio(molecules, silent = TRUE)

Arguments

molecules
  Parsed molecule object.

silent
  Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

This descriptor calculates the fraction of sp3 carbons to sp2 carbons. Note that it only considers carbon atoms and rather than use a simple ratio it reports the value of Nsp3/(Nsp3 + Nsp2). The original form of the descriptor (i.e., simple ratio) has been used to characterize molecular complexity, especially in the are of natural products, which usually have a high value of the sp3 to sp2 ratio.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named HybRatio.

Author(s)

Nan Xiao <http://nanx.me>

Examples

smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugHybridizationRatio(mol)
head(dat)
**extractDrugIPMolecularLearning**

*Calculate the Descriptor that Evaluates the Ionization Potential*

### Description

Calculate the Descriptor that Evaluates the Ionization Potential

### Usage

```r
evaluateIonization(molecules, silent = TRUE)
```

### Arguments

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is `TRUE`.

### Details

Calculate the ionization potential of a molecule. The descriptor assumes that explicit hydrogens have been added to the molecules.

### Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `MolIP`.

### Author(s)

Nan Xiao <http://nanx.me>

### Examples

```r
smi = system.file('vignettes/FDAIDF.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = evaluateIonization(mol)
head(dat)
```

---

**extractDrugKappaShapeIndices**

*Descriptor that Calculates Kier and Hall Kappa Molecular Shape Indices*

### Description

Descriptor that Calculates Kier and Hall Kappa Molecular Shape Indices

```r
smi = system.file('vignettes/FDAIDF.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugKappaShapeIndices(mol)
head(dat)
```
extractDrugKierHallSmarts

Usage

extractDrugKappaShapeIndices(molecules, silent = TRUE)

Arguments

molecules Parsed molecule object.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Kier and Hall Kappa molecular shape indices compare the molecular graph with minimal and maximal molecular graphs; see http://www.chemcomp.com/Journal_of_CCG/Features/descr.htm#KH for details: "they are intended to capture different aspects of molecular shape. Note that hydrogens are ignored. In the following description, n denotes the number of atoms in the hydrogen suppressed graph, m is the number of bonds in the hydrogen suppressed graph. Also, let p2 denote the number of paths of length 2 and let p3 denote the number of paths of length 3".

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 3 columns named Kier1, Kier2 and Kier3:

- Kier1 - First kappa shape index
- Kier2 - Second kappa shape index
- Kier3 - Third kappa shape index

Author(s)

Nan Xiao <http://nanx.me>

Examples

```r
smi = system.file('vignetteData/FDAMDD.smi', package = 'Rcpp')

mol = readMolFromSmi(smi, type = 'mol')

dat = extractDrugKappaShapeIndices(mol)

head(dat)
```

extractDrugKierHallSmarts

Descriptor that Counts the Number of Occurrences of the E-State Fragments

Description

Descriptor that Counts the Number of Occurrences of the E-State Fragments

Usage

extractDrugKierHallSmarts(molecules, silent = TRUE)
extractDrugKierHallSmarts

Arguments

molecules
Parsed molecule object.
silent
Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

A fragment count descriptor that uses e-state fragments. Traditionally the e-state descriptors identify the relevant fragments and then evaluate the actual e-state value. However it has been shown in Butina et al. that simply using the counts of the e-state fragments can lead to QSAR models that exhibit similar performance to those built using the actual e-state indices.

Atom typing and aromaticity perception should be performed prior to calling this descriptor. The atom type definitions are taken from Hall et al. The SMARTS definitions were obtained from RDKit.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 79 columns:

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>khs.sLi</td>
<td>[LiD1]--</td>
</tr>
<tr>
<td>1</td>
<td>khs.ssBe</td>
<td><a href="-*">BeD2</a>--</td>
</tr>
<tr>
<td>2</td>
<td>khs.sssBe</td>
<td><a href="-*">BeD4</a>(-<em>)(-</em>)--</td>
</tr>
<tr>
<td>3</td>
<td>khs.sBH</td>
<td><a href="-*">BD2H</a>--</td>
</tr>
<tr>
<td>4</td>
<td>khs.sssB</td>
<td><a href="-*">BD3</a>(-*)--</td>
</tr>
<tr>
<td>5</td>
<td>khs.sssB</td>
<td><a href="-*">BD4</a>(-<em>)(-</em>)--</td>
</tr>
<tr>
<td>6</td>
<td>khs.sCH3</td>
<td>[CD1H3]--</td>
</tr>
<tr>
<td>7</td>
<td>khs.dCH2</td>
<td>[CD1H2]##</td>
</tr>
<tr>
<td>8</td>
<td>khs.ssCH2</td>
<td><a href="-*">CD2H2</a>--</td>
</tr>
<tr>
<td>9</td>
<td>khs.tCH</td>
<td>[CD1H]##</td>
</tr>
<tr>
<td>10</td>
<td>khs.dsCH</td>
<td><a href="=*">CD2H</a>--</td>
</tr>
<tr>
<td>11</td>
<td>khs.aaCH</td>
<td><a href="">C,c;D2H</a>:*</td>
</tr>
<tr>
<td>12</td>
<td>khs.sssCH</td>
<td><a href="-*">CD3H</a>(-*)--</td>
</tr>
<tr>
<td>13</td>
<td>khs.ddC</td>
<td><a href="">CD2H0</a>==**</td>
</tr>
<tr>
<td>14</td>
<td>khs.tsC</td>
<td><a href="#*">CD2H0</a>--</td>
</tr>
<tr>
<td>15</td>
<td>khs.dssC</td>
<td><a href="=*">CD3H0</a>(-*)--</td>
</tr>
<tr>
<td>16</td>
<td>khs.aaasC</td>
<td><a href="">C,c;D3H0</a>:*</td>
</tr>
<tr>
<td>17</td>
<td>khs.aaaC</td>
<td><a href="">C,c;D3H0</a>:*</td>
</tr>
<tr>
<td>18</td>
<td>khs.ssssC</td>
<td><a href="-*">CD4H0</a>(-<em>)(-</em>)--</td>
</tr>
<tr>
<td>19</td>
<td>khs.sNH3</td>
<td>[ND1H3]--</td>
</tr>
<tr>
<td>20</td>
<td>khs.sNH2</td>
<td>[ND1H2]--</td>
</tr>
<tr>
<td>21</td>
<td>khs.sssNH2</td>
<td><a href="-*">ND2H2</a>--</td>
</tr>
<tr>
<td>22</td>
<td>khs.dNH</td>
<td>[ND1H]##</td>
</tr>
<tr>
<td>23</td>
<td>khs.ssNH</td>
<td><a href="-*">ND2H</a>--</td>
</tr>
<tr>
<td>24</td>
<td>khs.aaNH</td>
<td><a href="">N,ND2H</a>:*</td>
</tr>
<tr>
<td>25</td>
<td>khs.tN</td>
<td>[ND1H0]##</td>
</tr>
<tr>
<td>26</td>
<td>khs.sssNH</td>
<td><a href="-*">ND3H</a>(-*)--</td>
</tr>
<tr>
<td>27</td>
<td>khs.dsN</td>
<td><a href="">ND2H0</a>==**</td>
</tr>
<tr>
<td>28</td>
<td>khs.aaN</td>
<td><a href="">N,ND2H0</a>:*</td>
</tr>
<tr>
<td>29</td>
<td>khs.sssN</td>
<td><a href="-*">ND3H0</a>(-*)--</td>
</tr>
<tr>
<td>30</td>
<td>khs.ddsN</td>
<td><a href="%5BOD1H0%5D">ND3H0</a>([OD1H0])--,*</td>
</tr>
</tbody>
</table>
extractDrugKierHallSmarts

Author(s)

Nan Xiao <http://nanx.me>
**References**


**Examples**

```r
smi = system.file('vignettes/FDAIDDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugKierHallSmarts(mol)
head(dat)
```

**extractDrugKR**

*Calculate the KR (Klekota and Roth) Molecular Fingerprints (in Compact Format)*

**Description**

Calculate the KR (Klekota and Roth) Molecular Fingerprints (in Compact Format)

**Usage**

```r
extractDrugKR(molecules, silent = TRUE)
```

**Arguments**

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

Calculate the 4860 bit fingerprint defined by Klekota and Roth.

**Value**

A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component’s name is the length of the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

`extractDrugKRComplete`
Examples

```r
calculateDrugKRComplete <- function(molecules, silent = TRUE) {
  mol = readMolFromSmi(smi, type = 'mol')
  fp = extractDrugKR(mol)
  head(fp)
}
```

extractDrugKRComplete Calculate the KR (Klekota and Roth) Molecular Fingerprints (in Complete Format)

Description

Calculate the KR (Klekota and Roth) Molecular Fingerprints (in Complete Format)

Usage

```r
extractDrugKRComplete(molecules, silent = TRUE)
```

Arguments

- **molecules**: Parsed molucule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculate the 4860 bit fingerprint defined by Klekota and Roth.

Value

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.

Author(s)

Nan Xiao &lt;http://nanx.me&gt;

See Also

- extractDrugKR

Examples

```r
calculateDrugKRComplete <- function(molecules, silent = TRUE) {
  mol = readMolFromSmi(smi, type = 'mol')
  fp = extractDrugKRComplete(mol)
  dim(fp)
}
**extractDrugLargestChain**

Descriptor that Calculates the Number of Atoms in the Largest Chain

**Description**

Descriptor that Calculates the Number of Atoms in the Largest Chain

**Usage**

```r
extractDrugLargestChain(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is `TRUE`.

**Details**

This descriptor calculates the number of atoms in the largest chain. Note that a chain exists if there are two or more atoms. Thus single atom molecules will return 0.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `nAtomLC`.

**Author(s)**

Nan Xiao <http://nanx.me>

**Examples**

```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugLargestChain(mol)
head(dat)
```

---

**extractDrugLargestPiSystem**

Descriptor that Calculates the Number of Atoms in the Largest Pi Chain

**Description**

Descriptor that Calculates the Number of Atoms in the Largest Pi Chain
extractDrugLengthOverBreadth

Usage

extractDrugLengthOverBreadth(molecules, silent = TRUE)

Arguments

molecules  Parsed molecule object.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculates the Ratio of Length to Breadth as a result it does not perform any orientation and only considers the X & Y extents for a series of rotations about the Z axis (in 10 degree increments).
**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns two columns named L0BMAX and L0BMIN:

- L0BMAX - The maximum L/B ratio;
- L0BMIN - The L/B ratio for the rotation that results in the minimum area (defined by the product of the X & Y extents for that orientation).

**Note**

The descriptor assumes that the atoms have been configured.

**Author(s)**

Nan Xiao <http://nanx.me>

**Examples**

```r
sdf = system.file('sysdata/OptAA3d.sdf', package = 'Rcpl')

mol = readMolFromSDF(sdf)

dat = extractDrugLongestAliphaticChain(mol)

head(dat)
```

---

**extractDrugLongestAliphaticChain**

*Descriptor that Calculates the Number of Atoms in the Longest Aliphatic Chain*

**Description**

Descriptor that Calculates the Number of Atoms in the Longest Aliphatic Chain

**Usage**

```r
extractDrugLongestAliphaticChain(molecules, silent = TRUE)
```

**Arguments**

- `molecules` - Parsed molecule object.
- `silent` - Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

This descriptor calculates the number of atoms in the longest aliphatic chain.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named nAtomLAC.
**extractDrugMACCS**

*Calculate the MACCS Molecular Fingerprints (in Compact Format)*

**Description**

Calculate the MACCS Molecular Fingerprints (in Compact Format)

**Usage**

```r
extractDrugMACCS(molecules, silent = TRUE)
```

**Arguments**

- `molecules` Parsed molecule object.
- `silent` Logical. Whether the calculating process should be shown or not, default is `TRUE`.

**Details**

The popular 166 bit MACCS keys described by MDL.

**Value**

A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component's name is the length of the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

- `extractDrugMACCSCOMPLETE`

**Examples**

```r
smi = system.file('vignetteData/FDAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugLongestAliphaticChain(mol)
head(dat)

fp = extractDrugMACCS(mol)
head(fp)
```
extractDrugMACCSComplete

Calculate the MACCS Molecular Fingerprints (in Complete Format)

Description

Calculate the MACCS Molecular Fingerprints (in Complete Format)

Usage

extractDrugMACCSComplete(molecules, silent = TRUE)

Arguments

molecules Parsed molecule object.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

The popular 166 bit MACCS keys described by MDL.

Value

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.

Author(s)

Nan Xiao <http://nanx.me>

See Also

extractDrugMACCS

test

Examples

smi = system.file('vignettes/Rcpi/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugMACCSComplete(mol)
dim(fp)
extractDrugMannholdLogP

Descriptor that Calculates the LogP Based on a Simple Equation Using the Number of Carbons and Hetero Atoms

Description

Descriptor that Calculates the LogP Based on a Simple Equation Using the Number of Carbons and Hetero Atoms

Usage

extractDrugMannholdLogP(molecules, silent = TRUE)

Arguments

molecules Parsed molecule object.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

This descriptor calculates the LogP based on a simple equation using the number of carbons and hetero atoms. The implemented equation was proposed in Mannhold et al.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named MLogP.

Author(s)

Nan Xiao <http://nanx.me>

References


Examples

```r
smi = system.file('vignettes/FOAMDD.smi', package = 'Rcpi')
mol = readMolFromSmiles(smi, type = 'mol')
dat = extractDrugMannholdLogP(mol)
head(dat)
```
extractDrugMDE

**Description**

Calculate Molecular Distance Edge (MDE) Descriptors for C, N and O

**Usage**

```r
extractDrugMDE(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

This descriptor calculates the 10 molecular distance edge (MDE) descriptor described in Liu, S., Cao, C., & Li, Z, and in addition it calculates variants where O and N are considered.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named `nAtomLAC`.

**Author(s)**

Nan Xiao <http://nanx.me>

**References**


**Examples**

```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')

dat = extractDrugMDE(mol)

head(dat)
```
extractDrugMomentOfInertia

Descriptor that Calculates the Principal Moments of Inertia and Ratios of the Principal Moments

Description

Descriptor that Calculates the Principal Moments of Inertia and Ratios of the Principal Moments

Usage

extractDrugMomentOfInertia(molecules, silent = TRUE)

Arguments

- molecules: Parsed molecule object.
- silent: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

A descriptor that calculates the moment of inertia and radius of gyration. Moment of inertia (MI) values characterize the mass distribution of a molecule. Related to the MI values, ratios of the MI values along the three principal axes are also well known modeling variables. This descriptor calculates the MI values along the X, Y and Z axes as well as the ratio’s X/Y, X/Z and Y/Z. Finally it also calculates the radius of gyration of the molecule.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 7 columns named MOMI.X, MOMI.Y, MOMI.Z, MOMI.XY, MOMI.XZ, MOMI.YZ, MOMI.R:

- MOMI.X - MI along X axis
- MOMI.Y - MI along Y axis
- MOMI.Z - MI along Z axis
- MOMI.XY - X/Y
- MOMI.XZ - X/Z
- MOMI.YZ - Y/Z
- MOMI.R - Radius of gyration

One important aspect of the algorithm is that if the eigenvalues of the MI tensor are below 1e-3, then the ratio’s are set to a default of 1000.

Author(s)

Nan Xiao <http://nanx.me>
**Examples**

`sdf = system.file('sysdata/OptAA3d.sdf', package = 'Rcpi')`

```r
mol = readMolFromSDF(sdf)
dat = extractDrugMomentOfInertia(mol)
head(dat)
```

---

**extractDrugOBFP2**

*Calculate the FP2 Molecular Fingerprints*

**Description**

Calculate the FP2 Molecular Fingerprints

**Usage**

`extractDrugOBFP2(molecules, type = c("smile", "sdf"))`

**Arguments**

- `molecules`: R character string object containing the molecules. See the example section for details.
- `type`: 'smile' or 'sdf'.

**Details**

Calculate the 1024 bit FP2 fingerprints provided by OpenBabel.

**Value**

A matrix. Each row represents one molecule, the columns represent the fingerprints.

**Author(s)**

Nan Xiao [http://nanx.me](http://nanx.me)

**Examples**

```r
mol1 = 'C1CCC1CC(CN(C)(C))CC(=O)CC'  # one molecule SMILE in a vector
mol2 = c('CCC', 'CCN', 'CCN(C)(C)', 'Clccccccc1cc1cccc1',
         'Clcccc1CC(CN(C)(C))CC(=O)CC')  # multiple SMILES in a vector
mol3 = readChar(system.file('compseq/DB00860.sdf', package = 'Rcpi'),
                 nchars = 1e+6)  # single molecule in a sdf file
mol4 = readChar(system.file('sysdata/OptAA3d.sdf', package = 'Rcpi'),
                 nchars = 1e+6)  # multiple molecules in a sdf file

smifp0 = extractDrugOBFP2(mol1, type = 'smile')
smifp1 = extractDrugOBFP2(mol2, type = 'smile')
sdffp0 = extractDrugOBFP2(mol3, type = 'sdf')
sdffp1 = extractDrugOBFP2(mol4, type = 'sdf')
```
**extractDrugOBFP3**  
*Calculate the FP3 Molecular Fingerprints*

**Description**

Calculate the FP3 Molecular Fingerprints

**Usage**

```R
extractDrugOBFP3(molecules, type = c("smile", "sdf"))
```

**Arguments**

- **molecules**: R character string object containing the molecules. See the example section for details.
- **type**: 'smile' or 'sdf'.

**Details**

Calculate the 64 bit FP3 fingerprints provided by OpenBabel.

**Value**

A matrix. Each row represents one molecule, the columns represent the fingerprints.

**Author(s)**

Nan Xiao &lt;http://nanx.me&gt;

**Examples**

```R
mol1 = 'C1CCC1CC(CN(C)(C))CC(=O)CC' # one molecule SMILE in a vector
mol2 = c('CCC', 'CCN', 'CCN(C)(C)', 'c1ccccc1Cc1ccccc1', 'c1ccccc1Cc1ccccc1') # multiple SMILEs in a vector
mol3 = readChar(system.file('compseq/DB00860.sdf', package = 'Rcpi'), nchars = 1e+6) # single molecule in a sdf file
mol4 = readChar(system.file('sysdata/OptAA3d.sdf', package = 'Rcpi'), nchars = 1e+6) # multiple molecules in a sdf file

smifp0 = extractDrugOBFP3(mol1, type = 'smile')
smifp1 = extractDrugOBFP3(mol2, type = 'smile')
sdffp0 = extractDrugOBFP3(mol3, type = 'sdf')
sdffp1 = extractDrugOBFP3(mol4, type = 'sdf')
```
extractDrugOBFP4

**Calculate the FP4 Molecular Fingerprints**

**Description**

Calculate the FP4 Molecular Fingerprints

**Usage**

```r
extractDrugOBFP4(molecules, type = c("smile", "sdf"))
```

**Arguments**

- `molecules` R character string object containing the molecules. See the example section for details.
- `type` 'smile' or 'sdf'.

**Details**

Calculate the 512 bit FP4 fingerprints provided by OpenBabel.

**Value**

A matrix. Each row represents one molecule, the columns represent the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**Examples**

```r
mol1 = 'C1CC\text{C}{(CN(C)(C))CC(=O)C}' # one molecule SMILE in a vector
mol2 = c('CCC', 'CCN', 'CCN(C)(C)', 'C1ccccc1Cc1ccccc1',
         'C1CC\text{C}{(CN(C)(C))CC(=O)C}') # multiple SMILEs in a vector
mol3 = readChar(system.file('compseq/DB00860.sdf', package = 'Rcpi'),
                 nchars = 1e+6) # single molecule in a sdf file
mol4 = readChar(system.file('sysdata/OptAA3d.sdf', package = 'Rcpi'),
                 nchars = 1e+6) # multiple molecules in a sdf file

smifp0 = extractDrugOBFP4(mol1, type = 'smile')
smifp1 = extractDrugOBFP4(mol2, type = 'smile')
sdffp0 = extractDrugOBFP4(mol3, type = 'sdf')
sdffp1 = extractDrugOBFP4(mol4, type = 'sdf')
```
**Description**

Calculate the MACCS Molecular Fingerprints

**Usage**

```
extractDrugOBMACCS(molecules, type = c("smile", "sdf"))
```

**Arguments**

- `molecules`: R character string object containing the molecules. See the example section for details.
- `type`: 'smile' or 'sdf'.

**Details**

Calculate the 256 bit MACCS fingerprints provided by OpenBabel.

**Value**

A matrix. Each row represents one molecule, the columns represent the fingerprints.

**Author(s)**

Nan Xiao `<http://nanx.me>`

**Examples**

```r
mol1 = 'C1CCCC1CC(CC(C)(C))CC(=O)CC'  # one molecule SMILE in a vector
mol2 = c('CCC', 'CCN', 'CCN(C)(C)', 'c1ccccc1Cc1ccccc1',
         'C1CCCC1CC(CC(C)(C))CC(=O)CC')  # multiple SMILES in a vector
mol3 = readChar(system.file('compseq/DB00080.sdf', package = 'Rcpi'),
                 nchars = 1e+6)  # single molecule in a sdf file
mol4 = readChar(system.file('sysdata/OptAA3d.sdf', package = 'Rcpi'),
                 nchars = 1e+6)  # multiple molecules in a sdf file

# MACCS may not be available in current version of ChemmineOB
smifp0 = extractDrugOBMACCS(mol1, type = 'smile')
smifp1 = extractDrugOBMACCS(mol2, type = 'smile')
sdfffp0 = extractDrugOBMACCS(mol3, type = 'sdf')
sdfffp1 = extractDrugOBMACCS(mol4, type = 'sdf')
```
**extractDrugPetitjeanNumber**

*Descriptor that Calculates the Petitjean Number of a Molecule*

**Description**

Descriptor that Calculates the Petitjean Number of a Molecule

**Usage**

```r
extractDrugPetitjeanNumber(molecules, silent = TRUE)
```

**Arguments**

- `molecules` Parsed molecule object.
- `silent` Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

This descriptor calculates the Petitjean number of a molecule. According to the Petitjean definition, the eccentricity of a vertex corresponds to the distance from that vertex to the most remote vertex in the graph.

The distance is obtained from the distance matrix as the count of edges between the two vertices. If $r(i)$ is the largest matrix entry in row $i$ of the distance matrix $D$, then the radius is defined as the smallest of the $r(i)$. The graph diameter $D$ is defined as the largest vertex eccentricity in the graph. (http://www.edusoft-lc.com/molconn/manuals/400/chaptwo.html)

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named PetitjeanNumber.

**Author(s)**

Nan Xiao <http://nanx.me>

**Examples**

```r
smi = system.file('vignettes/FDAIMDD.smi', package = 'Rcpp')

mol = readMolFromSmi(smi, type = 'mol')

dat = extractDrugPetitjeanNumber(mol)

head(dat)
```
**extractDrugPetitjeanShapeIndex**

*Descriptor that Calculates the Petitjean Shape Indices*

**Description**

Descriptor that Calculates the Petitjean Shape Indices

**Usage**

```r
extractDrugPetitjeanShapeIndex(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is `TRUE`.

**Details**

The topological and geometric shape indices described Petitjean and Bath et al. respectively. Both measure the anisotropy in a molecule.

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns two columns named `topoShape` (Topological Shape Index) and `geomShape` (Geometric Shape Index).

**Author(s)**

Nan Xiao [<http://nanx.me>]

**References**

- Petitjean, M., Applications of the radius-diameter diagram to the classification of topological and geometrical shapes of chemical compounds, Journal of Chemical Information and Computer Science, 1992, 32:331-337

**Examples**

```r
sdf = system.file('sysdata/OptAA3d.sdf', package = 'Rcpp')
mol = readMolFromSDF(sdf)
dat = extractDrugPetitjeanShapeIndex(mol)
head(dat)
```
\textit{extractDrugPubChem} \hspace{1cm} Calculate the \textit{PubChem Molecular Fingerprints (in Compact Format)}

\begin{description}
\item[Description]
Calculate the PubChem Molecular Fingerprints (in Compact Format)
\item[Usage]
\texttt{extractDrugPubChem(molecules, silent = TRUE)}
\item[Arguments]
\begin{description}
\item[molecules] Parsed molecule object.
\item[silent] Logical. Whether the calculating process should be shown or not, default is \texttt{TRUE}.
\end{description}
\item[Details]
Calculate the 881 bit fingerprints defined by PubChem.
\item[Value]
A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component’s name is the length of the fingerprints.
\item[Author(s)]
Nan Xiao \texttt{<http://nanx.me>}
\item[See Also]
\texttt{extractDrugPubChemComplete}
\item[Examples]
\texttt{smi = system.file('vignettedata/FDAMDD.smi', package = 'Rcpp')}
\texttt{mol = readMolFromSmi(smi, type = 'mol')}
\texttt{fp = extractDrugPubChem(mol)}
\texttt{head(fp)}
extractDrugPubChemComplete

Calculate the PubChem Molecular Fingerprints (in Complete Format)

Description

Calculate the PubChem Molecular Fingerprints (in Complete Format)

Usage

extractDrugPubChemComplete(molecules, silent = TRUE)

Arguments

molecules          Parsed molecule object.
silent             Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculate the 881 bit fingerprints defined by PubChem.

Value

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.

Author(s)

Nan Xiao <http://nanx.me>

See Also

extractDrugPubChem

Examples

smi = system.file('vignetteData/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugPubChemComplete(mol)
dim(fp)
**extractDrugRotatableBondsCount**

*Descriptor that Calculates the Number of Nonrotatable Bonds on A Molecule*

---

**Description**

Descriptor that Calculates the Number of Nonrotatable Bonds on A Molecule

**Usage**

```r
extractDrugRotatableBondsCount(molecules, silent = TRUE)
```

**Arguments**

- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

The number of rotatable bonds is given by the SMARTS specified by Daylight on SMARTS tutorial ([http://www.daylight.com/dayhtml_tutorials/languages/smarts/smarts_examples.html#EXMPL](http://www.daylight.com/dayhtml_tutorials/languages/smarts/smarts_examples.html#EXMPL))

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named nRotB.

**Author(s)**

Nan Xiao <http://nanx.me>

**Examples**

```r
smi = system.file('vignettesdata/FOAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugRotatableBondsCount(mol)
head(dat)
```
extractDrugRuleOfFive

Descriptor that Calculates the Number Failures of the Lipinski’s Rule Of Five

Description
Descriptor that Calculates the Number Failures of the Lipinski’s Rule Of Five

Usage
extractDrugRuleOfFive(molecules, silent = TRUE)

Arguments
- molecules: Parsed molecule object.
- silent: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details
This descriptor calculates the number failures of the Lipinski’s Rule Of Five: http://en.wikipedia.org/wiki/Lipinski%27s_Rule_of_Five.

Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named LipinskiFailures.

Author(s)
Nan Xiao <http://nanx.me>

Examples
```r
smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugRuleOfFive(mol)
head(dat)
```

extractDrugShortestPath

Calculate the Shortest Path Molecular Fingerprints (in Compact Format)

Description
Calculate the Shortest Path Molecular Fingerprints (in Compact Format)
extractDrugShortestPathComplete

Usage

extractDrugShortestPathComplete(molecules, depth = 6, size = 1024, silent = TRUE)

Arguments

molecules Parsed molecule object.
depth The search depth. Default is 6.
size The length of the fingerprint bit string. Default is 1024.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculate the fingerprint based on the shortest paths between pairs of atoms and takes into account ring systems, charges etc.

Value

A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component's name is the length of the fingerprints.

Author(s)

Nan Xiao <http://nanx.me>

See Also

extractDrugShortestPathComplete

Examples

```r
smi = system.file('vignettes/FOAMMR.smi', package = 'Rcpp')
mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugShortestPathComplete(mol)
head(fp)
```

---

extractDrugShortestPathComplete

Calculate the Shortest Path Molecular Fingerprints (in Complete Format)

---

Description

Calculate the Shortest Path Molecular Fingerprints (in Complete Format)

Usage

extractDrugShortestPathComplete(molecules, depth = 6, size = 1024, silent = TRUE)
extractDrugStandard

Arguments

molecules Parsed molecule object.
depth The search depth. Default is 6.
size The length of the fingerprint bit string. Default is 1024.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculate the fingerprint based on the shortest paths between pairs of atoms and takes into account ring systems, charges etc.

Value

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.

Author(s)

Nan Xiao <http://nanx.me>

See Also

extractDrugShortestPath

Examples

smi = system.file('vignettes/FDAMDD.smi', package = 'Rcpi')

mol = readMolFromSmi(smi, type = 'mol')
f = extractDrugShortestPathComplete(mol)
dim(f)

extractDrugStandard Calculate the Standard Molecular Fingerprints (in Compact Format)

Description

Calculate the Standard Molecular Fingerprints (in Compact Format)

Usage

extractDrugStandard(molecules, depth = 6, size = 1024, silent = TRUE)

Arguments

molecules Parsed molecule object.
depth The search depth. Default is 6.
size The length of the fingerprint bit string. Default is 1024.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.
extractDrugStandardComplete

Details

Calculate the standard molecular fingerprints. Considers paths of a given length. This is hashed fingerprints, with a default length of 1024.

Value

A list, each component represents one of the molecules, each element in the component represents the index of which element in the fingerprint is 1. Each component’s name is the length of the fingerprints.

Author(s)

Nan Xiao <http://nanx.me>

See Also

extractDrugStandardComplete

Examples

```r
smi = system.file('vignettes/RDA/SMILES.smi', package = 'Rcpi')

mol = readMolFromSmiles(smi, type = 'mol')
fp = extractDrugStandardComplete(mol)
head(fp)
```

extractDrugStandardComplete

Calculate the Standard Molecular Fingerprints (in Complete Format)

Description

Calculate the Standard Molecular Fingerprints (in Complete Format)

Usage

```r
extractDrugStandardComplete(molecules, depth = 6, size = 1024,
silent = TRUE)
```

Arguments

- **molecules**: Parsed molecule object.
- **depth**: The search depth. Default is 6.
- **size**: The length of the fingerprint bit string. Default is 1024.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Calculate the standard molecular fingerprints. Considers paths of a given length. This is hashed fingerprints, with a default length of 1024.
**extractDrugTPSA**

**Value**

An integer vector or a matrix. Each row represents one molecule, the columns represent the fingerprints.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

extractDrugStandard

**Examples**

```r
smi = system.file('vignetteData/IODAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
fp = extractDrugStandardComplete(mol)
dim(fp)
```

---

**extractDrugTPSA**  
Descriptor of Topological Polar Surface Area Based on Fragment Contributions (TPSA)

**Description**

Descriptor of Topological Polar Surface Area Based on Fragment Contributions (TPSA)

**Usage**

```r
extractDrugTPSA(molecules, silent = TRUE)
```

**Arguments**

- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

**Details**

Calculate the descriptor of topological polar surface area based on fragment contributions (TPSA).

**Value**

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named TopoPSA.

**Author(s)**

Nan Xiao <http://nanx.me>
extractDrugVABC

References


Examples

```
smi = system.file('vignetteData/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugTPSA(mol)
head(dat)
```

```
extractDrugVABC  Descriptor that Calculates the Volume of A Molecule

Description

Descriptor that Calculates the Volume of A Molecule

Usage

extractDrugVABC(molecules, silent = TRUE)

Arguments

molecules Parsed molecule object.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

This descriptor calculates the volume of a molecule.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named VABC.

Author(s)

Nan Xiao <http://nanx.me>

Examples

```
smi = system.file('vignetteData/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugVABC(mol)
head(dat)
```
**extractDrugVAdjMa**

*Descriptor that Calculates the Vertex Adjacency Information of A Molecule*

### Description
Descriptor that Calculates the Vertex Adjacency Information of A Molecule

### Usage
`extractDrugVAdjMa(molecules, silent = TRUE)`

#### Arguments
- **molecules**: Parsed molecule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.

#### Details
Vertex adjacency information (magnitude): $1 + \log_2 m$ where $m$ is the number of heavy-heavy bonds. If $m$ is zero, then 0 is returned.

#### Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named VAdjMat.

#### Author(s)
Nan Xiao [http://nanx.me](http://nanx.me)

#### Examples
```r
smi = system.file('vignette_dir/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugVAdjMa(mol)
head(dat)
```

---

**extractDrugWeight**

*Descriptor that Calculates the Total Weight of Atoms*

### Description
Descriptor that Calculates the Total Weight of Atoms

### Usage
`extractDrugWeight(molecules, silent = TRUE)`

#### Examples
```r
smi = system.file('vignette_dir/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugWeight(mol)
head(dat)
```
extractDrugWeightedPath

Arguments

- molecules: Parsed molecule object.
- silent: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

This descriptor calculates the molecular weight.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named MW.

Author(s)

Nan Xiao <http://nanx.me>

Examples

```r
smi = system.file('vignettes/data/FDA MolD2.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugWeight(mol)
head(dat)
```

```
extractDrugWeightedPath

Descriptor that Calculates the Weighted Path (Molecular ID)

Description

Descriptor that Calculates the Weighted Path (Molecular ID)

Usage

extractDrugWeightedPath(molecules, silent = TRUE)

Arguments

- molecules: Parsed molecule object.
- silent: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

This descriptor calculates the weighted path (molecular ID) described by Randic, characterizing molecular branching. Five descriptors are calculated, based on the implementation in the ADAPT software package. Note that the descriptor is based on identifying all paths between pairs of atoms and so is NP-hard. This means that it can take some time for large, complex molecules.
Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 5 columns named WTPT.1, WTPT.2, WTPT.3, WTPT.4, WTPT.5:

• WTPT.1 - molecular ID
• WTPT.2 - molecular ID / number of atoms
• WTPT.3 - sum of path lengths starting from heteroatoms
• WTPT.4 - sum of path lengths starting from oxygens
• WTPT.5 - sum of path lengths starting from nitrogens

Author(s)

Nan Xiao <http://nanx.me>

References


Examples

```r
smi = system.file('vignette/data/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugWeightedPath(mol)
head(dat)
```

extractDrugWHIM

**Calculate Holistic Descriptors Described by Todeschini et al.**

Description

Calculate Holistic Descriptors Described by Todeschini et al.

Usage

```r
extractDrugWHIM(molecules, silent = TRUE)
```

Arguments

- **molecules**: Parsed molucule object.
- **silent**: Logical. Whether the calculating process should be shown or not, default is TRUE.
Details

Holistic descriptors described by Todeschini et al, the descriptors are based on a number of atom weightings. There are six different possible weightings:

- unit weights
- atomic masses
- van der Waals volumes
- Mulliken atomic electronegativities
- atomic polarizabilities
- E-state values described by Kier and Hall

Currently weighting schemes 1, 2, 3, 4 and 5 are implemented. The weight values are taken from Todeschini et al. and as a result 19 elements are considered. For each weighting scheme we can obtain

- 11 directional WHIM descriptors (\(\lambda_1\) .. 3, \(\nu_1\) .. 2, \(\gamma_1\) .. 3, \(\eta_1\) .. 3)
- 6 non-directional WHIM descriptors (\(T\), \(A\), \(V\), \(K\), \(G\), \(D\))

Though Todeschini et al. mentions that for planar molecules only 8 directional WHIM descriptors are required the current code will return all 11.

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns 17 columns:

- \(W_{\lambda_1}\)
- \(W_{\lambda_2}\)
- \(w_{\lambda_3}\)
- \(W_{\nu_1}\)
- \(W_{\nu_2}\)
- \(W_{\gamma_1}\)
- \(W_{\gamma_2}\)
- \(W_{\gamma_3}\)
- \(W_{\eta_1}\)
- \(W_{\eta_2}\)
- \(W_{\eta_3}\)
- \(W_T\)
- \(W_A\)
- \(W_V\)
- \(W_K\)
- \(W_G\)
- \(W_D\)

Each name will have a suffix of the form \(X\) where \(X\) indicates the weighting scheme used. Possible values of \(X\) are

- unity
• mass
• volume
• eneg
• polar

Author(s)
Nan Xiao <http://nanx.me>

References

Examples
sdf = system.file('sysdata/OptAA3d.sdf', package = 'Rcpp')
mol = readMolFromSDF(sdf)
dat = extractDrugWHIM(mol)
head(dat)

extractDrugWienerNumbers

Descriptor that Calculates Wiener Path Number and Wiener Polarity Number

Description
Descriptor that Calculates Wiener Path Number and Wiener Polarity Number

Usage
extractDrugWienerNumbers(molecules, silent = TRUE)

Arguments
molecules Parsed molecule object.
silent Logical. Whether the calculating process should be shown or not, default is TRUE.

Details
This descriptor calculates the Wiener numbers, including the Wiener Path number and the Wiener Polarity Number. Wiener path number: half the sum of all the distance matrix entries; Wiener polarity number: half the sum of all the distance matrix entries with a value of 3.

Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns two columns named WPATH (weiner path number) and WPOL (weiner polarity number).
extractDrugXLogP

Author(s)
Nan Xiao <http://nanx.me>

References

Examples
```r
smi = system.file('vignettes/VarVignettedata/FDAMDD.smi', package = 'Rcpi')
mol = readMolFromSmi(smi, type = 'mol')
dat = extractDrugWienerNumbers(mol)
head(dat)
```

```
extractDrugXLogP  Descriptor that Calculates the Prediction of logP Based on the Atom-Type Method Called XLogP
```

Description
Descriptor that Calculates the Prediction of logP Based on the Atom-Type Method Called XLogP

Usage
```r
extractDrugXLogP(molecules, silent = TRUE)
```

Arguments
- `molecules`: Parsed molecule object.
- `silent`: Logical. Whether the calculating process should be shown or not, default is TRUE.

Details
Prediction of logP based on the atom-type method called XLogP.

Value
A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named XLogP.

Author(s)
Nan Xiao <http://nanx.me>

References
Examples

```r
tax <- system.file('vignette/FOAMDD.smi', package = 'Rcpp')
mol <- readMolFromSmile(smi, type = 'mol')
dat <- extractDrugXLogP(mol)
head(dat)
```

descr = extractDrugZagrebIndex

*Descriptor that Calculates the Sum of the Squared Atom Degrees of All Heavy Atoms*

Description

Descriptor that Calculates the Sum of the Squared Atom Degrees of All Heavy Atoms

Usage

```r
extractDrugZagrebIndex(molecules, silent = TRUE)
```

Arguments

- `molecules` Parsed molecule object.
- `silent` Logical. Whether the calculating process should be shown or not, default is TRUE.

Details

Zagreb index: the sum of the squares of atom degree over all heavy atoms \( i \).

Value

A data frame, each row represents one of the molecules, each column represents one feature. This function returns one column named Zagreb.

Author(s)

Nan Xiao <http://nanx.me>

Examples

```r
tax <- system.file('vignette/FOAMDD.smi', package = 'Rcpp')
mol <- readMolFromSmile(smi, type = 'mol')
dat <- extractDrugZagrebIndex(mol)
head(dat)
```
extractPCMBLOSUM

**Generalized BLOSUM and PAM Matrix-Derived Descriptors**

**Description**

Generalized BLOSUM and PAM Matrix-Derived Descriptors

**Usage**

```r
elementPCMBLOSUM(x, submat = "AABLOSUM62", k, lag, scale = TRUE, silent = TRUE)
```

**Arguments**

- `x` A character vector, as the input protein sequence.
- `submat` Substitution matrix for the 20 amino acids. Should be one of AABLOSUM45, AABLOSUM50, AABLOSUM62, AABLOSUM80, AABLOSUM100, AAPAM30, AAPAM40, AAPAM70, AAPAM120, AAPAM250. Default is 'AABLOSUM62'.
- `k` Integer. The number of selected scales (i.e. the first k scales) derived by the substitution matrix. This could be selected according to the printed relative importance values.
- `lag` The lag parameter. Must be less than the amino acids.
- `scale` Logical. Should we auto-scale the substitution matrix (submat) before doing eigen decomposition? Default is TRUE.
- `silent` Logical. Whether we print the relative importance of each scales (diagonal value of the eigen decomposition result matrix B) or not. Default is TRUE.

**Details**

This function calculates the generalized BLOSUM matrix-derived descriptors. For users’ convenience, Rcpi provides the BLOSUM45, BLOSUM50, BLOSUM62, BLOSUM80, BLOSUM100, PAM30, PAM40, PAM70, PAM120, and PAM250 matrices for the 20 amino acids to select.

**Value**

A length lag * p^2 named vector, p is the number of scales selected.

**Author(s)**

Nan Xiao <http://nanx.me>

**References**


**Examples**

```r
x = readFASTA(system.file("protseq/P00750.fasta", package = "Rcpi"))[1]
blosum = extractPCMBLOSUM(x, submat = "AABLOSUM62", k = 5, lag = 7, scale = TRUE, silent = FALSE)
```
extractPCMDescScales  Scales-Based Descriptors with 20+ classes of Molecular Descriptors

Description
Scales-Based Descriptors with 20+ classes of Molecular Descriptors

Usage
extractPCMDescScales(x, propmat, index = NULL, pc, lag, scale = TRUE, silent = TRUE)

Arguments

x A character vector, as the input protein sequence.
propmat The matrix containing the descriptor set for the amino acids, which could be chosen from AAMOE2D, AAMOE3D, AACPSA, AADescAll, AA2DACOR, AA3DMoRSE, AAACF, ABurden, AACN, AConst, ADEedgeAdj, AEigIdx, AFGC, AGeom, AGETAWAY, AInfo, AMolProp, ARandic, ARDF, ATopo, ATopoChg, AWalk, AWIM.
index Integer vector or character vector. Specify which molecular descriptors to select from one of these descriptor sets by specify the numerical or character index of the molecular descriptors in the descriptor set. Default is NULL, means selecting all the molecular descriptors in this descriptor set.
pc Integer. The maximum dimension of the space which the data are to be represented in. Must be no greater than the number of AA properties provided.
lag The lag parameter. Must be less than the amino acids.
scale Logical. Should we auto-scale the property matrix (propmat) before doing MDS? Default is TRUE.
silent Logical. Whether we print the standard deviation, proportion of variance and the cumulative proportion of the selected principal components or not. Default is TRUE.

Details
This function calculates the scales-based descriptors with molecular descriptors sets calculated by Dragon, Discovery Studio and MOE. Users could specify which molecular descriptors to select from one of these descriptor sets by specify the numerical or character index of the molecular descriptors in the descriptor set.

Value
A length lag * p^2 named vector, p is the number of scales selected.

Author(s)
Nan Xiao <http://nanx.me>

See Also
See extractPCMScales for generalized AA-descriptor based scales descriptors.
Examples

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
descscales = extractPCMDescScales(x, propmat = 'AATopo', index = c(37:41, 43:47),
                                  pc = 5, lag = 7, silent = FALSE)
```

Description

Generalized Scales-Based Descriptors derived by Factor Analysis

Usage

`extractPCMFAScales(x, propmat, factors, scores = "regression", lag,`
```
scale = TRUE, silent = TRUE)```

Arguments

- `x`: A character vector, as the input protein sequence.
- `propmat`: A matrix containing the properties for the amino acids. Each row represent one amino acid type, each column represents one property. Note that the one-letter row names must be provided for we need them to seek the properties for each AA type.
- `factors`: Integer. The number of factors to be fitted. Must be no greater than the number of AA properties provided.
- `scores`: Type of scores to produce. The default is "regression", which gives Thompson’s scores, "Bartlett" given Bartlett’s weighted least-squares scores.
- `lag`: The lag parameter. Must be less than the amino acids number in the protein sequence.
- `scale`: Logical. Should we auto-scale the property matrix (propmat) before doing Factor Analysis? Default is TRUE.
- `silent`: Logical. Whether we print the SS loadings, proportion of variance and the cumulative proportion of the selected factors or not. Default is TRUE.

Details

This function calculates the generalized scales-based descriptors derived by Factor Analysis (FA).
Users could provide customized amino acid property matrices.

Value

A length `lag * p^2` named vector, `p` is the number of scales (factors) selected.

Author(s)

Nan Xiao <http://nanx.me>
extractPCMMDSScales

References

Examples
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
data(AATopo)
tprops = AATopo[, c(37:41, 43:47)] # select a set of topological descriptors
fa = extractPCMFAScales(x, propmat = tprops, factors = 5, lag = 7, silent = FALSE)

extractPCMMDSScales Generalized Scales-Based Descriptors derived by Multidimensional Scaling

Description
Generalized Scales-Based Descriptors derived by Multidimensional Scaling

Usage
extractPCMMDSScales(x, propmat, k, lag, scale = TRUE, silent = TRUE)

Arguments
x A character vector, as the input protein sequence.
propmat A matrix containing the properties for the amino acids. Each row represents one amino acid type, each column represents one property. Note that the one-letter row names must be provided for we need them to seek the properties for each AA type.
k Integer. The maximum dimension of the space which the data are to be represented in. Must be no greater than the number of AA properties provided.
lag The lag parameter. Must be less than the amino acids.
scale Logical. Should we auto-scale the property matrix (propmat) before doing MDS? Default is TRUE.
silent Logical. Whether we print the k eigenvalues computed during the scaling process or not. Default is TRUE.

Details
This function calculates the generalized scales-based descriptors derived by Multidimensional Scaling (MDS). Users could provide customized amino acid property matrices.

Value
A length lag * p^2 named vector, p is the number of scales (dimensionality) selected.
extractPCMPropScales

Author(s)
Nan Xiao <http://nanx.me>

References

See Also
See extractPCMScales for generalized scales-based descriptors derived by Principal Components Analysis.

Examples
x = readFASTA(system.file("/quotesingle.Varprotseq/P00750.fasta", package = "Rcpi"))[1]
data(AATopo)
tprops = AATopo[, c(37:41, 43:47)] # select a set of topological descriptors
mds = extractPCMMDSscales(x, propmat = tprops, k = 5, lag = 7, silent = FALSE)

extractPCMPropScales

Description
Generalized AA-Properties Based Scales Descriptors

Usage
extractPCMPropScales(x, index = NULL, pc, lag, scale = TRUE, silent = TRUE)

Arguments
x A character vector, as the input protein sequence.
index Integer vector or character vector. Specify which AAindex properties to select from the AAindex database by specify the numerical or character index of the properties in the AAindex database. Default is NULL, means selecting all the AA properties in the AAindex database.
pc Integer. Use the first pc principal components as the scales. Must be no greater than the number of AA properties provided.
lag The lag parameter. Must be less than the amino acids.
scale Logical. Should we auto-scale the property matrix before PCA? Default is TRUE.
silent Logical. Whether we print the standard deviation, proportion of variance and the cumulative proportion of the selected principal components or not. Default is TRUE.
**Details**

This function calculates the generalized amino acid properties based scales descriptors. Users could specify which AAindex properties to select from the AAindex database by specify the numerical or character index of the properties in the AAindex database.

**Value**

A length $\text{lag} \times p^2$ named vector, $p$ is the number of scales (principal components) selected.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

See `extractPCMScales` for generalized scales-based descriptors.

**Examples**

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
propscales = extractPCMPropScales(x, index = c(160:165, 258:296), pc = 5, lag = 7, silent = FALSE)
```

---

**extractPCMScales**

*Generalized Scales-Based Descriptors derived by Principal Components Analysis*

**Usage**

```r
extractPCMScales(x, propmat, pc, lag, scale = TRUE, silent = TRUE)
```

**Arguments**

- `x`: A character vector, as the input protein sequence.
- `propmat`: A matrix containing the properties for the amino acids. Each row represent one amino acid type, each column represents one property. Note that the one-letter row names must be provided for we need them to seek the properties for each AA type.
- `pc`: Integer. Use the first `pc` principal components as the scales. Must be no greater than the number of AA properties provided.
- `lag`: The lag parameter. Must be less than the amino acids.
- `scale`: Logical. Should we auto-scale the property matrix (`propmat`) before PCA? Default is TRUE.
- `silent`: Logical. Whether we print the standard deviation, proportion of variance and the cumulative proportion of the selected principal components or not. Default is TRUE.
Details

This function calculates the generalized scales-based descriptors derived by Principal Components Analysis (PCA). Users could provide customized amino acid property matrices. This function implements the core computation procedure needed for the generalized scales-based descriptors derived by AA-Properties (AAindex) and generalized scales-based descriptors derived by 20+ classes of 2D and 3D molecular descriptors (Topological, WHIM, VHSE, etc.).

Value

A length \( l \cdot p^2 \) named vector, \( p \) is the number of scales (principal components) selected.

Author(s)

Nan Xiao <http://nanx.me>

See Also

See `extractPCMDescScales` for generalized AA property-based scales descriptors, and `extractPCMPropScales` for (19 classes) AA descriptor-based scales descriptors.

Examples

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
data(AAindex)
AAidxmat = t(na.omit(as.matrix(AAindex[, 7:26])))
scales = extractPCMScales(x, propmat = AAidxmat, pc = 5, lag = 7, silent = FALSE)
```

---

**extractProtAAC**

*Amino Acid Composition Descriptor*

**Description**

Amino Acid Composition Descriptor

**Usage**

`extractProtAAC(x)`

**Arguments**

- `x` A character vector, as the input protein sequence.

**Details**

This function calculates the Amino Acid Composition descriptor (Dim: 20).

**Value**

A length 20 named vector
Amphiphilic Pseudo Amino Acid Composition Descriptor

Amphiphilic Pseudo Amino Acid Composition Descriptor

Usage

```
extractProtAPAAC(x, props = c("Hydrophobicity", "Hydrophilicity"),
  lambda = 30, w = 0.05, customprops = NULL)
```

Arguments

- **x**: A character vector, as the input protein sequence.
- **props**: A character vector, specifying the properties used. 2 properties are used by default, as listed below:
  - 'Hydrophobicity' Hydrophobicity value of the 20 amino acids
  - 'Hydrophilicity' Hydrophilicity value of the 20 amino acids
- **lambda**: The lambda parameter for the APAAC descriptors, default is 30.
- **w**: The weighting factor, default is 0.05.
- **customprops**: A n x 21 named data frame contains n customize property. Each row contains one property. The column order for different amino acid types is 'AccNo', 'A', 'R', 'N', 'D', 'C', 'E', 'Q', 'G', 'H', 'I', 'L', 'K', 'M', 'F', 'P', 'S', 'T', 'W', 'Y', 'V', and the columns should also be exactly named like this. The AccNo column contains the properties' names. Then users should explicitly specify these properties with these names in the argument props. See the examples below for a demonstration. The default value for customprops is NULL.
Details
This function calculates the Amphiphilic Pseudo Amino Acid Composition (APAAC) descriptor (Dim: \(20 + (n \times \lambda)\), \(n\) is the number of properties selected, default is 80).

Value
A length \(20 + n \times \lambda\) named vector, \(n\) is the number of properties selected.

Note
Note the default \(20 \times 2\) prop values have been already independently given in the function. Users could also specify other (up to 544) properties with the Accession Number in the AAindex data, with or without the default three properties, which means users should explicitly specify the properties to use.

Author(s)
Nan Xiao <http://nanx.me>

References
Type 2 pseudo amino acid composition. http://www.csbio.sjtu.edu.cn/bioinf/PseAAC/type2.htm
JACS, 1962, 84: 4240-4246. (C. Tanford). (The hydrophobicity data)

See Also
See extractProtPAAC for pseudo amino acid composition descriptor.

Examples
x = readFASTA(system.file("/quotesingle.Varprotseq/P00750.fasta", package = "Rcpp"))[1]
extractProtAPAAC(x)

myprops = data.frame(AccNo = c("MyProp1", "MyProp2", "MyProp3"),
A = c(0.62, -0.5, 15), R = c(-2.53, 3, 101),
N = c(-0.78, 0.2, 58), D = c(-0.9, 3, 59),
C = c(0.29, -1, 47), E = c(-0.74, 3, 73),
Q = c(-0.85, 0.2, 72), G = c(0.48, 0, 1),
H = c(-0.4, -0.5, 82), I = c(1.38, -1.8, 57),
L = c(1.06, -1.8, 57), K = c(-1.5, 3, 73),
M = c(0.64, -1.3, 75), F = c(1.19, -2.5, 91),
P = c(0.12, 0, 42), S = c(-0.18, 0.3, 31),
T = c(-0.05, -0.4, 45), W = c(0.81, -3.4, 130),
Y = c(0.26, -2.3, 107), V = c(1.08, -1.5, 43))

# Use 2 default properties, 4 properties in the AAindex database,
# and 3 customized properties
extractProtCTDC(x, customprops = myprops,
props = c('Hydropobicity', 'Hydropophilicity',
       'CIDH920105', 'BHAR880101',
       'CHAM820101', 'CHAM820102',
       'MyProp1', 'MyProp2', 'MyProp3'))

extractProtCTDC  CTD Descriptors - Composition

Description
CTD Descriptors - Composition

Usage
extractProtCTDC(x)

Arguments
x  A character vector, as the input protein sequence.

Details
This function calculates the Composition descriptor of the CTD descriptors (Dim: 21).

Value
A length 21 named vector

Author(s)
Nan Xiao <http://nanx.me>

References
Inna Dubchak, Ilya Muchink, Stephen R. Holbrook and Sung-Hou Kim. Prediction of protein fold-
ing class using global description of amino acid sequence. Proceedings of the National Academy of
Sciences. USA, 1995, 92, 8700-8704.

Inna Dubchak, Ilya Muchink, Christopher Mayor, Igor Dralyuk and Sung-Hou Kim. Recognition
of a Protein Fold in the Context of the SCOP classification. Proteins: Structure, Function and

See Also
See extractProtCTDT and extractProtCTDD for Transition and Distribution of the CTD descrip-
tors.

Examples
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extractProtCTDC(x)
**extractProtCTDD**

CTD Descriptors - Distribution

---

**Description**

CTD Descriptors - Distribution

**Usage**

extractProtCTDD(x)

**Arguments**

x  
A character vector, as the input protein sequence.

**Details**

This function calculates the Distribution descriptor of the CTD descriptors (Dim: 105).

**Value**

A length 105 named vector

**Author(s)**

Nan Xiao <http://nanx.me>

**References**


**See Also**

See `extractProtCTDC` and `extractProtCTDT` for Composition and Transition of the CTD descriptors.

**Examples**

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extractProtCTDD(x)
```
CTD Descriptors - Transition

Description

CTD Descriptors - Transition

Usage

extractProtCTDT(x)

Arguments

x  A character vector, as the input protein sequence.

Details

This function calculates the Transition descriptor of the CTD descriptors (Dim: 21).

Value

A length 21 named vector

Author(s)

Nan Xiao <http://nanx.me>

References


See Also

See extractProtCTDC and extractProtCTDD for Composition and Distribution of the CTD descriptors.

Examples

x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extactProtCTDT(x)
**Conjoint Triad Descriptor**

**Description**

Conjoint Triad Descriptor

**Usage**

extractProtCTriad(x)

**Arguments**

x  
A character vector, as the input protein sequence.

**Details**

This function calculates the Conjoint Triad descriptor (Dim: 343).

**Value**

A length 343 named vector

**Author(s)**

Nan Xiao <http://nanx.me>

**References**


**Examples**

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extractProtCTriad(x)
```

**Dipeptide Composition Descriptor**

**Description**

Dipeptide Composition Descriptor

**Usage**

extractProtDC(x)
Arguments

x  A character vector, as the input protein sequence.

Details

This function calculates the Dipeptide Composition descriptor (Dim: 400).

Value

A length 400 named vector

Author(s)

Nan Xiao <http://nanx.me>

References


See Also

See `extractProtAAC` and `extractProtTC` for Amino Acid Composition and Tripeptide Composition descriptors.

Examples

```r
x = readFASTA(system.file("/quotesingle.Varprotseq/P00750.fasta/quotesingle.Var", package = "Rcpi"))[1]
extractProtDC(x)
```

---

**extractProtGeary**

*Geary Autocorrelation Descriptor*

Description

Geary Autocorrelation Descriptor

Usage

```r
extractProtGeary(x, props = c("CIDH920105", "BHAR880101", "CHAM820101", "CHAM820102", "CHOC760101", "BIGC670101", "CHAM810101", "DAYM780201"),
nlag = 30L, customprops = NULL)
```
Arguments

- **x**
  A character vector, as the input protein sequence.

- **props**
  A character vector, specifying the Accession Number of the target properties. 8 properties are used by default, as listed below:
  - **AccNo. CIDH920105** Normalized average hydrophobicity scales (Cid et al., 1992)
  - **AccNo. BHAR880101** Average flexibility indices (Bhaskaran-Ponnuswamy, 1988)
  - **AccNo. CHAM820101** Polarizability parameter (Charton-Charton, 1982)
  - **AccNo. CHAM820102** Free energy of solution in water, kcal/mole (Charton-Charton, 1982)
  - **AccNo. CHOC760101** Residue accessible surface area in tripeptide (Chothia, 1976)
  - **AccNo. BIGC670101** Residue volume (Bigelow, 1967)
  - **AccNo. CHAMS810101** Steric parameter (Charton, 1981)
  - **AccNo. DAYM780201** Relative mutability (Dayhoff et al., 1978b)

- **nlag**
  Maximum value of the lag parameter. Default is 30.

- **customprops**
  A n x 21 named data frame contains n customize property. Each row contains one property. The column order for different amino acid types is 'AccNo', 'A', 'R', 'N', 'D', 'C', 'E', 'Q', 'G', 'H', 'I', 'L', 'K', 'M', 'F', 'P', 'S', 'T', 'W', 'Y', 'V', and the columns should also be exactly named like this. The AccNo column contains the properties’ names. Then users should explicitly specify these properties with these names in the argument props. See the examples below for a demonstration. The default value for customprops is NULL.

Details

This function calculates the Geary autocorrelation descriptor (Dim: length(props) * nlag).

Value

A length nlag named vector

Author(s)

Nan Xiao <http://nanx.me>

References


See Also

See `extractProtMoreauBroto` and `extractProtMoran` for Moreau-Broto autocorrelation descriptors and Moran autocorrelation descriptors.
extractProtMoran

**Examples**

```r
x = readFASTA(system.file('proteins/lenk_fasta.fasta', package = 'Rcpi'))[[1]]
extractProtGeary(x)

myprops = data.frame(AccNo = c("MyProp1", "MyProp2", "MyProp3"),
                      A = c(0.62, -0.5, 15), R = c(-2.53, 3, 101),
                      N = c(-0.78, 0.2, 58), D = c(-0.9, 3, 59),
                      C = c(0.29, -1, 47), E = c(-0.74, 3, 73),
                      Q = c(-0.85, 0.2, 72), G = c(0.48, 0, 1),
                      H = c(-0.4, -0.5, 82), I = c(1.38, -1.8, 57),
                      L = c(1.06, -1.8, 57), K = c(-1.5, 3, 73),
                      M = c(0.64, -1.3, 75), F = c(1.19, -2.5, 91),
                      P = c(0.12, 0, 42), S = c(-0.18, 0.3, 31),
                      T = c(-0.05, -0.4, 45), W = c(0.81, -3.4, 130),
                      Y = c(0.26, -2.3, 107), V = c(1.08, -1.5, 43))

# Use 4 properties in the AAindex database, and 3 customized properties
extractProtGeary(x, customprops = myprops,
                 props = c("CIDH920105", "BHAR880101",
                          "CHAM820101", "CHAM820102",
                          "CHOC760101", "BIGC670101", "CHAM810101", "DAYM780201"))
```

**Description**

Moran Autocorrelation Descriptor

**Usage**

```r
extractProtMoran(x, props = c("CIDH920105", "BHAR880101", "CHAM820101",
                          "CHAM820102", "CHOC760101", "BIGC670101", "CHAM810101", "DAYM780201"),
                 nlag = 30L, customprops = NULL)
```

**Arguments**

- **x**
  
  A character vector, as the input protein sequence.

- **props**
  
  A character vector, specifying the Accession Number of the target properties. 8 properties are used by default, as listed below:

  - **AccNo. CIDH920105** Normalized average hydrophobicity scales (Cid et al., 1992)
  - **AccNo. BHAR880101** Average flexibility indices (Bhaskaran-Ponnuswamy, 1988)
  - **AccNo. CHAM820101** Polarizability parameter (Charton-Charton, 1982)
  - **AccNo. CHAM820102** Free energy of solution in water, kcal/mole (Charton-Charton, 1982)
  - **AccNo. CHOC760101** Residue accessible surface area in tripeptide (Chothia, 1976)
  - **AccNo. BIGC670101** Residue volume (Bigelow, 1967)
  - **AccNo. CHAM810101** Steric parameter (Charton, 1981)
**extractProtMoran**

**AccNo. DAYM780201** Relative mutability (Dayhoff et al., 1978b)

<table>
<thead>
<tr>
<th>nlag</th>
<th>Maximum value of the lag parameter. Default is 30.</th>
</tr>
</thead>
</table>

**Details**

This function calculates the Moran autocorrelation descriptor (Dim: \( \text{length(props)} \times \text{nlag} \)).

**Value**

A length \( \text{nlag} \) named vector

**Author(s)**

Nan Xiao <http://nanx.me>

**References**


**See Also**

See `extractProtMoreauBroto` and `extractProtGeary` for Moreau-Broto autocorrelation descriptors and Geary autocorrelation descriptors.

**Examples**

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extractProtMoran(x)
```

```r
tx = c(0.62, -0.5, 15),  R = c(-2.53, 3, 101),
N = c(-0.78, 0.2, 58),  D = c(-0.9, 3, 59),
C = c(0.29, -1, 47),   E = c(-0.74, 3, 73),
Q = c(-0.85, 0.2, 72), G = c(0.48, 0, 1),
H = c(-0.4, -0.5, 82), I = c(1.38, -1.8, 57),
L = c(1.06, -1.8, 57), K = c(-1.5, 3, 73),
M = c(0.64, -1.3, 75), F = c(1.19, -2.5, 91),
P = c(0.12, 0, 42), S = c(-0.18, 0.3, 31),
T = c(-0.05, -0.4, 45), W = c(0.81, -3.4, 130),
```
# Use 4 properties in the AAindex database, and 3 customized properties

```r
extractProtMoran(x, customprops = myprops,
  props = c("CIDH920105", "BHAR880101",
  "CHAM820101", "CHAM820102",
  "MyProp1", "MyProp2", "MyProp3"))
```

## Description

Normalized Moreau-Broto Autocorrelation Descriptor

## Usage

```r
extractProtMoreauBroto(x, props = c("CIDH920105", "BHAR880101", "CHAM820101",
  "CHAM820102", "CHOC760101", "BIGC670101", "CHAM810101”, "DAYM780201"),
  nlag = 30L, customprops = NULL)
```

### Arguments

- **x**
  A character vector, as the input protein sequence.

- **props**
  A character vector, specifying the Accession Number of the target properties. 8 properties are used by default, as listed below:
  - **AccNo. CIDH920105** Normalized average hydrophobicity scales (Cid et al., 1992)
  - **AccNo. BHAR880101** Average flexibility indices (Bhaskaran-Ponnuswamy, 1988)
  - **AccNo. CHAM820101** Polarizability parameter (Charton-Charton, 1982)
  - **AccNo. CHAM820102** Free energy of solution in water, kcal/mole (Charton-Charton, 1982)
  - **AccNo. CHOC760101** Residue accessible surface area in tripeptide (Chothia, 1976)
  - **AccNo. BIGC670101** Residue volume (Bigelow, 1967)
  - **AccNo. CHAM810101** Steric parameter (Charton, 1981)
  - **AccNo. DAYM780201** Relative mutability (Dayhoff et al., 1978b)

- **nlag**
  Maximum value of the lag parameter. Default is 30.

- **customprops**
  A \( n \times 21 \) named data frame contains \( n \) customize property. Each row contains one property. The column order for different amino acid types is 'AccNo', 'A', 'R', 'N', 'D', 'C', 'E', 'Q', 'G', 'H', 'I', 'L', 'K', 'M', 'F', 'P', 'S', 'T', 'W', 'Y', 'V', and the columns should also be exactly named like this. The AccNo column contains the properties' names. Then users should explicitly specify these properties with these names in the argument props. See the examples below for a demonstration. The default value for customprops is NULL.

## Details

This function calculates the normalized Moreau-Broto autocorrelation descriptor (Dim: \( \text{length} (\text{props}) \times \text{nlag} \)).
Value

A length nlag named vector

Author(s)

Nan Xiao <http://nanx.me>

References


See Also

See extractProtMoran and extractProtGeary for Moran autocorrelation descriptors and Geary autocorrelation descriptors.

Examples

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extractProtMoreauBroto(x)

myprops = data.frame(AccNo = c("MyProp1", "MyProp2", "MyProp3"),
                     A = c(0.62, -0.5, 15), R = c(-2.53, 3, 101),
                     N = c(-0.78, 0.2, 58), D = c(-0.9, 3, 59),
                     C = c(0.29, -1, 47), E = c(-0.74, 3, 73),
                     Q = c(-0.85, 0.2, 72), G = c(0.48, 0, 1),
                     H = c(-0.4, -0.5, 82), I = c(1.38, -1.8, 57),
                     L = c(1.06, -1.8, 57), K = c(-1.5, 3, 73),
                     M = c(0.64, -1.3, 75), F = c(1.19, -2.5, 91),
                     P = c(0.12, 0, 42), S = c(-0.18, 0.3, 31),
                     T = c(-0.05, -0.4, 45), W = c(0.81, -3.4, 130),
                     Y = c(0.26, -2.3, 107), V = c(1.08, -1.5, 43))

# Use 4 properties in the AAindex database, and 3 customized properties
extractProtMoreauBroto(x, customprops = myprops,
                       props = c('CIDH920105', 'BHAR8880101', 'CHAM820101', 'CHAM820102',
                                 'MyProp1', 'MyProp2', 'MyProp3'))
```
extractProtPAAC

Pseudo Amino Acid Composition Descriptor

Description

Pseudo Amino Acid Composition Descriptor

Usage

extractProtPAAC(x, props = c("Hydrophobicity", "Hydrophilicity", "SideChainMass"), lambda = 30, w = 0.05, customprops = NULL)

Arguments

x A character vector, as the input protein sequence.
props A character vector, specifying the properties used. 3 properties are used by default, as listed below:
'Hydrophobicity' Hydrophobicity value of the 20 amino acids
'Hydrophilicity' Hydrophilicity value of the 20 amino acids
'SideChainMass' Side-chain mass of the 20 amino acids
lambda The lambda parameter for the PAAC descriptors, default is 30.
w The weighting factor, default is 0.05.
customprops A n x 21 named data frame contains n customize property. Each row contains one property. The column order for different amino acid types is 'AccNo', 'A', 'R', 'N', 'D', 'C', 'E', 'Q', 'G', 'H', 'I', 'L', 'K', 'M', 'F', 'P', 'S', 'T', 'W', 'Y', 'V', and the columns should also be exactly named like this. The AccNo column contains the properties' names. Then users should explicitly specify these properties with these names in the argument props. See the examples below for a demonstration. The default value for customprops is NULL.

Details

This function calculates the Pseudo Amino Acid Composition (PAAC) descriptor (Dim: 20 + lambda, default is 50).

Value

A length 20 + lambda named vector

Note

Note the default 20 * 3 prop values have been already independently given in the function. Users could also specify other (up to 544) properties with the Accession Number in the AAindex data, with or without the default three properties, which means users should explicitly specify the properties to use.

Author(s)

Nan Xiao <http://nanx.me>
extractProtPSSM

Description

Compute PSSM (Position-Specific Scoring Matrix) for given protein sequence

References


Type 1 pseudo amino acid composition. [http://www.csbio.sjtu.edu.cn/bioinf/PseAAC/type1.htm](http://www.csbio.sjtu.edu.cn/bioinf/PseAAC/type1.htm)


JACS, 1962, 84: 4240-4246. (C. Tanford). (The hydrophobicity data)


See Also

See `extractProtAPAAC` for amphiphilic pseudo amino acid composition descriptor.

Examples

```r
x = readFASTA(system.file("protseq/P00750.fasta", package = "Rcpi"))[1]
extractProtPAAC(x)

myprops = data.frame(AccNo = c("MyProp1", "MyProp2", "MyProp3"),
  A = c(0.62, -0.5, 15), R = c(-2.53, 3, 101),
  N = c(-0.78, 0.2, 58), D = c(-0.9, 3, 29),
  C = c(0.29, -1, 47), E = c(-0.74, 3, 73),
  Q = c(-0.85, 0.2, 72), G = c(0.48, 0, 1),
  H = c(-0.4, -0.5, 82), I = c(1.38, -1.8, 57),
  L = c(1.06, -1.8, 57), K = c(-1.5, 3, 73),
  M = c(0.64, -1.3, 75), F = c(1.19, -2.5, 91),
  P = c(0.12, 0, 42), S = c(-0.18, 0.3, 31),
  T = c(-0.05, -0.4, 45), W = c(0.81, -3.4, 130),
  Y = c(0.26, -2.3, 107), V = c(1.08, -1.5, 43))

# Use 3 default properties, 4 properties in the AAindex database,
# and 3 cutomized properties
extractProtPAAC(x, customprops = myprops,
  props = c("Hydrophobicity", "Hydrophilicity", "SideChainMass",
    "CIDH920105", "BHAR880101", "CHAM820101", "CHAM820102",
    "MyProp1", "MyProp2", "MyProp3"))
```
Usage

extractProtPSSM(seq, start.pos = 1L, end.pos = nchar(seq),
  psiblast.path = NULL, makeblastdb.path = NULL, database.path = NULL,
  iter = 5, silent = TRUE, evalue = 10L, word.size = NULL,
  gapopen = NULL, gapextend = NULL, matrix = "BLOSUM62",
  threshold = NULL, seg = "no", soft.masking = FALSE,
  culling.limit = NULL, best.hit.overhang = NULL,
  best.hit.score.edge = NULL, xdrop.ungap = NULL, xdrop.gap = NULL,
  xdrop.gap.final = NULL, window.size = NULL, gap.trigger = 22L,
  num.threads = 1L, pseudocount = 0L, inclusion.ethresh = 0.002)

Arguments

seq Character vector, as the input protein sequence.
start.pos Optional integer denoting the start position of the fragment window. Default is 1, i.e. the first amino acid of the given sequence.
end.pos Optional integer denoting the end position of the fragment window. Default is nchar(seq), i.e. the last amino acid of the given sequence.
psiblast.path Character string indicating the path of the psiblast program. If NCBI Blast+ was previously installed in the operation system, the path will be automatically detected.
makeblastdb.path Character string indicating the path of the makeblastdb program. If NCBI Blast+ was previously installed in the system, the path will be automatically detected.
database.path Character string indicating the path of a reference database (a FASTA file).
iter Number of iterations to perform for PSI-Blast.
silent Logical. Whether the PSI-Blast running output should be shown or not (May not work on some Windows versions and PSI-Blast versions), default is TRUE.
evalue Expectation value (E) threshold for saving hits. Default is 10.
word.size Word size for wordfinder algorithm. An integer >= 2.
gapopen Integer. Cost to open a gap.
gapextend Integer. Cost to extend a gap.
matrix Character string. The scoring matrix name (default is 'BLOSUM62').
threshold Minimum word score such that the word is added to the BLAST lookup table. A real value >= 0.
seg Character string. Filter query sequence with SEG (‘yes’, ‘window locut hicut’, or ‘no’ to disable) Default is ‘no’.
soft.masking Logical. Apply filtering locations as soft masks? Default is FALSE.
culling.limit An integer >= 0. If the query range of a hit is enveloped by that of at least this many higher-scoring hits, delete the hit. Incompatible with best.hit overhang and best_hit_score_edge.
best.hit.overhang Best Hit algorithm overhang value (A real value >= 0 and <= 0.5, recommended value: 0.1). Incompatible with culling_limit.
b est.hit.score.edge Best Hit algorithm score edge value (A real value >=0 and <= 0.5, recommended value: 0.1). Incompatible with culling_limit.
Details
This function calculates the PSSM (Position-Specific Scoring Matrix) derived by PSI-Blast for given protein sequence or peptides. For given protein sequences or peptides, PSSM represents the log-likelihood of the substitution of the 20 types of amino acids at that position in the sequence. Note that the output value is not normalized.

Value
The original PSSM, a numeric matrix which has $end\text{.}pos - start\text{.}pos + 1$ columns and 20 named rows.

Note
The function requires the makeblastdb and psiblast programs to be properly installed in the operation system or their paths provided.

The two command-line programs are included in the NCBI-BLAST+ software package. To install NCBI Blast+, just open the NCBI FTP site using web browser or FTP software: ftp://anonymous@ftp.ncbi.nlm.nih.gov:21/blast/executables/blast+/LATEST/ then download the executable version of BLAST+ according to your operation system, and compile or install the downloaded source code or executable program.

Ubuntu/Debian users can directly use the command sudo apt-get install ncbi-blast+ to install NCBI Blast+. For OS X users, download ncbi-blast- ... .dmg then install. For Windows users, download ncbi-blast- ... .exe then install.

Author(s)
Nan Xiao <http://nanx.me>

References


extractProtPSSMAcc

See Also

extractProtPSSMFeature, extractProtPSSMAcc

Examples

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]

dbpath = tempfile('tempdb', fileext = '.fasta')
invisible(file.copy(from = system.file('protseq/Plasminogen.fasta', package = 'Rcpi'), to = dbpath))
pssmmat = extractProtPSSM(seq = x, database.path = dbpath)
dim(pssmmat) # 20 x 562 (P00750: length 562, 20 Amino Acids)
```

extractProtPSSMAcc Profile-based protein representation derived by PSSM (Position-Specific Scoring Matrix) and auto cross covariance

Description

Profile-based protein representation derived by PSSM (Position-Specific Scoring Matrix) and auto cross covariance

Usage

```r
extractProtPSSMAcc(pssmmat, lag)
```

Arguments

- `pssmmat` The PSSM computed by `extractProtPSSM`.
- `lag` The lag parameter. Must be less than the number of amino acids in the sequence (i.e. the number of columns in the PSSM matrix).

Details

This function calculates the feature vector based on the PSSM by running PSI-Blast and auto cross covariance transformation.

Value

A length `lag * 20^2` named numeric vector, the element names are derived by the amino acid name abbreviation (crossed amino acid name abbreviation) and lag index.

Author(s)

Nan Xiao <http://nanx.me>

References

extractProtPSSMFeature

See Also
extractProtPSSM extractProtPSSMFeature

Examples

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]

dbpath = tempfile('tempdb', fileext = '.fasta')
invisible(file.copy(from = system.file('protseq/Plasminogen.fasta', package = 'Rcpi'), to = dbpath))

pssmmat = extractProtPSSM(seq = x, database.path = dbpath)
pssmacc = extractProtPSSMAcc(pssmmat, lag = 3)
tail(pssmacc)
```

---

extractProtPSSMFeature

Profile-based protein representation derived by PSSM (Position-Specific Scoring Matrix)

Description

Profile-based protein representation derived by PSSM (Position-Specific Scoring Matrix)

Usage

```r
extractProtPSSMFeature(pssmmat)
```

Arguments

- `pssmmat` The PSSM computed by `extractProtPSSM`.

Details

This function calculates the profile-based protein representation derived by PSSM. The feature vector is based on the PSSM computed by `extractProtPSSM`. For a given sequence, the PSSM feature represents the log-likelihood of the substitution of the 20 types of amino acids at that position in the sequence. Each PSSM feature value in the vector represents the degree of conservation of a given amino acid type. The value is normalized to interval (0, 1) by the transformation $1/(1+e^{-x})$.

Value

A numeric vector which has $20 \times N$ named elements, where $N$ is the size of the window (number of rows of the PSSM).

Author(s)

Nan Xiao <http://nanx.me>

References


See Also

extractProtPSSM extractProtPSSMAcc

Examples

x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]

dbpath = tempfile(fileext = '.fasta')
invisible(file.copy(from = system.file('protseq/Plasminogen.fasta', package = 'Rcpi'), to = dbpath))
pssmmat = extractProtPSSM(seq = x, database.path = dbpath)
pssmfeature = extractProtPSSMFeature(pssmmat)
head(pssmfeature)

extractProtQSO

Quasi-Sequence-Order (QSO) Descriptor

Description
Quasi-Sequence-Order (QSO) Descriptor

Usage

extractProtQSO(x, nlag = 30, w = 0.1)

Arguments

x A character vector, as the input protein sequence.
nlag The maximum lag, default is 30.
w The weighting factor, default is 0.1.

Details
This function calculates the Quasi-Sequence-Order (QSO) descriptor (Dim: 2θ + 2θ + (2 * nlag),
default is 100).

Value
A length 2θ + 2θ + (2 * nlag) named vector

Author(s)
Nan Xiao <http://nanx.me>

References
Kuo-Chen Chou. Prediction of Protein Subcellar Locations by Incorporating Quasi-Sequence-
Kuo-Chen Chou and Yu-Dong Cai. Prediction of Protein Sucellular Locations by GO-FunD-PseAA
Gisbert Schneider and Paul Wrede. The Rational Design of Amino Acid Sequences by Artifical
Neural Networks and Simulated Molecular Evolution: Do Novo Design of an Idealized Leader
See Also

See `extractProtSOCN` for sequence-order-coupling numbers.

Examples

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extractProtQSO(x)
```

---

### Description

Sequence-Order-Coupling Numbers

### Usage

```r
extractProtSOCN(x, nlag = 30)
```

### Arguments

- **x**: A character vector, as the input protein sequence.
- **nlag**: The maximum lag. Default is 30.

### Details

This function calculates the Sequence-Order-Coupling Numbers (Dim: nlag * 2, default is 60).

### Value

A length nlag * 2 named vector

### Author(s)

Nan Xiao <http://nanx.me>

### References


### See Also

See `extractProtQSO` for quasi-sequence-order descriptors.
**ExtractProtTC**

**Examples**

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extractProtSOCN(x)
```

---

**ExtractProtTC**  
**Tripeptide Composition Descriptor**

**Description**

Tripeptide Composition Descriptor

**Usage**

```r
extractProtTC(x)
```

**Arguments**

- `x` A character vector, as the input protein sequence.

**Details**

This function calculates the Tripeptide Composition descriptor (Dim: 8000).

**Value**

A length 8000 named vector

**Author(s)**

Nan Xiao <http://nanx.me>

**References**


**See Also**

See `extractProtAAC` and `extractProtDC` for Amino Acid Composition and Dipeptide Composition descriptors.

**Examples**

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
extractProtTC(x)
```
Generating Compound-Protein Interaction Descriptors

Usage

getCPI(drugmat, protmat, type = c("combine", "tensorprod"))

Arguments

drugmat  The compound descriptor matrix.
protmat  The protein descriptor matrix.
type     The interaction type, one or two of "combine" and "tensorprod".

Details

This function calculates the compound-protein interaction descriptors by three types of interaction:

- combine - combine the two descriptor matrix, result has \((p1 + p2)\) columns
- tensorprod - calculate column-by-column (pseudo)-tensor product type interactions, result has \((p1 \times p2)\) columns

Value

A matrix containing the compound-protein interaction descriptors

Author(s)

Nan Xiao <http://nanx.me>

See Also

See getPPI for generating protein-protein interaction descriptors.

Examples

```r
x = matrix(1:10, ncol = 2)
y = matrix(1:15, ncol = 3)
getCPI(x, y, 'combine')
getCPI(x, y, 'tensorprod')
getCPI(x, y, type = c('combine', 'tensorprod'))
getCPI(x, y, type = c('tensorprod', 'combine'))
```
getDrug

Retrieve Drug Molecules in MOL and SMILES Format from Databases

Description

Retrieve Drug Molecules in MOL and SMILES Format from Databases

Usage

getDrug(id, from = c("pubchem", "chembl", "cas", "kegg", "drugbank"),
        type = c("mol", "smile"), parallel = 5)

Arguments

id A character vector, as the drug ID(s).
from The database, one of 'pubchem', 'chembl', 'cas', 'kegg', 'drugbank'.
type The returned molecule format, mol or smile.
parallel An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details

This function retrieves drug molecules in MOL and SMILES format from five databases.

Value

A length of id character vector, each element containing the corresponding drug molecule.

Author(s)

Nan Xiao <http://nanx.me>

See Also

See getProt for retrieving protein sequences from three databases.

Examples

id = c("DB00859", "DB00860")
getDrug(id, "drugbank", "smile")
getFASTAFromKEGG

Retrieve Protein Sequence in FASTA Format from the KEGG Database

**Description**

Retrieve Protein Sequence in FASTA Format from the KEGG Database

**Usage**

```r
getFASTAFromKEGG(id, parallel = 5)
```

**Arguments**

- `id` A character vector, as the protein ID.
- `parallel` An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

**Details**

This function retrieves protein sequences in FASTA format from the KEGG database.

**Value**

A list, each component contains one of the protein sequences in FASTA format.

**Author(s)**

Nan Xiao [http://nanx.me](http://nanx.me)

**See Also**

See `getSeqFromKEGG` for retrieving protein represented by amino acid sequence from the KEGG database. See `readFASTA` for reading FASTA format files.

**Examples**

```r
id = c('hsa:10161', 'hsa:10162')
getFASTAFromKEGG(id)
```
getFASTAFromUniProt

Retrieve Protein Sequence in FASTA Format from the UniProt Database

Description

Retrieve Protein Sequence in FASTA Format from the UniProt Database

Usage

getFASTAFromUniProt(id, parallel = 5)

Arguments

- **id**: A character vector, as the protein ID.
- **parallel**: An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details

This function retrieves protein sequences in FASTA format from the UniProt database.

Value

A list, each component contains one of the protein sequences in FASTA format.

Author(s)

Nan Xiao <http://nanx.me>

References


See Also

See `getSeqFromUniProt` for retrieving protein represented by amino acid sequence from the UniProt database. See `readFASTA` for reading FASTA format files.

Examples

```r
id = c("P00750", "P00751", "P00752")
getFASTAFromUniProt(id)
```
**getMolFromCAS**  
*Retrieve Drug Molecules in InChI Format from the CAS Database*

**Description**

Retrieve Drug Molecules in InChI Format from the CAS Database

**Usage**

```r
getMolFromCAS(id, parallel = 5)
```

**Arguments**

- `id`: A character vector, as the CAS drug ID.
- `parallel`: An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

**Details**

This function retrieves drug molecules in InChI format from the CAS database. CAS database only provides InChI data, so here we return the molecule in InChI format, users could convert them to SMILES format using Open Babel (http://openbabel.org/) or other third-party tools.

**Value**

A length of `id` character vector, each element containing the corresponding drug molecule.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

See `getDrug` for retrieving drug molecules in MOL and SMILES Format from other databases.

**Examples**

```r
id = '52-67-5'  # Penicillamine
getMolFromCAS(id)
```
getMolFromChEMBL

Retrieve Drug Molecules in MOL Format from the ChEMBL Database

Description

Retrieve Drug Molecules in MOL Format from the ChEMBL Database

Usage

getMolFromChEMBL(id, parallel = 5)

Arguments

id A character vector, as the ChEMBL drug ID.
parallel An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details

This function retrieves drug molecules in MOL format from the ChEMBL database.

Value

A length of id character vector, each element containing the corresponding drug molecule.

Author(s)

Nan Xiao <http://nanx.me>

See Also

See getSmifFromChEMBL for retrieving drug molecules in SMILES format from the ChEMBL database.

Examples

id = 'CHEMBL1430'  # Penicillamine
getMolFromChEMBL(id)
getMolFromDrugBank

Retrieve Drug Molecules in MOL Format from the DrugBank Database

Description

Retrieve Drug Molecules in MOL Format from the DrugBank Database

Usage

getMolFromDrugBank(id, parallel = 5)

Arguments

- **id**: A character vector, as the DrugBank drug ID.
- **parallel**: An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details

This function retrieves drug molecules in MOL format from the DrugBank database.

Value

A length of `id` character vector, each element containing the corresponding drug molecule.

Author(s)

Nan Xiao <http://nanx.me>

See Also

See `getSmiFromDrugBank` for retrieving drug molecules in SMILES format from the DrugBank database.

Examples

```r
id = 'DB00859' # Penicillamine
getMolFromDrugBank(id)
```
getMolFromKEGG

Retrieve Drug Molecules in MOL Format from the KEGG Database

Description
Retrieve Drug Molecules in MOL Format from the KEGG Database

Usage
getMolFromKEGG(id, parallel = 5)

Arguments
id
A character vector, as the KEGG drug ID.
parallel
An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details
This function retrieves drug molecules in MOL format from the KEGG database.

Value
A length of id character vector, each element containing the corresponding drug molecule.

Author(s)
Nan Xiao <http://nanx.me>

See Also
See getSmiFromKEGG for retrieving drug molecules in SMILES format from the KEGG database.

Examples
id = 'D00496'  # Penicillamine
getMolFromKEGG(id)
getMolFromPubChem

Retrieve Drug Molecules in MOL Format from the PubChem Database

Description
Retrieve Drug Molecules in MOL Format from the PubChem Database

Usage
getMolFromPubChem(id, parallel = 5)

Arguments
id
A character vector, as the PubChem drug ID.

parallel
An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details
This function retrieves drug molecules in MOL format from the PubChem database.

Value
A length of id character vector, each element containing the corresponding drug molecule.

Author(s)
Nan Xiao <http://nanx.me>

See Also
See getSmiFromPubChem for retrieving drug molecules in SMILES format from the PubChem database.

Examples
id = c("7847562", "7847563")  # Penicillamine
getMolFromPubChem(id)
getPDBFromRCSBPDB

Retrieve Protein Sequence in PDB Format from RCSB PDB

**Description**

Retrieve Protein Sequence in PDB Format from RCSB PDB

**Usage**

getPDBFromRCSBPDB(id, parallel = 5)

**Arguments**

- **id**: A character vector, as the protein ID.
- **parallel**: An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

**Details**

This function retrieves protein sequences in PDB format from RCSB PDB.

**Value**

A list, each component contains one of the protein sequences in PDB format.

**Author(s)**

Nan Xiao <http://nanx.me>

**See Also**

See `getSeqFromRCSBPDB` for retrieving protein represented by amino acid sequence from the RCSB PDB database.

**Examples**

```r
id = c('4HBB', '4FF9')
getPDBFromRCSBPDB(id)
```
getPPI

Generating Protein-Protein Interaction Descriptors

Description
Generating Protein-Protein Interaction Descriptors

Usage
getPPI(protmat1, protmat2, type = c("combine", "tensorprod", "entrywise"))

Arguments
protmat1 The first protein descriptor matrix, must have the same ncol with protmat2.
protmat2 The second protein descriptor matrix, must have the same ncol with protmat1.
type The interaction type, one or more of "combine", "tensorprod", and "entrywise".

Details
This function calculates the protein-protein interaction descriptors by three types of interaction:

• combine - combine the two descriptor matrix, result has (p + p) columns
• tensorprod - calculate column-by-column (pseudo)-tensor product type interactions, result has (p * p) columns
• entrywise - calculate entrywise product and entrywise sum of the two matrices, then combine them, result has (p + p) columns

Value
A matrix containing the protein-protein interaction descriptors

Author(s)
Nan Xiao <http://nanx.me>

See Also
See getPPI for generating compound-protein interaction descriptors.

Examples
x = matrix(1:10, ncol = 2)
y = matrix(5:14, ncol = 2)
getPPI(x, y, type = 'combine')
getPPI(x, y, type = 'tensorprod')
getPPI(x, y, type = 'entrywise')
getPPI(x, y, type = c('combine', 'tensorprod'))
getPPI(x, y, type = c('combine', 'entrywise'))
getPPI(x, y, type = c('entrywise', 'tensorprod'))
getPPI(x, y, type = c('combine', 'entrywise', 'tensorprod'))
getProt

Retrieve Protein Sequence in various Formats from Databases

Description
Retrieve Protein Sequence in various Formats from Databases

Usage
getProt(id, from = c("uniprot", "kegg", "pdb"), type = c("fasta", "pdb", "aaseq"), parallel = 5)

Arguments
id A character vector, as the protein ID(s).
from The database, one of ‘uniprot’, ‘kegg’, or ‘pdb’.
type The returned protein format, one of fasta, pdb, or aaseq.
parallel An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details
This function retrieves protein sequence in various formats from three databases.

Value
A length of id character list, each element containing the corresponding protein sequence(s) or file(s).

Author(s)
Nan Xiao <http://nanx.me>

See Also
See getDrug for retrieving drug molecules from five databases.

Examples
id = c("P00750", "P00751", "P00752")
getProt(id, from = 'uniprot', type = 'aaseq')
getSeqFromKEGG

Retrieve Protein Sequence from the KEGG Database

Description

Retrieve Protein Sequence from the KEGG Database

Usage

getSeqFromKEGG(id, parallel = 5)

Arguments

id A character vector, as the protein ID.
parallel An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details

This function retrieves protein represented by amino acid sequence from the KEGG database.

Value

A list, each component contains one of the protein represented by amino acid sequence(s).

Author(s)

Nan Xiao <http://nanx.me>

See Also

See getFASTAFromKEGG for retrieving protein sequence in FASTA format from the KEGG database.

Examples

id = c('hsa:10161', 'hsa:10162')

c(getSeqFromKEGG(id))
getSeqFromRCSBPDB

Retrieve Protein Sequence from RCSB PDB

Description
Retrieve Protein Sequence from RCSB PDB

Usage
getSeqFromRCSBPDB(id, parallel = 5)

Arguments
id A character vector, as the protein ID.
parallel An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details
This function retrieves protein sequences from RCSB PDB.

Value
A list, each component contains one of the protein represented by amino acid sequence(s).

Author(s)
Nan Xiao <http://nanx.me>

See Also
See getPDBFromRCSBPDB for retrieving protein in PDB format from the RCSB PDB database.

Examples
\[ id = c('4HJB', '4FF9') \]
getSeqFromRCSBPDB(id)
getSeqFromUniProt  Retrieve Protein Sequence from the UniProt Database

Description
Retrieve Protein Sequence from the UniProt Database

Usage
getSeqFromUniProt(id, parallel = 5)

Arguments
id  A character vector, as the protein ID.
parallel  An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details
This function retrieves protein represented by amino acid sequence from the UniProt database.

Value
A list, each component contains one of the protein represented by amino acid sequence(s).

Author(s)
Nan Xiao &lt;http://nanx.me&gt;

References

See Also
See getFASTAFromUniProt for retrieving protein sequences in FASTA format from the UniProt database.

Examples
id = c('P00750', 'P00751', 'P00752')
getSeqFromUniProt(id)
getSmiFromChEMBL

Retrieve Drug Molecules in SMILES Format from the ChEMBL Database

Description
Retrieve Drug Molecules in SMILES Format from the ChEMBL Database

Usage
getSmiFromChEMBL(id, parallel = 5)

Arguments
id A character vector, as the ChEMBL drug ID.
parallel An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details
This function retrieves drug molecules in SMILES format from the ChEMBL database.

Value
A length of id character vector, each element containing the corresponding drug molecule.

Author(s)
Nan Xiao <http://nanx.me>

See Also
See getMolFromChEMBL for retrieving drug molecules in MOL format from the ChEMBL database.

Examples
id = ’CHEMBL1430’ # Penicillamine
getSmiFromChEMBL(id)
getSmiFromDrugBank

Retrieve Drug Molecules in SMILES Format from the DrugBank Database

Description

Retrieve Drug Molecules in SMILES Format from the DrugBank Database

Usage

getsmiFromDrugBank(id, parallel = 5)

Arguments

id
A character vector, as the DrugBank drug ID.
parallel
An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details

This function retrieves drug molecules in SMILES format from the DrugBank database.

Value

A length of id character vector, each element containing the corresponding drug molecule.

Author(s)

Nan Xiao <http://nanx.me>

See Also

See `getMolFromDrugBank` for retrieving drug molecules in MOL format from the DrugBank database.

Examples

id = 'DB00859' # Penicillamine

getSmiFromDrugBank(id)
getSmiFromKEGG

Retrieve Drug Molecules in SMILES Format from the KEGG Database

Description

Retrieve Drug Molecules in SMILES Format from the KEGG Database

Usage

getSmiFromKEGG(id, parallel = 5)

Arguments

id  A character vector, as the KEGG drug ID.
parallel  An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details

This function retrieves drug molecules in SMILES format from the KEGG database.

Value

A length of id character vector, each element containing the corresponding drug molecule.

Author(s)

Nan Xiao <http://nanx.me>

See Also

See getMolFromKEGG for retrieving drug molecules in MOL format from the KEGG database.

Examples

id = 'D00496'  # Penicillamine
getSmiFromKEGG(id)
getSmiFromPubChem

Retrieve Drug Molecules in SMILES Format from the PubChem Database

Description

Retrieve Drug Molecules in SMILES Format from the PubChem Database

Usage

getSmiFromPubChem(id, parallel = 5)

Arguments

id A character vector, as the PubChem drug ID.
parallel An integer, the parallel parameter, indicates how many process the user would like to use for retrieving the data (using RCurl), default is 5. For regular cases, we recommend a number less than 20.

Details

This function retrieves drug molecules in SMILES format from the PubChem database.

Value

A length of id character vector, each element containing the corresponding drug molecule.

Author(s)

Nan Xiao <http://nanx.me>

See Also


Examples

id = c('7847562', '7847563')  # Penicillamine
getSmiFromPubChem(id)
OptAA3d

OptAA3d.sdf - 20 Amino Acids Optimized with MOE 2011.10 (Semiempirical AM1)

Description
OptAA3d.sdf - 20 Amino Acids Optimized with MOE 2011.10 (Semiempirical AM1)

Details
OptAA3d.sdf - 20 Amino Acids Optimized with MOE 2011.10 (Semiempirical AM1)

Value
OptAA3d data

Examples
# This example requires the rcdk package
# library('rcdk')
# optaa3d = load.molecules(system.file('sysdata/OptAA3d.sdf', package = 'Rcsi'))
# view.molecule.2d(optaa3d[[1]]) # view the first amino acid

---

readFASTA

Read Protein Sequences in FASTA Format

Description
Read Protein Sequences in FASTA Format

Usage
readFASTA(file = system.file("protseq/P00750.fasta", package = "Rcsi"),
legacy.mode = TRUE, seqonly = FALSE)

Arguments

file
The name of the file which the sequences in fasta format are to be read from. If it does not contain an absolute or relative path, the file name is relative to the current working directory, getwd. The default here is to read the P00750.fasta file which is present in the protseq directory of the Rcsi package.

legacy.mode
If set to TRUE, lines starting with a semicolon ';' are ignored. Default value is TRUE.

seqonly
If set to TRUE, only sequences as returned without attempt to modify them or to get their names and annotations (execution time is divided approximately by a factor 3). Default value is FALSE.

Details
This function reads protein sequences in FASTA format.
readMolFromSDF

Value
The result character vector

Note
Note that any different sets of instances (chunklets), e.g. 1, 3, 7 and 4, 6, might belong to the same class and might belong to different classes.

Author(s)
Nan Xiao <http://nanx.me>

References

See Also
See readPDB for reading protein sequences in PDB format.

Examples
P00750 = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))
P00750

readMolFromSDF  Read Molecules from SDF Files and Return Parsed Java Molecular Object

Description
Read Molecules from SDF Files and Return Parsed Java Molecular Object

Usage
readMolFromSDF(sdffile)

Arguments
sdffile Character vector, containing SDF file location(s).

Details
This function reads molecules from SDF files and return parsed Java molecular object needed by extractDrug... functions.

Value
A list, containing parsed Java molecular object.
Author(s)

Nan Xiao <http://nanx.me>

See Also

See `readMolFromSmi` for reading molecules by SMILES string and returning parsed Java molecular object.

Examples

```r
sdf = system.file("compseq/DB00859.sdf", package = "Rcpi")
sdfs = c(system.file("compseq/DB00859.sdf", package = "Rcpi"),
        system.file("compseq/DB00860.sdf", package = "Rcpi"))
mol = readMolFromSDF(sdf)
mols = readMolFromSDF(sdfs)
```

Description

Read Molecules from SMILES Files and Return Parsed Java Molecular Object or Plain Text List

Usage

```r
readMolFromSmi(smifile, type = c("mol", "text"))
```

Arguments

- **smifile**: Character vector, containing SMILES file location(s).
- **type**: 'mol' or 'text'. 'mol' returns parsed Java molecular object, used for 'text' returns (plain-text) character string list. For common molecular descriptors and fingerprints, use 'mol'. For descriptors and fingerprints calculated by OpenBabel, i.e. functions named `extractDrugOB...()`, use 'text'.

Details

This function reads molecules from SMILES strings and return parsed Java molecular object or plain text list needed by `extractDrug...()` functions.

Value

A list, containing parsed Java molecular object or character strings.

Author(s)

Nan Xiao <http://nanx.me>
See Also

See `readMolFromSDF` for reading molecules from SDF files and returning parsed Java molecular object.

Examples

```r
smi = system.file('vignettes/FOAMD0.smi', package = 'Rcpi')
mol1 = readMolFromSmi(smi, type = 'mol')
mol2 = readMolFromSmi(smi, type = 'text')
```

readPDB  
Read Protein Sequences in PDB Format

Description

Read Protein Sequences in PDB Format

Usage

```r
readPDB(file = system.file("protseq/4HHB.pdb", package = "Rcpi"))
```

Arguments

- `file` The name of the file which the sequences in PDB format are to be read from. If it does not contain an absolute or relative path, the file name is relative to the current working directory, `getwd`. The default here is to read the 4HHB.PDB file which is present in the protseq directory of the Rcpi package.

Details

This function reads protein sequences in PDB (Protein Data Bank) format, and return the amino acid sequences represented by single-letter code.

Value

A character vector, representing the amino acid sequence of the single-letter code.

Author(s)

Nan Xiao <http://nanx.me>

References


See Also

See `readFASTA` for reading protein sequences in FASTA format.
Parallelized Drug Molecule Similarity Search by Molecular Fingerprints Similarity or Maximum Common Substructure Search

Usage

```r
searchDrug(mol, moldb, cores = 2, method = c("fp", "mcs"),
           fptype = c("standard", "extended", "graph", "hybrid", "maccs", "estate",
                     "pubchem", "kr", "shortestpath", "fp2", "fp3", "fp4", "obmaccs"),
           fpsim = c("tanimoto", "euclidean", "cosine", "dice", "hamming"),
           mcssim = c("tanimoto", "overlap"), ...)
```

Arguments

- `mol` The query molecule. The location of a sdf file containing one molecule.
- `moldb` The molecule database. The location of a sdf file containing all the molecules to be searched with.
- `cores` Integer. The number of CPU cores to use for parallel search, default is 2. Users could use the `detectCores()` function in the `parallel` package to see how many cores they could use.
- `method` 'fp' or 'mcs'. Search by molecular fingerprints or by maximum common substructure searching.
- `fptype` The fingerprint type, only available when `method` = 'fp'. Rcpi supports 13 types of fingerprints, including 'standard', 'extended', 'graph', 'hybrid', 'maccs', 'estate', 'pubchem', 'kr', 'shortestpath', 'fp2', 'fp3', 'fp4', 'obmaccs'.
- `fpsim` Similarity measure type for fingerprint, only available when `method` = 'fp'. Including 'tanimoto', 'euclidean', 'cosine', 'dice' and 'hamming'. See `calcDrugFPSim` for details.
- `mcssim` Similarity measure type for maximum common substructure search, only available when `method` = 'mcs'. Including 'tanimoto' and 'overlap'.
- `...` Other possible parameter for maximum common substructure search, see `calcDrugMCSSim` for available options.

Details

This function does compound similarity search derived by various molecular fingerprints with various similarity measures or derived by maximum common substructure search. This function runs for a query compound against a set of molecules.
segProt

Value

Named numerical vector. With the decreasing similarity value of the molecules in the database.

Author(s)

Nan Xiao <http://nanx.me>

Examples

mol = system.file('compseq/DB00530.sdf', package = 'Rcpi')
# DrugBank ID DB00530: Erlotinib
moldb = system.file('compseq/tyrphostin.sdf', package = 'Rcpi')
# Database composed by searching 'tyrphostin' in PubChem and filtered by Lipinski's Rule of Five

searchDrug(mol, moldb, cores = 4, method = 'fp', fptype = 'maccs', fpsim = 'hamming')
searchDrug(mol, moldb, cores = 4, method = 'fp', fptype = 'fp2', fpsim = 'tanimoto')
searchDrug(mol, moldb, cores = 4, method = 'mcs', mcssim = 'tanimoto')

segProt

Protein Sequence Segmentation

Description

Protein Sequence Segmentation

Usage


Arguments

x A character vector, as the input protein sequence.


k A positive integer, specify the window size (half of the window), default is 7.

Details

This function extracts the segmentations from the protein sequence.

Value

A named list, each component contains one of the segmentations (a character string), names of the list components are the positions of the specified amino acid in the sequence.

Author(s)

Nan Xiao <http://nanx.me>
Examples

```r
x = readFASTA(system.file('protseq/P00750.fasta', package = 'Rcpi'))[[1]]
segProt(x, aa = 'R', k = 5)
```
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