

# Package ‘dcGOR’

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**Type** Package

**Title** Analysis of Ontologies and Protein Domain Annotations

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**Depends** R (>= 3.1.0), Matrix, igraph, dnet

**Imports** methods

**Suggests** foreach, doMC, ape

**Description** The package is used to analyse domain-centric ontologies and annotations, particularly those in the dcGO database. The dcGO (<http://supfam.org/SUPERFAMILY/dcGO>) is a comprehensive domain-centric database for annotating protein domains using a panel of ontologies including Gene Ontology. With the package, users are expected to analyse and visualise domain-centric ontologies and annotations. Supported analyses include but are not limited to: easy access to a wide range of ontologies and their domain-centric annotations; able to build customised ontologies and annotations; domain-based enrichment analysis and visualisation; construction of a domain (semantic similarity) network according to ontology annotations; significance analysis for estimating a contact (statistical significance) network via Random Walk with Restart; and high-performance parallel computing. The under-development functionalities are: 1) to create domain-centric ontologies; 2) to predict ontology terms for input protein sequences (precisely domain content in the form of architectures) plus to assess the predictions; 3) to reconstruct ancestral discrete characters using maximum likelihood/parsimony.

**URL** <http://supfam.org/dcGOR>, <http://dcgor.r-forge.r-project.org>, <http://cran.r-project.org/package=dcGOR>, <https://github.com/hfang-bristol/dcGOR>

**Collate** 'ClassMethod-dcGOR.r' 'dcDAGannotate.r' 'dcRDataLoader.r' 'dcEnrichment.r' 'visEnrichment.r' 'dcDAGdomainSim.r' 'dcRWRpipeline.r' 'dcConverter.r' 'dcBuildInfoDataFrame.r' 'dcBuildAnno.r' 'dcBuildOnto.r' 'dcAlgoPropagate.r' 'dcAlgoPredict.r' 'dcAlgoPredictMain.r' 'dcAlgoPredictGenome.r' 'dcAncestralML.r' 'dcAncestralMP.r' 'dcSubtreeClade.r' 'dcSubtreeTips.r' 'dcTreeConnectivity.r' 'dcDuplicated.r' 'dcSplitArch.r' 'dcAlgo.r' 'dcFunArgs.r' 'dcSparseMatrix.r' 'dcList2Matrix.r' 'dcAlgoPredictPR.r' 'dcSupraBetter.r' 'dcRWRpredict.r' 'dcNaivePredict.r'

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**biocViews** Bioinformatics

**R topics documented:**

AdjData-class . . . . .	4
Ancestral_domainome . . . . .	4
Anno-class . . . . .	5
Anno-method . . . . .	7
AnnoData-class . . . . .	8
Cnetwork-class . . . . .	9
Cnetwork-method . . . . .	10
Coutput-class . . . . .	11
Coutput-method . . . . .	13
dcAlgo . . . . .	14
dcAlgoPredict . . . . .	16
dcAlgoPredictGenome . . . . .	19
dcAlgoPredictMain . . . . .	22
dcAlgoPredictPR . . . . .	24
dcAlgoPropagate . . . . .	26
dcAncestralML . . . . .	28
dcAncestralMP . . . . .	31
dcBuildAnno . . . . .	33
dcBuildInfoDataFrame . . . . .	34
dcBuildOnto . . . . .	35
dcConverter . . . . .	37
dcDAGannotate . . . . .	38
dcDAGdomainSim . . . . .	39
dcDuplicated . . . . .	44
dcEnrichment . . . . .	45
dcFunArgs . . . . .	50
dcList2Matrix . . . . .	51
dcNaivePredict . . . . .	52
dcRDataLoader . . . . .	54
dcRWRpipeline . . . . .	56
dcRWRpredict . . . . .	58
dcSparseMatrix . . . . .	61
dcSplitArch . . . . .	62
dcSubtreeClade . . . . .	63
dcSubtreeTips . . . . .	64
dcSupraBetter . . . . .	65
dcTreeConnectivity . . . . .	66
Dnetwork-class . . . . .	67
Dnetwork-method . . . . .	69
Eoutput-class . . . . .	70
Eoutput-method . . . . .	72
eTOL . . . . .	73
Feature2GOBP.interpro . . . . .	75
Feature2GOBP.pfam . . . . .	75
Feature2GOBP.sf . . . . .	76
Feature2GOCC.interpro . . . . .	77
Feature2GOCC.pfam . . . . .	78
Feature2GOCC.sf . . . . .	79
Feature2GOMF.interpro . . . . .	80
Feature2GOMF.pfam . . . . .	80

Feature2GOMF.sf . . . . .	81
Feature2HPPA.interpro . . . . .	82
Feature2HPPA.pfam . . . . .	83
Feature2HPPA.sf . . . . .	84
InfoDataFrame-class . . . . .	85
InfoDataFrame-method . . . . .	86
InterPro . . . . .	87
InterPro2GOBP . . . . .	88
InterPro2GOCC . . . . .	89
InterPro2GOMF . . . . .	90
Onto-class . . . . .	91
Onto-method . . . . .	93
onto.DO . . . . .	94
onto.EC . . . . .	95
onto.GOBP . . . . .	95
onto.GOCC . . . . .	96
onto.GOMF . . . . .	97
onto.HPMI . . . . .	98
onto.HPON . . . . .	98
onto.HPPA . . . . .	99
onto.KW . . . . .	100
onto.MP . . . . .	101
onto.UP . . . . .	101
Pfam . . . . .	102
Pfam2GOBP . . . . .	103
Pfam2GOCC . . . . .	104
Pfam2GOMF . . . . .	105
Rfam . . . . .	106
Rfam2GOBP . . . . .	107
Rfam2GOCC . . . . .	108
Rfam2GOMF . . . . .	109
SCOP.fa . . . . .	110
SCOP.fa2DO . . . . .	111
SCOP.fa2EC . . . . .	112
SCOP.fa2GOBP . . . . .	113
SCOP.fa2GOCC . . . . .	114
SCOP.fa2GOMF . . . . .	115
SCOP.fa2HPMI . . . . .	116
SCOP.fa2HPON . . . . .	117
SCOP.fa2HPPA . . . . .	118
SCOP.fa2KW . . . . .	119
SCOP.fa2MP . . . . .	120
SCOP.fa2UP . . . . .	121
SCOP.sf . . . . .	122
SCOP.sf2DO . . . . .	123
SCOP.sf2EC . . . . .	124
SCOP.sf2GOBP . . . . .	125
SCOP.sf2GOCC . . . . .	126
SCOP.sf2GOMF . . . . .	127
SCOP.sf2HPMI . . . . .	128
SCOP.sf2HPON . . . . .	129
SCOP.sf2HPPA . . . . .	130

SCOP.sf2KW . . . . .	131
SCOP.sf2MP . . . . .	132
SCOP.sf2UP . . . . .	133
visEnrichment . . . . .	134

<b>Index</b>	<b>138</b>
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AdjData-class	<i>Definition for VIRTUAL S4 class AdjData</i>
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**Description**

AdjData is union of other classes: either matrix or dgCMatrix (a sparse matrix in the package Matrix). It is used as a virtual class

**Value**

Class AdjData

**See Also**

[Onto-class](#)

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Ancestral_domainome	<i>Ancestral superfamily domain repertoires in Eukaryotes</i>
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**Description**

An object of class "Anno" that contains information about domain repertoires (a complete set of domains: domain-ome) in Eukaryotes (including extant and ancestral genomes). This data is prepared based on 1) SUPERFAMILY database which provides domain and architecture assignments to all completely sequenced genomes including eukaryotic genomes; 2) ancestral domain architecture repertoires inferred by applying Dollo parsimony to eukaryotic part of species tree of life (sTOL), from which ancestral superfamily domain and architecture repertoires at all branching points in eukaryotic evolution are inferred. This allows us to list ancestral domain and architecture repertoires that were present at these points. Based on the observed/inferred domain and architecture repertoires, we also define genome-specific plasticity potential for an individual domain as how many different architectures (or architecture diversity) it can be formed in an extant/ancestral genome. As a result, for each genome, domain repertoires (domainome) are represented as a profile of states on domains, where non-zero entry indicates a domain for which how many different architectures have occurred in the genome.

**Usage**

data(Ancestral\_domainome)

**Value**

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of 2019 domains X 875 terms/genomes (including 438 extant genomes and 437 ancestral genomes), with each entry telling how many different architectures a domain has in a genome. Note: zero entry also means that this domain is absent in the genome
- termData: variables describing terms/genomes (i.e. columns in annoData), including extant/ancestral genome information: "left\_id" (unique and used as internal id), "right\_id" (used in combination with "left\_id" to define the post-ordered binary tree structure), "taxon\_id" (NCBI taxonomy id, if matched), "genome" (2-letter genome identifiers used in SUPERFAMILY, if being extant), "name" (NCBI taxonomy name, if matched), "rank" (NCBI taxonomy rank, if matched), "branchlength" (branch length in relevance to the parent), and "common\_name" (NCBI taxonomy common name, if matched and existed)
- domainData: variables describing domains (i.e. rows in annoData), including information about domains: "sunid" for SCOP id, "level" for SCOP level, "classification" for SCOP classification, "description" for SCOP description

**References**

Fang et al. (2013) A daily-updated tree of (sequenced) life as a reference for genome research. *Scientific reports*, 3:2015.  
 Morais et al. (2011) SUPERFAMILY 1.75 including a domain-centric gene ontology method. *Nucleic Acids Res*, 39(Database issue):D427-34.  
 Andreeva et al. (2008) Data growth and its impact on the SCOP database: new developments. *Nucleic Acids Res*, 36(Database issue):D419-425

**Examples**

```
data(Ancestral_domainome)
Ancestral_domainome
# retrieve info on terms/genomes
termData(Ancestral_domainome)
# retrieve info on SCOP domains
domainData(Ancestral_domainome)
# retrieve the first 5 rows and columns of data
x <- annoData(Ancestral_domainome)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

Anno-class

---

*Definition for S4 class Anno*


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**Description**

Anno has 3 slots: annoData, termData and domainData

**Value**

Class Anno

## Slots

`annoData` An object of S4 class [AnnoData](#), containing data matrix with the column number equal to `nrow(termData)` and the row number equal to `nrow(domainData)`.

`termData` An object of S4 class [InfoDataFrame](#), describing information on columns in `annoData`.

`domainData` An object of S4 class [InfoDataFrame](#), describing information on rows in `annoData`.

## Creation

An object of this class can be created via: `new("Anno", annoData, termData, domainData)`

## Methods

Class-specific methods:

- `dim()`: retrieve the dimension in the object
- `annoData()`: retrieve the slot 'annoData' in the object
- `termData()`: retrieve the slot 'termData' (as class `InfoDataFrame`) in the object
- `domainData()`: retrieve the slot 'domainData' (as class `InfoDataFrame`) in the object
- `tData()`: retrieve `termData` (as `data.frame`) in the object
- `dData()`: retrieve `domainData` (as `data.frame`) in the object
- `termNames()`: retrieve term names (ie, row names of `termData`) in the object
- `domanNames()`: retrieve domain names (ie, row names of `domainData`) in the object

Standard generic methods:

- `str()`: compact display of the content in the object
- `show()`: abbreviated display of the object
- `as(matrix, "Anno")`: convert a matrix to an object of class `Anno`
- `as(dgCMatrix, "Anno")`: convert a `dgCMatrix` (a sparse matrix) to an object of class `Anno`
- `[i, j]`: get the subset of the same class

## Access

Ways to access information on this class:

- `showClass("Anno")`: show the class definition
- `showMethods(classes="Anno")`: show the method definition upon this class
- `getSlots("Anno")`: get the name and class of each slot in this class
- `slotNames("Anno")`: get the name of each slot in this class
- `selectMethod(f, signature="Anno")`: retrieve the definition code for the method 'f' defined in this class

## See Also

[Anno-method](#)

**Examples**

```
# create an object of class Anno, only given a matrix
annoData <- matrix(runif(50),nrow=10,ncol=5)
as(annoData, "Anno")

# create an object of class Anno, given a matrix plus information on its columns/rows
# 1) create termData: an object of class InfoDataFrame
data <- data.frame(x=1:5, y=I(LETTERS[1:5]), row.names=paste("Term",
1:5, sep="_"))
termData <- new("InfoDataFrame", data=data)
termData
# 2) create domainData: an object of class InfoDataFrame
data <- data.frame(x=1:10, y=I(LETTERS[1:10]),
row.names=paste("Domain", 1:10, sep="_"))
domainData <- new("InfoDataFrame", data=data)
domainData
# 3) create an object of class Anno
# VERY IMPORTANT: make sure having consistent names between annoData and domainData (and termData)
annoData <- matrix(runif(50),nrow=10,ncol=5)
rownames(annoData) <- rowNames(domainData)
colnames(annoData) <- rowNames(termData)
x <- new("Anno", annoData=annoData, domainData=domainData,
termData=termData)
x
# 4) look at various methods defined on class Anno
dim(x)
annoData(x)
termData(x)
tData(x)
domainData(x)
dData(x)
termNames(x)
domainNames(x)
# 5) get the subset
x[1:3,1:2]
```

Anno-method

*Methods defined for S4 class Anno***Description**

Methods defined for class Anno.

**Usage**

```
## S4 method for signature Anno
dim(x)

## S4 method for signature Anno
annoData(x)

## S4 method for signature Anno
termData(x)
```

```
## S4 method for signature Anno
domainData(x)

## S4 method for signature Anno
tData(object)

## S4 method for signature Anno
dData(object)

## S4 method for signature Anno
termNames(object)

## S4 method for signature Anno
domainNames(object)

## S4 method for signature Anno
show(object)

## S4 method for signature Anno,ANY,ANY,ANY
x[i, j, ..., drop = FALSE]
```

### Arguments

x	an object of class Anno
object	an object of class Anno
i	an index
j	an index
...	additional parameters
drop	a logic for matrices and arrays. If TRUE the result is coerced to the lowest possible dimension. This only works for extracting elements, not for the replacement

### See Also

[Anno-class](#)

---

AnnoData-class

*Definition for VIRTUAL S4 class AnnoData*

---

### Description

AnnoData is union of other classes: either matrix or dgCMatrix (a sparse matrix in the package Matrix). It is used as a virtual class

### Value

Class AnnoData

### See Also

[Anno-class](#)



Cnetwork-class

*Definition for S4 class Cnetwork***Description**

Cnetwork is an S4 class to store a contact network, such as the one from RWR-based contact between samples/terms by [dcRWRpipeline](#). It has 2 slots: nodeInfo and adjMatrix

**Value**

Class Cnetwork

**Slots**

nodeInfo An object of S4 class [InfoDataFrame](#), describing information on nodes/domains.

adjMatrix An object of S4 class [AdjData](#), containing symmetric adjacency data matrix for an indirect domain network

**Creation**

An object of this class can be created via: `new("Cnetwork", nodeInfo, adjMatrix)`

**Methods**

Class-specific methods:

- `dim()`: retrieve the dimension in the object
- `adjMatrix()`: retrieve the slot 'adjMatrix' in the object
- `nodeInfo()`: retrieve the slot 'nodeInfo' (as class [InfoDataFrame](#)) in the object
- `nInfo()`: retrieve nodeInfo (as `data.frame`) in the object
- `nodeNames()`: retrieve node/term names (ie, row names of nodeInfo) in the object

Standard generic methods:

- `str()`: compact display of the content in the object
- `show()`: abbreviated display of the object
- `as(matrix, "Cnetwork")`: convert a matrix to an object of class Cnetwork
- `as(dgCMatrix, "Cnetwork")`: convert a `dgCMatrix` (a sparse matrix) to an object of class Cnetwork
- `[i]`: get the subset of the same class

**Access**

Ways to access information on this class:

- `showClass("Cnetwork")`: show the class definition
- `showMethods(classes="Cnetwork")`: show the method definition upon this class
- `getSlots("Cnetwork")`: get the name and class of each slot in this class
- `slotNames("Cnetwork")`: get the name of each slot in this class
- `selectMethod(f, signature="Cnetwork")`: retrieve the definition code for the method 'f' defined in this class

**See Also**

[Cnetwork-method](#)

**Examples**

```
# create an object of class Cnetwork, only given a matrix
adjM <- matrix(runif(25),nrow=5,ncol=5)
as(adjM, "Cnetwork")

# create an object of class Cnetwork, given a matrix plus information on nodes
# 1) create nodeI: an object of class InfoDataFrame
data <- data.frame(id=paste("Domain", 1:5, sep="_"),
  level=rep("SCOP",5), description=I(LETTERS[1:5]),
  row.names=paste("Domain", 1:5, sep="_"))
nodeI <- new("InfoDataFrame", data=data)
nodeI
# 2) create an object of class Cnetwork
# VERY IMPORTANT: make sure having consistent names between nodeInfo and adjMatrix
adjM <- matrix(runif(25),nrow=5,ncol=5)
colnames(adjM) <- rownames(adjM) <- rowNames(nodeI)
x <- new("Cnetwork", adjMatrix=adjM, nodeInfo=nodeI)
x
# 3) look at various methods defined on class Cnetwork
dim(x)
adjMatrix(x)
nodeInfo(x)
nInfo(x)
nodeNames(x)
# 4) get the subset
x[1:2]
```

---

Cnetwork-method

*Methods defined for S4 class Cnetwork*

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**Description**

Methods defined for class Cnetwork.

**Usage**

```
## S4 method for signature Cnetwork
dim(x)

## S4 method for signature Cnetwork
adjMatrix(x)

## S4 method for signature Cnetwork
nodeInfo(x)

## S4 method for signature Cnetwork
nInfo(object)

## S4 method for signature Cnetwork
```

```

nodeNames(object)

## S4 method for signature Cnetwork
show(object)

## S4 method for signature Cnetwork,ANY,ANY,ANY
x[i, j, ..., drop = FALSE]
```

### Arguments

x	an object of class Cnetwork
object	an object of class Cnetwork
i	an index
j	an index
...	additional parameters
drop	a logic for matrices and arrays. If TRUE the result is coerced to the lowest possible dimension. This only works for extracting elements, not for the replacement

### See Also

[Cnetwork-class](#)

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Coutput-class	<i>Definition for S4 class Coutput</i>
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### Description

Coutput is an S4 class to store output by [dcRWRpipeline](#).

### Value

Class Coutput

### Slots

ratio A symmetrix matrix, containing ratio

zscore A symmetrix matrix, containing z-scores

pvalue A symmetrix matrix, containing p-values

adjp A symmetrix matrix, containing adjusted p-values

cnetwork An object of S4 class [Cnetwork](#), storing contact network.

### Creation

An object of this class can be created via: `new("Coutput", ratio,zscore, pvalue, adjp, cnetwork)`

## Methods

Class-specific methods:

- `ratio()`: retrieve the slot 'ratio' in the object
- `zscore()`: retrieve the slot 'zscore' in the object
- `pvalue()`: retrieve the slot 'pvalue' in the object
- `adjp()`: retrieve the slot 'adjp' in the object
- `cnetwork()`: retrieve the slot 'cnetwork' in the object
- `write()`: write the object into a local file

Standard generic methods:

- `str()`: compact display of the content in the object
- `show()`: abbreviated display of the object

## Access

Ways to access information on this class:

- `showClass("Coutput")`: show the class definition
- `showMethods(classes="Coutput")`: show the method definition upon this class
- `getSlots("Coutput")`: get the name and class of each slot in this class
- `slotNames("Coutput")`: get the name of each slot in this class
- `selectMethod(f, signature="Coutput")`: retrieve the definition code for the method 'f' defined in this class

## See Also

[Coutput-method](#)

## Examples

```
# 1) load onto.GOMF (as Onto object)
g <- dcRDataLoader(onto.GOMF)

# 2) load SCOP superfamilies annotated by GOMF (as Anno object)
Anno <- dcRDataLoader(SCOP.sf2GOMF)

# 3) prepare for ontology appended with annotation information
dag <- dcDAGannotate(g, annotations=Anno, path.mode="shortest_paths",
verbose=TRUE)

# 4) calculate pair-wise semantic similarity between 10 randomly chosen domains
alldomains <- unique(unlist(nInfo(dag)$annotations))
domains <- sample(alldomains,10)
dnetwork <- dcDAGdomainSim(g=dag, domains=domains,
method.domain="BM.average", method.term="Resnik", parallel=FALSE,
verbose=TRUE)
dnetwork

# 5) estimate RWR dating based sample/term relationships
# define sets of seeds as data
# each seed with equal weight (i.e. all non-zero entries are 1)
```

```

data <- data.frame(aSeeds=c(1,0,1,0,1), bSeeds=c(0,0,1,0,1))
rownames(data) <- id(dnetwork)[1:5]
# calcualte their two contact graph
coutput <- dcRWRpipeline(data=data, g=dnetwork, parallel=FALSE)
coutput

# 6) write into the file Coutput.txt in your local directory
write(coutput, file=Coutput.txt, saveBy="adjp")

# 7) retrieve several slots directly
ratio(coutput)
zscore(coutput)
pvalue(coutput)
adjp(coutput)
cnetwork(coutput)

```

Coutput-method

*Methods defined for S4 class Coutput***Description**

Methods defined for S4 class Coutput.

**Usage**

```

## S4 method for signature Coutput
show(object)

## S4 method for signature Coutput
ratio(x)

## S4 method for signature Coutput
zscore(x)

## S4 method for signature Coutput
pvalue(x)

## S4 method for signature Coutput
adjp(x)

## S4 method for signature Coutput
cnetwork(x)

## S4 method for signature Coutput
write(x, file = "Coutput.txt", saveBy = c("adjp",
"pvalue", "zscore", "ratio"), verbose = T)

```

**Arguments**

object	an object of S4 class Coutput. Usually this is an output from <a href="#">dcRWRpipeline</a>
x	an object of S4 class Coutput. Usually this is part of the output from <a href="#">dcRWRpipeline</a>
file	a character specifying a file name written into. By default, it is 'Coutput.txt'

saveBy	which statistics will be saved. It can be "pvalue" for p value, "adjp" for adjusted p value, "zscore" for z-score, "ratio" for ratio
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to true for display

### Value

write(x) also returns a symmetrix matrix storing the specific statistics

### See Also

[Coutput-class](#)

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dcAlgo	<i>Function to apply dcGO algorithm to infer domain-centric ontology</i>
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### Description

dcAlgo is supposed to apply dcGO algorithm to infer domain-centric ontology from input files. It requires two input files: 1) an annotation file containing annotations between proteins/genes and ontology terms; 2) an architecture file containing domain architectures for proteins/genes.

### Usage

```
dcAlgo(anno.file, architecture.file, output.file = NULL, ontology =
c(NA,
"GOBP", "GOMF", "GOCC", "DO", "HPPA", "HPMI", "HPON", "MP", "EC", "KW",
"UP"),
feature.mode = c("supra", "individual", "comb"), min.overlap = 3,
fdr.cutoff = 0.001, hscore.type = c("zscore", "fdr"), parallel = TRUE,
multicores = NULL, verbose = T, RData.ontology.customised = NULL,
RData.location = "http://dcgor.r-forge.r-project.org/data")
```

### Arguments

anno.file	an annotation file containing annotations between proteins/genes and ontology terms. For example, a file containing annotations between human genes and HP terms can be found in <a href="http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt">http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt</a> . As seen in this example, the input file must contain the header (in the first row) and two columns: 1st column for 'SeqID' (actually these IDs can be anything), 2nd column for 'termID' (HP terms). Note: the file should use the tab delimiter as the field separator between columns
architecture.file	an architecture file containing domain architectures (including individual domains) for proteins/genes. For example, a file containing human genes and domain architectures can be found in <a href="http://dcgor.r-forge.r-project.org/data/Algo/SCOP_architecture.txt">http://dcgor.r-forge.r-project.org/data/Algo/SCOP_architecture.txt</a> . As seen in this example, the input file must contain the header (in the first row) and two columns: 1st column for 'SeqID' (actually these IDs can be anything), 2nd column for 'Architecture' (SCOP domain architectures, each represented as comma-separated domains). Note: the file should use the tab delimiter as the field separator between columns

output.file	an output file containing results. If not NULL, a tab-delimited text file will be also written out, with 1st column 'Feature_id' for features/domains, 2nd column 'Term_id' for ontology terms, 3rd column 'Score' for hypergeometric scores (indicative of strength for feature-term associations). Otherwise, there is no output file (by default)
ontology	the ontology identity. It can be "GOBP" for Gene Ontology Biological Process, "GOMF" for Gene Ontology Molecular Function, "GOCC" for Gene Ontology Cellular Component, "DO" for Disease Ontology, "HPPA" for Human Phenotype Phenotypic Abnormality, "HPMI" for Human Phenotype Mode of Inheritance, "HPON" for Human Phenotype ONset and clinical course, "MP" for Mammalian Phenotype, "EC" for Enzyme Commission, "KW" for UniProtKB KeyWords, "UP" for UniProtKB UniPathway. For details on the eligibility for pairs of input domain and ontology, please refer to the online Documentations at <a href="http://supfam.org/dcGOR/docs.html">http://supfam.org/dcGOR/docs.html</a> . If NA, then the user has to input a customised RData-formatted file (see RData.ontology.customised below)
feature.mode	the mode of how to define the features thereof. It can be: "supra" for combinations of one or two successive domains (including individual domains; considering the order), "individual" for individual domains only, and "comb" for all possible combinations (including individual domains; ignoring the order)
min.overlap	the minimum number of overlaps with each term in consideration. By default, it sets to a minimum of 3
fdr.cutoff	the fdr cutoff to call the significant associations between features and terms. By default, it sets to 1e-3
hscore.type	the type of defining the hypergeometric score. It can be: "zscore" for z-score (by default), "fdr" for fdr (after being transformed via $-1 * \log_2(fdr)$ )
parallel	logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R"); biocLite(c("foreach", "doMC"))</code> . If not yet installed, this option will be disabled
multicores	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display
RData.ontology.customised	a file name for RData-formatted file containing an object of S4 class 'Onto' (i.g. ontology). By default, it is NULL. It is only needed when the user wants to perform customised analysis using their own ontology. See <a href="#">dcBuildOnto</a> for how to creat this object
RData.location	the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as:

*RData.location* = ".". If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

### Value

a data frame containing three columns: 1st column 'Feature\_id' for features, 2nd 'Term\_id' for terms, and 3rd 'Score' for the hypergeometric score indicative of strength of associations between features and terms

### Note

When 'output.file' is specified, a tab-delimited text file is output, with the column names: 1st column 'Feature\_id' for features, 2nd 'Term\_id' for terms, and 3rd 'Score' for the hypergeometric score indicative of strength of associations between features and terms

### See Also

[dcRDataLoader](#), [dcSplitArch](#), [dcConverter](#), [dcDuplicated](#), [dcAlgoPropagate](#)

### Examples

```
# 1) Prepare input file: anno.file and architecture.file
anno.file <- "http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt"
architecture.file <-
"http://dcgor.r-forge.r-project.org/data/Algo/SCOP_architecture.txt"

# 2) Do inference using built-in ontology
res <- dcAlgo(anno.file, architecture.file, ontology="HPPA",
feature.mode="supra", parallel=FALSE)
res[1:5,]

# 3) Advanced usage: using customised ontology
x <-
base::load(base::url("http://dcgor.r-forge.r-project.org/data/onto.HPPA.RData"))
RData.ontology.customised <- onto.HPPA.RData
base::save(list=x, file=RData.ontology.customised)
#list.files(pattern=*.RData)
## you will see an RData file onto.HPPA.RData in local directory
res <- dcAlgo(anno.file, architecture.file, feature.mode="supra",
parallel=FALSE, RData.ontology.customised=RData.ontology.customised)
res[1:5,]
```

---

dcAlgoPredict

*Function to predict ontology terms given domain architectures (including individual domains)*

---

### Description

dcAlgoPredict is supposed to predict ontology terms given domain architectures (including individual domains). It involves 3 steps: 1) splitting an architecture into individual domains and all possible consecutive domain combinations (viewed as component features); 2) merging hscores among component features; 3) scaling merged hscores into predictive scores across terms.



**Usage**

```
dcAlgoPredict(data, RData.HIS = c(NA, "Feature2GOBP.sf",
  "Feature2GOMF.sf",
  "Feature2GOCC.sf", "Feature2HPPA.sf", "Feature2GOBP.pfam",
  "Feature2GOMF.pfam", "Feature2GOCC.pfam", "Feature2HPPA.pfam",
  "Feature2GOBP.interpro", "Feature2GOMF.interpro",
  "Feature2GOCC.interpro",
  "Feature2HPPA.interpro"), merge.method = c("sum", "max", "sequential"),
  scale.method = c("log", "linear", "none"), feature.mode = c("supra",
  "individual", "comb"), slim.level = NULL, max.num = NULL,
  parallel = TRUE, multicores = NULL, verbose = T,
  RData.HIS.customised = NULL,
  RData.location = "http://dcgor.r-forge.r-project.org/data")
```

**Arguments**

data	an input data vector containing domain architectures. An architecture is represented in the form of comma-separated domains
RData.HIS	RData to load. This RData conveys two bits of information: 1) feature (domain) type; 2) ontology. It stores the hypergeometric scores (hscore) between features (individual domains or consecutive domain combinations) and ontology terms. The RData name tells which domain type and which ontology to use. It can be: SCOP sf domains/combinations (including "Feature2GOBP.sf", "Feature2GOMF.sf", "Feature2GOCC.sf", "Feature2HPPA.sf"), Pfam domains/combinations (including "Feature2GOBP.pfam", "Feature2GOMF.pfam", "Feature2GOCC.pfam", "Feature2HPPA.pfam"), InterPro domains (including "Feature2GOBP.interpro", "Feature2GOMF.interpro", "Feature2GOCC.interpro", "Feature2HPPA.interpro"). If NA, then the user has to input a customised RData-formatted file (see RData.HIS.customised below)
merge.method	the method used to merge predictions for each component feature (individual domains and their combinations derived from domain architecture). It can be one of "sum" for summing up, "max" for the maximum, and "sequential" for the sequential weighting. The sequential weighting is done via: $\sum_{i=1} \frac{R_i}{i}$ , where $R_i$ is the $i^{th}$ ranked highest hscore
scale.method	the method used to scale the predictive scores. It can be: "none" for no scaling, "linear" for being linearly scaled into the range between 0 and 1, "log" for the same as "linear" but being first log-transformed before being scaled. The scaling between 0 and 1 is done via: $\frac{S-S_{min}}{S_{max}-S_{min}}$ , where $S_{min}$ and $S_{max}$ are the minimum and maximum values for $S$
feature.mode	the mode of how to define the features thereof. It can be: "supra" for combinations of one or two successive domains (including individual domains; considering the order), "individual" for individual domains only, and "comb" for all possible combinations (including individual domains; ignoring the order)
slim.level	whether only slim terms are returned. By default, it is NULL and all predicted terms will be reported. If it is specified as a vector containing any values from 1 to 4, then only slim terms at these levels will be reported. Here is the meaning of these values: '1' for very general terms, '2' for general terms, '3' for specific terms, and '4' for very specific terms
max.num	whether only top terms per sequence are returned. By default, it is NULL and no constraint is imposed. If an integer is specified, then all predicted terms (with

	scores in a decreasing order) beyond this number will be discarded. Notably, this parameter works after the preceding parameter <code>slim.level</code>
<code>parallel</code>	logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R"); biocLite(c("foreach", "doMC"))</code> . If not yet installed, this option will be disabled
<code>multicores</code>	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled
<code>verbose</code>	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display
<code>RData.HIS.customised</code>	a file name for RData-formatted file containing an object of S3 class 'HIS'. By default, it is NULL. It is only needed when the user wants to perform customised analysis. See <a href="#">dcAlgoPropagate</a> on how this object is created
<code>RData.location</code>	the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as: <code>RData.location = "."</code> . If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

**Value**

a named list of architectures, each containing predictive scores

**Note**

none

**See Also**

[dcRDataLoader](#), [dcSplitArch](#), [dcConverter](#), [dcAlgoPropagate](#), [dcAlgoPredictMain](#), [dcAlgoPredictGenome](#)

**Examples**

```
# 1) randomly generate 5 domains and/or domain architectures
x <- dcRDataLoader(RData="Feature2GOMF.sf")
data <- sample(names(x$hscore), 5)

# 2) get predictive scores of all predicted terms for this domain architecture
## using sequential method (by default)
pscore <- dcAlgoPredict(data=data, RData.HIS="Feature2GOMF.sf",
parallel=FALSE)
## using max method
```

```

pscore_max <- dcAlgoPredict(data=data, RData.HIS="Feature2GOMF.sf",
merge.method="max", parallel=FALSE)
## using sum method
pscore_sum <- dcAlgoPredict(data=data, RData.HIS="Feature2GOMF.sf",
merge.method="sum", parallel=FALSE)

# 3) advanced usage
## a) focus on those terms at the 2nd level (general)
pscore <- dcAlgoPredict(data=data, RData.HIS="Feature2GOMF.sf",
slim.level=2, parallel=FALSE)
## b) visualise predictive scores in the ontology hierarchy
### load the ontology
g <- dcRDataLoader("onto.GOMF", verbose=FALSE)
ig <- dcConverter(g, from=Onto, to=igraph, verbose=FALSE)
### do visualisation for the 1st architecture
data <- pscore[[1]]
subg <- dnet::dDAGinduce(ig, nodes_query=names(data),
path.mode="shortest_paths")
dnet::visDAG(g=subg, data=data, node.info="term_id")

```

---

dcAlgoPredictGenome	<i>Function to predict ontology terms for genomes with domain architectures (including individual domains)</i>
---------------------	--

---

## Description

dcAlgoPredictGenome is supposed to predict ontology terms for genomes with domain architectures (including individual domains).

## Usage

```

dcAlgoPredictGenome(input.file, RData.HIS = c(NULL, "Feature2GOBP.sf",
"Feature2GOMF.sf", "Feature2GOCC.sf", "Feature2HPPA.sf",
"Feature2GOBP.pfam",
"Feature2GOMF.pfam", "Feature2GOCC.pfam", "Feature2HPPA.pfam",
"Feature2GOBP.interpro", "Feature2GOMF.interpro",
"Feature2GOCC.interpro",
"Feature2HPPA.interpro"), weight.method = c("none", "copynum", "ic",
"both"), merge.method = c("sum", "max", "sequential"),
scale.method = c("log", "linear", "none"), feature.mode = c("supra",
"individual", "comb"), slim.level = NULL, max.num = NULL,
parallel = TRUE, multicores = NULL, verbose = T,
RData.HIS.customised = NULL,
RData.location = "http://dcgor.r-forge.r-project.org/data")

```

## Arguments

input.file	an input file containing genomes and their domain architectures (including individual domains). For example, a file containing Hominidae genomes and their domain architectures can be found in <a href="http://dcgor.r-forge.r-project.org/data/Feature/Hominidae.txt">http://dcgor.r-forge.r-project.org/data/Feature/Hominidae.txt</a> . As seen in this example, the input file must contain the header (in the first row) and two columns: 1st column for 'Genome'
------------	---

	(a genome like a container), 2nd column for 'Architecture' (SCOP domain architectures, each represented as comma-separated domains). Alternatively, the input.file can be a matrix or data frame, assuming that input file has been read. Note: the file should use the tab delimiter as the field separator between columns
RData.HIS	RData to load. This RData conveys two bits of information: 1) feature (domain) type; 2) ontology. It stores the hypergeometric scores (hscore) between features (individual domains or consecutive domain combinations) and ontology terms. The RData name tells which domain type and which ontology to use. It can be: SCOP sf domains/combinations (including "Feature2GOBP.sf", "Feature2GOMF.sf", "Feature2GOCC.sf", "Feature2HPPA.sf"), Pfam domains/combinations (including "Feature2GOBP.pfam", "Feature2GOMF.pfam", "Feature2GOCC.pfam", "Feature2HPPA.pfam"), InterPro domains (including "Feature2GOBP.interpro", "Feature2GOMF.interpro", "Feature2GOCC.interpro", "Feature2HPPA.interpro"). If NA, then the user has to input a customised RData-formatted file (see RData.HIS.customised below)
weight.method	the method used how to weight predictions. It can be one of "none" (no weighting; by default), "copynum" for weighting copynumber of architectures, and "ic" for weighting information content (ic) of the term, "both" for weighting both copynumber and ic
merge.method	the method used to merge predictions for each component feature (individual domains and their combinations derived from domain architecture). It can be one of "sum" for summing up, "max" for the maximum, and "sequential" for the sequential merging. The sequential merging is done via: $\sum_{i=1} \frac{R_i}{i}$ , where $R_i$ is the $i^{th}$ ranked highest hscore
scale.method	the method used to scale the predictive scores. It can be: "none" for no scaling, "linear" for being linearly scaled into the range between 0 and 1, "log" for the same as "linear" but being first log-transformed before being scaled. The scaling between 0 and 1 is done via: $\frac{S-S_{min}}{S_{max}-S_{min}}$ , where $S_{min}$ and $S_{max}$ are the minimum and maximum values for $S$
feature.mode	the mode of how to define the features thereof. It can be: "supra" for combinations of one or two successive domains (including individual domains; considering the order), "individual" for individual domains only, and "comb" for all possible combinations (including individual domains; ignoring the order)
slim.level	whether only slim terms are returned. By default, it is NULL and all predicted terms will be reported. If it is specified as a vector containing any values from 1 to 4, then only slim terms at these levels will be reported. Here is the meaning of these values: '1' for very general terms, '2' for general terms, '3' for specific terms, and '4' for very specific terms
max.num	whether only top terms per sequence are returned. By default, it is NULL and no constraint is imposed. If an integer is specified, then all predicted terms (with scores in a decreasing order) beyond this number will be discarded. Notably, this parameter works after the preceding parameter slim.level
parallel	logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R"); biocLite(c("foreach", "doMC"))</code> . If not yet installed, this option will be disabled

multicores	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display
RData.HIS.customised	a file name for RData-formatted file containing an object of S3 class 'HIS'. By default, it is NULL. It is only needed when the user wants to perform customised analysis. See <a href="#">dcAlgoPropagate</a> on how this object is created
RData.location	the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as: <i>RData.location</i> = ".". If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

**Value**

a matrix of terms X genomes, containing the predicted scores (per genome) as a whole

**Note**

none

**See Also**

[dcRDataLoader](#), [dcAlgoPropagate](#), [dcAlgoPredict](#)

**Examples**

```
# 1) Prepare an input file containing domain architectures
input.file <-
"http://dcgor.r-forge.r-project.org/data/Feature/Hominidae.txt"

# 2) Do prediction using built-in data
output <- dcAlgoPredictGenome(input.file, RData.HIS="Feature2GOMF.sf",
parallel=FALSE)
dim(output)
output[1:10,]

# 3) Advanced usage: using customised data
x <-
base::load(base::url("http://dcgor.r-forge.r-project.org/data/Feature2GOMF.sf.RData"))
RData.HIS.customised <- Feature2GOMF.sf.RData
base::save(list=x, file=RData.HIS.customised)
#list.files(pattern=*.RData)
## you will see an RData file Feature2GOMF.sf.RData in local directory
output <- dcAlgoPredictGenome(input.file, parallel=FALSE,
RData.HIS.customised=RData.HIS.customised)
```

```
dim(output)
output[1:10,]
```

---

dcAlgoPredictMain	<i>Function to predict ontology terms given an input file containing domain architectures (including individual domains)</i>
-------------------	--

---

## Description

dcAlgoPredictMain is supposed to predict ontology terms given an input file containing domain architectures (including individual domains).

## Usage

```
dcAlgoPredictMain(input.file, output.file = NULL, RData.HIS = c(NA,
"Feature2GOBP.sf", "Feature2GOMF.sf", "Feature2GOCC.sf",
"Feature2HPPA.sf",
"Feature2GOBP.pfam", "Feature2GOMF.pfam", "Feature2GOCC.pfam",
"Feature2HPPA.pfam", "Feature2GOBP.interpro", "Feature2GOMF.interpro",
"Feature2GOCC.interpro", "Feature2HPPA.interpro"), merge.method =
c("sum",
"max", "sequential"), scale.method = c("log", "linear", "none"),
feature.mode = c("supra", "individual", "comb"), slim.level = NULL,
max.num = NULL, parallel = TRUE, multicores = NULL, verbose = T,
RData.HIS.customised = NULL,
RData.location = "http://dcbio.r-forge.r-project.org/data")
```

## Arguments

input.file	an input file containing domain architectures (including individual domains). For example, a file containing UniProt ID and domain architectures for human proteins can be found in <a href="http://dcbio.r-forge.r-project.org/data/Feature/hs.txt">http://dcbio.r-forge.r-project.org/data/Feature/hs.txt</a> . As seen in this example, the input file must contain the header (in the first row) and two columns: 1st column for 'SeqID' (actually these IDs can be anything), 2nd column for 'Architecture' (SCOP domain architectures, each represented as comma-separated domains). Alternatively, the input.file can be a matrix or data frame, assuming that input file has been read. Note: the file should use the tab delimiter as the field separator between columns
output.file	an output file containing predicted results. If not NULL, a tab-delimited text file will be also written out; otherwise, there is no output file (by default)
RData.HIS	RData to load. This RData conveys two bits of information: 1) feature (domain) type; 2) ontology. It stores the hypergeometric scores (hscore) between features (individual domains or consecutive domain combinations) and ontology terms. The RData name tells which domain type and which ontology to use. It can be: SCOP sf domains/combinations (including "Feature2GOBP.sf", "Feature2GOMF.sf", "Feature2GOCC.sf", "Feature2HPPA.sf"), Pfam domains/combinations (including "Feature2GOBP.pfam", "Feature2GOMF.pfam", "Feature2GOCC.pfam", "Feature2HPPA.pfam"), InterPro domains (including "Feature2GOBP.interpro", "Feature2GOMF.interpro", "Feature2GOCC.interpro", "Feature2HPPA.interpro"). If NA, then the user has to input a customised RData-formatted file (see RData.HIS.customised below)

<code>merge.method</code>	the method used to merge predictions for each component feature (individual domains and their combinations derived from domain architecture). It can be one of "sum" for summing up, "max" for the maximum, and "sequential" for the sequential merging. The sequential merging is done via: $\sum_{i=1} \frac{R_i}{i}$ , where $R_i$ is the $i^{th}$ ranked highest hscore
<code>scale.method</code>	the method used to scale the predictive scores. It can be: "none" for no scaling, "linear" for being linearly scaled into the range between 0 and 1, "log" for the same as "linear" but being first log-transformed before being scaled. The scaling between 0 and 1 is done via: $\frac{S-S_{min}}{S_{max}-S_{min}}$ , where $S_{min}$ and $S_{max}$ are the minimum and maximum values for $S$
<code>feature.mode</code>	the mode of how to define the features thereof. It can be: "supra" for combinations of one or two successive domains (including individual domains; considering the order), "individual" for individual domains only, and "comb" for all possible combinations (including individual domains; ignoring the order)
<code>slim.level</code>	whether only slim terms are returned. By default, it is NULL and all predicted terms will be reported. If it is specified as a vector containing any values from 1 to 4, then only slim terms at these levels will be reported. Here is the meaning of these values: '1' for very general terms, '2' for general terms, '3' for specific terms, and '4' for very specific terms
<code>max.num</code>	whether only top terms per sequence are returned. By default, it is NULL and no constraint is imposed. If an integer is specified, then all predicted terms (with scores in a decreasing order) beyond this number will be discarded. Notably, this parameter works after the preceding parameter <code>slim.level</code>
<code>parallel</code>	logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R"); biocLite(c("foreach", "doMC"))</code> . If not yet installed, this option will be disabled
<code>multicores</code>	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled
<code>verbose</code>	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display
<code>RData.HIS.customised</code>	a file name for RData-formatted file containing an object of S3 class 'HIS'. By default, it is NULL. It is only needed when the user wants to perform customised analysis. See <a href="#">dcAlgoPropagate</a> on how this object is created
<code>RData.location</code>	the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as: <code>RData.location = "."</code> . If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

**Value**

a data frame containing three columns: 1st column the same as the input file (e.g. 'SeqID'), 2nd for 'Term' (predicted ontology terms), 3rd for 'Score' (along with predicted scores)

**Note**

When 'output.file' is specified, a tab-delimited text file is written out, with the column names: 1st column the same as the input file (e.g. 'SeqID'), 2nd for 'Term' (predicted ontology terms), 3rd for 'Score' (along with predicted scores)

**See Also**

[dcRDataLoader](#), [dcAlgoPropagate](#), [dcAlgoPredict](#)

**Examples**

```
# 1) Prepare an input file containing domain architectures
input.file <- "http://dcbio.r-forge.r-project.org/data/Feature/hs.txt"

# 2) Do prediction using built-in data
output <- dcAlgoPredictMain(input.file, RData.HIS="Feature2GOMF.sf",
parallel=FALSE)
output[1:5,]

# 3) Advanced usage: using customised data
x <-
base::load(base::url("http://dcbio.r-forge.r-project.org/data/Feature2GOMF.sf.RData"))
RData.HIS.customised <- Feature2GOMF.sf.RData
base::save(list=x, file=RData.HIS.customised)
#list.files(pattern=*.RData)
## you will see an RData file Feature2GOMF.sf.RData in local directory
output <- dcAlgoPredictMain(input.file, parallel=FALSE,
RData.HIS.customised=RData.HIS.customised)
output[1:5,]
```

---

dcAlgoPredictPR

*Function to assess the prediction performance via Precision-Recall (PR) analysis*

---

**Description**

dcAlgoPredictPR is supposed to assess the prediction performance via Precision-Recall (PR) analysis. It requires two input files: 1) a Glod Standard Positive (GSP) file containing known annotations between proteins/genes and ontology terms; 2) a prediction file containing predicted terms for proteins/genes. Note: the known annotations will be recursively propagated towards the root of the ontology.

**Usage**

```
dcAlgoPredictPR(GSP.file, prediction.file, ontology = c(NA, "GOBP",
"GOMF",
"GOCC", "DO", "HPPA", "HPMI", "HPON", "MP", "EC", "KW", "UP"),
```



```
num.threshold = 10, bin = c("uniform", "quantile"), verbose = T,
RData.ontology.customised = NULL,
RData.location = "http://dcgor.r-forge.r-project.org/data")
```

## Arguments

- |                           |   |
|---------------------------|---|
| GSP.file                  | a Glod Standard Positive (GSP) file containing known annotations between proteins/genes and ontology terms. For example, a file containing annotations between human genes and HP terms can be found in <a href="http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt">http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt</a> . As seen in this example, the input file must contain the header (in the first row) and two columns: 1st column for 'SeqID' (actually these IDs can be anything), 2nd column for 'termID' (HP terms). Alternatively, the GSP.file can be a matrix or data frame, assuming that GSP file has been read. Note: the file should use the tab delimiter as the field separator between columns  |
| prediction.file           | a prediction file containing proteins/genes, their predicted terms along with predictive scores. As seen in an example below, this file is usually created via <a href="#">dcAlgoPredictMain</a> , containing three columns: 1st column for 'SeqID' (actually these IDs can be anything), 2nd column for 'Term' (ontology terms), 3rd column for 'Score' (predictive score). Alternatively, the prediction.file can be a matrix or data frame, assuming that prediction file has been read. Note: the file should use the tab delimiter as the field separator between columns  |
| ontology                  | the ontology identity. It can be "GOBP" for Gene Ontology Biological Process, "GOMF" for Gene Ontology Molecular Function, "GOCC" for Gene Ontology Cellular Component, "DO" for Disease Ontology, "HPPA" for Human Phenotype Phenotypic Abnormality, "HPMI" for Human Phenotype Mode of Inheritance, "HPON" for Human Phenotype ONset and clinical course, "MP" for Mammalian Phenotype, "EC" for Enzyme Commission, "KW" for UniProtKB KeyWords, "UP" for UniProtKB UniPathway. For details on the eligibility for pairs of input domain and ontology, please refer to the online Documentations at <a href="http://supfam.org/dcGOR/docs.html">http://supfam.org/dcGOR/docs.html</a> . If NA, then the user has to input a customised RData-formatted file (see RData.ontology.customised below) |
| num.threshold             | an integer to specify how many PR points (as a function of the score threshold) will be calculated  |
| bin                       | how to bin the scores. It can be "uniform" for binning scores with equal interval (ie with uniform distribution), and 'quantile' for binning scores with equal frequency (ie with equal number)   |
| verbose                   | logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display   |
| RData.ontology.customised | a file name for RData-formatted file containing an object of S4 class 'Onto' (i.g. ontology). By default, it is NULL. It is only needed when the user wants to perform customised analysis using their own ontology. See <a href="#">dcBuildOnto</a> for how to creat this object   |
| RData.location            | the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase  |

the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as: `RData.location = "."`. If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

### Value

a data frame containing two columns: 1st column 'Precision' for precision, 2nd 'Recall' for recall. The row has the names corresponding to the score threshold.

### Note

Prediction coverage: the ratio between predicted targets in number and GSP targets in number  
F-measure: the maximum of a harmonic mean between precision and recall along PR curve

### See Also

[dcRDataLoader](#), [dcConverter](#), [dcDuplicated](#), [dcAlgoPredictMain](#)

### Examples

```
# 1) Generate prediction file with HPPA predictions for human genes
architecture.file <-
"http://dcgor.r-forge.r-project.org/data/Algo/SCOP_architecture.txt"
prediction.file <- "SCOP_architecture.HPPA_predicted.txt"
res <- dcAlgoPredictMain(input.file=architecture.file,
output.file=prediction.file, RData.HIS="Feature2HPPA.sf",
parallel=FALSE)

# 2) Calculate Precision and Recall
GSP.file <- "http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt"
res_PR <- dcAlgoPredictPR(GSP.file=GSP.file,
prediction.file=prediction.file, ontology="HPPA")
res_PR

# 3) Plot PR-curve
plot(res_PR[,2], res_PR[,1], xlim=c(0,1), ylim=c(0,1), type="b",
xlab="Recall", ylab="Precision")
```

---

dcAlgoPropagate

---

*Function to propagate ontology annotations according to an input file*


---

### Description

dcAlgoPropagate is supposed to propagate ontology annotations, given an input file. This input file contains original annotations between domains/features and ontology terms, along with the hypergeometric scores (hscore) in support for their annotations. The annotations are propagated to the ontology root (either retaining the maximum hscore or additively accumulating the hscore). After the propagation, the ontology terms of increasing levels are determined based on the concept of Information Content (IC) to product a slim version of ontology. It returns an object of S3 class "HIS" with three components: "hscore", "ic" and "slim".

## Usage

```
dcAlgoPropagate(input.file, ontology = c(NA, "GOBP", "GOMF", "GOCC",
"DO",
"HPPA", "HPMI", "HPON", "MP", "EC", "KW", "UP"), propagation = c("max",
"sum"), output.file = "HIS.RData", verbose = T,
RData.ontology.customised = NULL,
RData.location = "http://dcgor.r-forge.r-project.org/data")
```

## Arguments

- |                           |   |
|---------------------------|---|
| input.file                | an input file used to build the object. This input file contains original annotations between domains/features and ontology terms, along with the hypergeometric scores (hscore) in support for their annotations. For example, a file containing original annotations between SCOP domain architectures and GO terms can be found in <a href="http://dcgor.r-forge.r-project.org/data/Feature/Feature2G0.sf.txt">http://dcgor.r-forge.r-project.org/data/Feature/Feature2G0.sf.txt</a> . As seen in this example, the input file must contain the header (in the first row) and three columns: 1st column for 'Feature_id' (here SCOP domain architectures), 2nd column for 'Term_id' (GO terms), and 3rd column for 'Score' (hscore). Alternatively, the input.file can be a matrix or data frame, assuming that input file has been read. Note: the file should use the tab delimiter as the field separator between columns |
| ontology                  | the ontology identity. It can be "GOBP" for Gene Ontology Biological Process, "GOMF" for Gene Ontology Molecular Function, "GOCC" for Gene Ontology Cellular Component, "DO" for Disease Ontology, "HPPA" for Human Phenotype Phenotypic Abnormality, "HPMI" for Human Phenotype Mode of Inheritance, "HPON" for Human Phenotype ONset and clinical course, "MP" for Mammalian Phenotype, "EC" for Enzyme Commission, "KW" for UniProtKB KeyWords, "UP" for UniProtKB UniPathway. For details on the eligibility for pairs of input domain and ontology, please refer to the online Documentations at <a href="http://supfam.org/dcGOR/docs.html">http://supfam.org/dcGOR/docs.html</a> . If NA, then the user has to input a customised RData-formatted file (see RData.ontology.customised below)   |
| propagation               | how to propagate the score. It can be "max" for retaining the maximum hscore (by default), "sum" for additively accumulating the hscore   |
| output.file               | an output file used to save the HIS object as an RData-formatted file (see 'Value' for details). If NULL, this file will be saved into "HIS.RData" in the current working local directory. If NA, there will be no output file  |
| verbose                   | logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display   |
| RData.ontology.customised | a file name for RData-formatted file containing an object of S4 class 'Onto' (i.g. ontology). By default, it is NULL. It is only needed when the user wants to perform customised analysis using their own ontology. See <a href="#">dcBuildOnto</a> for how to creat this object   |
| RData.location            | the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first  |

downloaded into your current working directory, and then set this option as: `RData.location = "."`. If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

### Value

an object of S3 class HIS, with following components:

- `hscore`: a list of features, each with a term-named vector containing hscore
- `ic`: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- `slim`: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

### Note

None

### See Also

[dcRDataLoader](#), [dcConverter](#), [dcAlgo](#), [dcList2Matrix](#)

### Examples

```
# build an "HIS" object for GO Molecular Function
input.file <-
"http://dcgor.r-forge.r-project.org/data/Feature/Feature2GO.sf.txt"
Feature2GOMF.sf <- dcAlgoPropagate(input.file=input.file,
ontology="GOMF", output.file="Feature2GOMF.sf.RData")
names(Feature2GOMF.sf)
Feature2GOMF.sf$hscore[1]
Feature2GOMF.sf$ic[1:10]
Feature2GOMF.sf$slim[1]

# extract hscore as a matrix with 3 columns (Feature_id, Term_id, Score)
hscore <- Feature2GOMF.sf$hscore
hscore_mat <- dcList2Matrix(hscore)
colnames(hscore_mat) <- c("Feature_id", "Term_id", "Score")
dim(hscore_mat)
hscore_mat[1:10,]
```

## Description

dcAncestralML is supposed to reconstruct ancestral discrete states using fast maximum likelihood algorithm. It takes inputs both the phylo-formatted tree and discrete states in the tips. The algorithm assumes that state changes can be described by a probabilistic reversible model. It first determines transition matrix between states (also considering branch lengths), then uses dynamic programming (from tips to the root) to estimate conditional maximum likelihood, and finally reconstructs the ancestral states (from the root to tips). If the ties occur at the root, the state at the root is set to the last state in ties (for example, usually being 'present' for 'present'-'absent' two states).

## Usage

```
dcAncestralML(data, phy, transition.model = c("different", "symmetric",
"same", "customised"), customised.model = NULL, edge.length.power = 1,
initial.estimate = 0.1, output.detail = F, parallel = T,
multicores = NULL, verbose = T)
```

## Arguments

- |                   |   |
|-------------------|---|
| data              | an input data matrix storing discrete states for tips (in rows) X characters (in columns). The rows in the matrix are for tips. If the row names do not exist, then addumedly they have the same order as in the tree tips. More wisely, users provide row names which can be matched to the tip labels of the tree. The row names can be more than found in the tree labels, and they should contain all those in the tree labels        |
| phy               | an object of class 'phylo'  |
| transition.model  | a character specifying the transition model. It can be: "different" for all-transition-different model (such as <i>matrix(c(0, 1, 2, 0), 2)</i> ), "symmetric" for the symmetric model (such as <i>matrix(c(0, 1, 1, 0), 2)</i> or <i>matrix(c(0, 1, 2, 1, 0, 3, 2, 3, 0), 3)</i> ), "same" for all-transition-same model (such as <i>matrix(c(0, 1, 1, 0), 2)</i> ), "customised" for the user-customised model (see the next parameter) |
| customised.model  | a matrix customised for the transition model. It can be: <i>matrix(c(0, 1, 1, 0), 2)</i> , <i>matrix(c(0, 1, 2, 0), 2)</i> , or <i>matrix(c(0, 1, 2, 1, 0, 3, 2, 3, 0), 3)</i>  |
| edge.length.power | a non-negative value giving the exponent transformation of the branch lengths. It is useful when determining transition matrix between states   |
| initial.estimate  | the initial value used for the maximum likelihood estimation  |
| output.detail     | logical to indicate whether the output is returned as a detailed list. If TRUE, a nested list is returned: a list of characters (corresponding to columns of input data matrix), in which each element is a list consisting of three components ("states", "transition" and "relative"). If FALSE, a matrix is returned: the columns respond to the input data columns, and rows responding to all node index in the phylo-formatted tree |
| parallel          | logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R");</code>                       |

	biocLite(c("foreach", "doMC")). If not yet installed, this option will be disabled
multicores	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

### Value

It depends on the 'output.detail'. If FALSE (by default), a matrix is returned, with the columns responding to the input data columns, and rows responding to node index in the phylo-formatted tree. If TRUE, a nested list is returned. Outer-most list is for characters (corresponding to columns of input data matrix), in which each element is a list (inner-most) consisting of three components ("states", "transition" and "relative"):

- states: a named vector storing states (extant and ancestral states)
- transition: an estimated transition matrix between states
- relative: a matrix of nodes X states, storing conditional maximum likelihood being relative to each state

### Note

This fast dynamic programming for ancestral discrete state reconstruction is partially inspired by a joint estimation procedure as described in <http://mbe.oxfordjournals.org/content/17/6/890.full>

### See Also

[dcAncestralMP](#), [dcDuplicated](#)

### Examples

```
# 1) a newick tree that is imported as a phylo-formatted tree
tree <- "(((t1:5,t2:5):2,(t3:4,t4:4):3):2,(t5:4,t6:4):6);"
phy <- ape::read.tree(text=tree)

# 2) an input data matrix storing discrete states for tips (in rows) X four characters (in columns)
data1 <- matrix(c(0,rep(1,3),rep(0,2)), ncol=1)
data2 <- matrix(c(rep(0,4),rep(1,2)), ncol=1)
data <- cbind(data1, data1, data1, data2)
colnames(data) <- c("C1", "C2", "C3", "C4")
## reconstruct ancestral states, without detailed output
res <- dcAncestralML(data, phy, parallel=FALSE)
res

# 3) an input data matrix storing discrete states for tips (in rows) X only one character
data <- matrix(c(0,rep(1,3),rep(0,2)), ncol=1)
## reconstruct ancestral states, with detailed output
res <- dcAncestralML(data, phy, parallel=FALSE, output.detail=TRUE)
res
## get the inner-most list
res <- res[[1]]
## visualise the tree with ancestral states and their conditional probability
```

```

Ntip <- ape::Ntip(phy)
Nnode <- ape::Nnode(phy)
color <- c("white", "gray")
## visualise main tree
ape::plot.phylo(phy, type="p", use.edge.length=TRUE, label.offset=1,
show.tip.label=TRUE, show.node.label=FALSE)
## visualise tips (state 1 in gray, state 0 in white)
x <- data[,1]
ape::tiplabels(pch=22, bg=color[as.numeric(x)+1], cex=2, adj=1)
## visualise internal nodes
### thermo bar to illustrate relative probability (state 1 in gray, state 0 in white)
ape::nodelabels(thermo=res$relative[Ntip+1:Nnode,2:1],
piecol=color[2:1], cex=0.75)
### labeling reconstructed ancestral states
ape::nodelabels(text=res$states[Ntip+1:Nnode], node=Ntip+1:Nnode,
frame="none", col="red", bg="transparent", cex=0.75)

```

dcAncestralMP

*Function to reconstruct ancestral discrete states using maximum parsimony algorithm*

## Description

dcAncestralMP is supposed to reconstruct ancestral discrete states using a maximum parsimony-modified Fitch algorithm. In a from-tip-to-root manner, ancestral state for an internal node is determined if a state is shared in a majority by all its children. If two or more states in a majority are equally shared, this internal node is temporarily marked as an unknown tie, which is further resolved in a from-root-to-tip manner: always being the same state as its direct parent holds. If the ties also occur at the root, the state at the root is set to the last state in ties (for example, usually being 'present' for 'present'-'absent' two states).

## Usage

```
dcAncestralMP(data, phy, output.detail = F, parallel = T,
multicores = NULL, verbose = T)
```

## Arguments

data	an input data matrix/frame storing discrete states for tips (in rows) X characters (in columns). The rows in the matrix are for tips. If the row names do not exist, then addumedly they have the same order as in the tree tips. More wisely, users provide row names which can be matched to the tip labels of the tree. The row names can be more than found in the tree labels, and they should contain all those in the tree labels
phy	an object of class 'phylo'
output.detail	logical to indicate whether the output is returned as a detailed list. If TRUE, a nested list is returned: a list of characters (corresponding to columns of input data matrix), in which each element is a list consisting of three components ("states", "transition" and "relative"). If FALSE, a matrix is returned: the columns respond to the input data columns, and rows responding to all node index in the phylo-formatted tree

parallel	logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R"); biocLite(c("foreach", "doMC"))</code> . If not yet installed, this option will be disabled
multicores	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

### Value

It depends on the 'output.detail'. If FALSE (by default), a matrix is returned, with the columns responding to the input data columns, and rows responding to node index in the phylo-formatted tree. If TRUE, a nested list is returned. Outer-most list is for characters (corresponding to columns of input data matrix), in which each element is a list (inner-most) consisting of three components ("states", "transition" and "relative"):

- states: a named vector storing states (extant and ancestral states)
- transition: a posterior transition matrix between states
- relative: a matrix of nodes X states, storing relative probability

### Note

This maximum parsimony algorithm for ancestral discrete state reconstruction is attributable to the basic idea as described in <http://sysbio.oxfordjournals.org/content/20/4/406.short>

### See Also

[dcAncestralML](#), [dcTreeConnectivity](#), [dcDuplicated](#)

### Examples

```
# 1) a newick tree that is imported as a phylo-formatted tree
tree <- "(((t1:5,t2:5):2,(t3:4,t4:4):3):2,(t5:4,t6:4):6);"
phy <- ape::read.tree(text=tree)

# 2) an input data matrix storing discrete states for tips (in rows) X four characters (in columns)
data1 <- matrix(c(0,rep(1,3),rep(0,2)), ncol=1)
data2 <- matrix(c(rep(0,4),rep(1,2)), ncol=1)
data <- cbind(data1, data1, data1, data2)
colnames(data) <- c("C1", "C2", "C3", "C4")
## reconstruct ancestral states, without detailed output
res <- dcAncestralMP(data, phy, parallel=FALSE)
res

# 3) an input data matrix storing discrete states for tips (in rows) X only one character
data <- matrix(c(0,rep(1,3),rep(0,2)), ncol=1)
## reconstruct ancestral states, with detailed output
res <- dcAncestralMP(data, phy, parallel=FALSE, output.detail=TRUE)
res
```



```

## get the inner-most list
res <- res[[1]]
## visualise the tree with ancestral states and their conditional probability
Ntip <- ape::Ntip(phy)
Nnode <- ape::Nnode(phy)
color <- c("white", "gray")
## visualise main tree
ape::plot.phylo(phy, type="p", use.edge.length=TRUE, label.offset=1,
show.tip.label=TRUE, show.node.label=FALSE)
## visualise tips (state 1 in gray, state 0 in white)
x <- data[,1]
ape::tiplabels(pch=22, bg=color[as.numeric(x)+1], cex=2, adj=1)
## visualise internal nodes
### thermo bar to illustrate relative probability (state 1 in gray, state 0 in white)
ape::nodelabels(thermo=res$relative[Ntip+1:Nnode,2:1],
piecol=color[2:1], cex=0.75)
### labeling reconstructed ancestral states
ape::nodelabels(text=res$states[Ntip+1:Nnode], node=Ntip+1:Nnode,
frame="none", col="red", bg="transparent", cex=0.75)

```

---

dcBuildAnno

---

*Function to build an object of the S4 class Anno from input files*


---

## Description

dcBuildAnno is supposed to build an object of the S4 class [Anno](#), given input files. These input files include 1) a file containing domain information, 2) a file containing term information, and 3) a file containing associations between domains and terms.

## Usage

```
dcBuildAnno(domain_info.file, term_info.file, association.file,
output.file = "Anno.RData")
```

## Arguments

domain\_info.file

an input file containing domain information. For example, a file containing InterPro domains (InterPro) can be found in <http://dcbio.r-forge.r-project.org/data/InterPro/InterPro.txt>. As seen in this example, the input file must contain the header (in the first row), and entries in the first column intend to be domain ID (and must be unique). Note: the file should use the tab delimiter as the field separator between columns

term\_info.file

an input file containing term information. For example, a file containing Gene Ontology (GO) terms can be found in <http://dcbio.r-forge.r-project.org/data/InterPro/GO.txt>. As seen in this example, the input file must contain the header (in the first row) and four columns: 1st column for term ID (must be unique), 2nd column for term name, 3rd column for term namespace, and 4th column for term distance. These four columns must be provided, but the content for the last column can be arbitrary (if it is hard to prepare). Note: the file should use the tab delimiter as the field separator between columns

`association.file`

an input file containing associations between domains and terms. For example, a file containing associations between InterPro domains and GO Molecular Function (GOMF) terms can be found in <http://dcgor.r-forge.r-project.org/data/InterPro/Domain2GOMF.txt>. As seen in this example, the input file must contain the header (in the first row) and two columns: 1st column for domain ID (corresponding to the first column in 'domain\_info.file'), 2nd column for term ID (corresponding to the first column in 'term\_info.file'). If there are additional columns, these columns will be ignored. Note: the file should use the tab delimiter as the field separator between columns

`output.file`

an output file used to save the built object as an RData-formatted file. If NULL, this file will be saved into "Anno.RData" in the current working local directory

### Value

Any use-specified variable that is given on the right side of the assignment sign '<-', which contains the built Anno object. Also, an RData file specified in "output.file" is saved in the local directory.

### Note

If there are no use-specified variable that is given on the right side of the assignment sign '<-', then no object will be loaded onto the working environment.

### See Also

[Anno](#)

### Examples

```
# build an "Anno" object that contains SCOP domain superfamilies (sf) annotated by GOBP terms
InterPro2GOMF <-
dcBuildAnno(domain_info.file="http://dcgor.r-forge.r-project.org/data/InterPro/InterPro.txt",
term_info.file="http://dcgor.r-forge.r-project.org/data/InterPro/GO.txt",
association.file="http://dcgor.r-forge.r-project.org/data/InterPro/Domain2GOMF.txt",
output.file="InterPro2GOMF.RData")
InterPro2GOMF
```

---

<code>dcBuildInfoDataFrame</code>	<i>Function to build an object of the S4 class <code>InfoDataframe</code> from an input file</i>
-----------------------------------	--

---

### Description

`dcBuildInfoDataFrame` is supposed to build an object of the S4 class [InfoDataFrame](#), given an input file. This input file can, for example, contain the domain information.

### Usage

```
dcBuildInfoDataFrame(input.file, output.file = "InfoDataFrame.RData")
```

**Arguments**

input.file	an input file used to build the object. For example, a file containing InterPro domains (InterPro) can be found in <a href="http://dcgor.r-forge.r-project.org/data/InterPro/InterPro.txt">http://dcgor.r-forge.r-project.org/data/InterPro/InterPro.txt</a> . As seen in this example, the input file must contain the header (in the first row), and entries in the first column intend to be domain identities (and must be unique). Note: the file should use the tab delimiter as the field separator between columns
output.file	an output file used to save the built object as an RData-formatted file. If NULL, this file will be saved into "InfoDataFrame.RData" in the current working local directory

**Value**

Any use-specified variable that is given on the right side of the assignment sign '`<-`', which contains the built `dcBuildInfoDataFrame` object. Also, an RData file specified in "output.file" is saved in the local directory.

**Note**

If there are no use-specified variable that is given on the right side of the assignment sign '`<-`', then no object will be loaded onto the working environment.

**See Also**

[InfoDataFrame](#)

**Examples**

```
# build an "InfoDataFrame" object that contains information on InterPro domains (InterPro)
InterPro <-
dcBuildInfoDataFrame(input.file="http://dcgor.r-forge.r-project.org/data/InterPro/InterPro.txt",
output.file="InterPro.RData")
InterPro
```

---

dcBuildOnto

---

*Function to build an object of the S4 class `Onto` from input files*


---

**Description**

`dcBuildOnto` is supposed to build an object of the S4 class [Onto](#), given input files. These input files include 1) a file containing term relations, and 2) a file containing term/node information.

**Usage**

```
dcBuildOnto(relations.file, nodes.file, output.file = "Onto.RData")
```

## Arguments

- `relations.file` an input file containing term relations (i.e. edges from parent terms to child terms). For example, a file containing relations between GO Molecular Function (GOMF) terms can be found in [http://drgor.r-forge.r-project.org/data/onto/igraph\\_GOMF\\_edges.txt](http://drgor.r-forge.r-project.org/data/onto/igraph_GOMF_edges.txt). As seen in this example, the input file must contain the header (in the first row) and two columns: 1st column for parent term ID, and 2nd column for child term ID. Note: the file should use the tab delimiter as the field separator between columns
- `nodes.file` an input file containing term/node information. For example, a file containing GO Molecular Function (GOMF) terms can be found in [http://drgor.r-forge.r-project.org/data/onto/igraph\\_GOMF\\_nodes.txt](http://drgor.r-forge.r-project.org/data/onto/igraph_GOMF_nodes.txt). As seen in this example, the input file must contain the header (in the first row) and five columns: 1st column 'name' for node names (actually term ID; must be unique), 2nd column 'term\_id' for term ID, 3rd 'term\_name' for term name, 4th column 'term\_namespace' for term namespace, and 5th column 'term\_distance' for term distance. These five columns must be provided, the content in the first two columns are identical, and the content for the last column can be arbitrary (if it is hard to prepare). Note: the file should use the tab delimiter as the field separator between columns
- `output.file` an output file used to save the built object as an RData-formatted file. If NULL, this file will be saved into "Onto.RData" in the current working local directory

## Value

Any use-specified variable that is given on the right side of the assignment sign '`<-`', which contains the built `Onto` object. Also, an RData file specified in "output.file" is saved in the local directory.

## Note

If there are no use-specified variable that is given on the right side of the assignment sign '`<-`', then no object will be loaded onto the working environment.

## See Also

[Onto](#)

## Examples

```
# build an "Onto" object for GO Molecular Function
onto.GOMF <-
dcBuildOnto(relations.file="http://drgor.r-forge.r-project.org/data/onto/igraph_GOMF_edges.txt",
nodes.file="http://drgor.r-forge.r-project.org/data/onto/igraph_GOMF_nodes.txt",
output.file="onto.GOMF.RData")
onto.GOMF
```

---

dcConverter	<i>Function to convert an object between graph classes</i>
-------------	--

---

## Description

dcConverter is supposed to convert an object between classes 'Onto' and 'igraph', or between 'Dnetwork' and 'igraph', or between 'Cnetwork' and 'igraph'.

## Usage

```
dcConverter(obj, from = c("Onto", "igraph", "Dnetwork", "Cnetwork"),
to = c("igraph", "Onto", "Dnetwork", "Cnetwork"), verbose = TRUE)
```

## Arguments

obj	an object of class "Onto", "igraph", "Dnetwork" or "Cnetwork"
from	a character specifying the class converted from. It can be one of "Onto", "igraph", "Dnetwork" and "Dnetwork"
to	a character specifying the class converted to. It can be one of "Onto", "igraph", "Dnetwork" and "Dnetwork"
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to true for display

## Value

an object of class "Onto", "igraph", "Dnetwork" or "Cnetwork"

## Note

Conversion is also supported between classes 'Onto' and 'igraph', or between 'Dnetwork' and 'igraph', or between 'Cnetwork' and 'igraph'

## See Also

[dcRDataLoader](#), [Onto-class](#), [Dnetwork-class](#), [Cnetwork-class](#)

## Examples

```
# 1) conversion between Onto and igraph
# 1a) load onto.GOMF (as Onto object)
on <- dcRDataLoader(onto.GOMF)
on
# 1b) convert the object from Onto to igraph class
ig <- dcConverter(on, from=Onto, to=igraph)
ig
# 1c) convert the object from igraph to Onto class
dcConverter(ig, from=igraph, to=Onto)

# 2) conversion between Dnetwork and igraph
# 2a) computer a domain semantic network (as Dnetwork object)
g <- dcRDataLoader(onto.GOMF)
Anno <- dcRDataLoader(SCOP.sf2GOMF)
```

```

dag <- dcDAGannotate(g, annotations=Anno, path.mode="shortest_paths",
verbose=FALSE)
alldomains <- unique(unlist(nInfo(dag)$annotations))
domains <- sample(alldomains,5) # randomly sample 5 domains
dnetwork <- dcDAGdomainSim(g=dag, domains=domains,
method.domain="BM.average", method.term="Resnik", parallel=FALSE,
verbose=FALSE)
dnetwork
# 2b) convert the object from Dnetwork to igraph class
ig <- dcConverter(dnetwork, from=Dnetwork, to=igraph)
ig
# 2c) convert the object from igraph to Dnetwork class
dcConverter(ig, from=igraph, to=Dnetwork)

```

---

dcDAGannotate	<i>Function to generate a subgraph of a direct acyclic graph (DAG) induced by the input annotation data</i>
---------------	---

---

## Description

dcDAGannotate is supposed to produce a subgraph induced by the input annotation data, given a direct acyclic graph (DAG; an ontology). The input is a graph of "igraph" or "Onto" object, a list of the vertices containing annotation data, and the mode defining the paths to the root of DAG. The induced subgraph contains vertices (with annotation data) and their ancestors along with the defined paths to the root of DAG. The annotations at these vertices (including their ancestors) are also updated according to the true-path rule: a domain annotated to a term should also be annotated by its all ancestor terms.

## Usage

```

dcDAGannotate(g, annotations, path.mode = c("all_paths",
"shortest_paths",
"all_shortest_paths"), verbose = TRUE)

```

## Arguments

<code>g</code>	an object of class "igraph" or <a href="#">Onto</a>
<code>annotations</code>	an object of class <a href="#">Anno</a> , that is, the vertices/nodes for which annotation data are provided
<code>path.mode</code>	the mode of paths induced by vertices/nodes with input annotation data. It can be "all_paths" for all possible paths to the root, "shortest_paths" for only one path to the root (for each node in query), "all_shortest_paths" for all shortest paths to the root (i.e. for each node, find all shortest paths with the equal lengths)
<code>verbose</code>	logical to indicate whether the messages will be displayed in the screen. By default, it sets to true for display

## Value

- `subg`: an induced subgraph, an object of class "igraph" or "Onto" (the same as input). In addition to the original attributes to nodes and edges, the return subgraph is also appended by new node attributes: "annotations", which contains a list of domains either as original annotations or inherited annotations; "IC", which stands for information content defined as negative 10-based log-transformed frequency of domains annotated to that term.

**Note**

For the mode "shortest\_paths", the induced subgraph is the most concise, and thus informative for visualisation when there are many nodes in query, while the mode "all\_paths" results in the complete subgraph.

**See Also**

[dcRDataLoader](#), [dcEnrichment](#), [dcDAGdomainSim](#), [dcConverter](#)

**Examples**

```
# 1) load onto.GOMF (as Onto object)
g <- dcRDataLoader(onto.GOMF)

# 2) load SCOP superfamilies annotated by GOMF (as Anno object)
Anno <- dcRDataLoader(SCOP.sf2GOMF)

# 3) prepare for annotation data
# randomly select 5 terms vertices (and their annotation data)
annotations <- Anno[,sample(1:dim(Anno)[2], 5)]

# 4) obtain the induced subgraph according to the input annotation data
# 4a) based on all possible paths (i.e. the complete subgraph induced)
dcDAGannotate(g, annotations, path.mode="all_paths", verbose=TRUE)
# 4b) based on shortest paths (i.e. the most concise subgraph induced)
dag <- dcDAGannotate(g, annotations, path.mode="shortest_paths",
verbose=TRUE)

# 5) color-code nodes/terms according to the number of annotations
if(class(dag)==Onto) dag <- dcConverter(dag, from=Onto,
to=igraph)
data <- sapply(V(dag)$annotations, length)
names(data) <- V(dag)$name
dnet::visDAG(g=dag, data=data, node.info="both")
```

---

dcDAGdomainSim

*Function to calculate pair-wise semantic similarity between domains based on a direct acyclic graph (DAG) with annotated data*

---

**Description**

dcDAGdomainSim is supposed to calculate pair-wise semantic similarity between domains based on a direct acyclic graph (DAG) with annotated data. It first calculates semantic similarity between terms and then derives semantic similarity between domains from terms-term semantic similarity. Parallel computing is also supported for Linux or Mac operating systems.

**Usage**

```
dcDAGdomainSim(g, domains = NULL, method.domain = c("BM.average",
"BM.max",
"BM.complete", "average", "max"), method.term = c("Resnik", "Lin",
"Schlicker", "Jiang", "Pesquita"), force = TRUE, fast = TRUE,
parallel = TRUE, multicores = NULL, verbose = TRUE)
```

## Arguments

<code>g</code>	an object of class "igraph" or <a href="#">Onto</a> . It must contain a node attribute called 'annotations' for storing annotation data (see example for howto)
<code>domains</code>	the domains between which pair-wise semantic similarity is calculated. If NULL, all domains annotatable in the input dag will be used for calculation, which is very prohibitively expensive!
<code>method.domain</code>	the method used for how to derive semantic similarity between domains from semantic similarity between terms. It can be "average" for average similarity between any two terms (one from domain 1, the other from domain 2), "max" for the maximum similarity between any two terms, "BM.average" for best-matching (BM) based average similarity (i.e. for each term of either domain, first calculate maximum similarity to any term in the other domain, then take average of maximum similarity; the final BM-based average similarity is the pre-calculated average between two domains in pair), "BM.max" for BM based maximum similarity (i.e. the same as "BM.average", but the final BM-based maximum similarity is the maximum of the pre-calculated average between two domains in pair), "BM.complete" for BM-based complete-linkage similarity (inspired by complete-linkage concept: the least of any maximum similarity between a term of one domain and a term of the other domain). When comparing BM-based similarity between domains, "BM.average" and "BM.max" are sensitive to the number of terms involved; instead, "BM.complete" is much robust in this aspect. By default, it uses "BM.average".
<code>method.term</code>	the method used to measure semantic similarity between terms. It can be "Resnik" for information content (IC) of most informative common ancestor (MICA) (see <a href="http://arxiv.org/pdf/cmp-lg/9511007.pdf">http://arxiv.org/pdf/cmp-lg/9511007.pdf</a> ), "Lin" for $2 \cdot \text{IC}$ at MICA divided by the sum of IC at pairs of terms (see <a href="http://webdocs.cs.ualberta.ca/~lindek/papers/sim.pdf">http://webdocs.cs.ualberta.ca/~lindek/papers/sim.pdf</a> ), "Schlicker" for weighted version of 'Lin' by the $1 - \text{prob}(\text{MICA})$ (see <a href="http://www.ncbi.nlm.nih.gov/pubmed/16776819">http://www.ncbi.nlm.nih.gov/pubmed/16776819</a> ), "Jiang" for $1 - \text{difference between the sum of IC at pairs of terms and } 2 \cdot \text{IC at MICA}$ (see <a href="http://arxiv.org/pdf/cmp-lg/9709008.pdf">http://arxiv.org/pdf/cmp-lg/9709008.pdf</a> ), "Pesquita" for graph information content similarity related to Tanimoto-Jacard index (ie. summed information content of common ancestors divided by summed information content of all ancestors of term1 and term2 (see <a href="http://www.ncbi.nlm.nih.gov/pubmed/18460186">http://www.ncbi.nlm.nih.gov/pubmed/18460186</a> ))
<code>force</code>	logical to indicate whether the only most specific terms (for each domain) will be used. By default, it sets to true. It is always advisable to use this since it is computationally fast but without compromising accuracy (considering the fact that true-path-rule has been applied when running <a href="#">dcDAGannotate</a> )
<code>fast</code>	logical to indicate whether a vectorised fast computation is used. By default, it sets to true. It is always advisable to use this vectorised fast computation; since the conventional computation is just used for understanding scripts
<code>parallel</code>	logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R"); biocLite(c("foreach", "doMC"))</code> . If not yet installed, this option will be disabled
<code>multicores</code>	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled



verbose            logical to indicate whether the messages will be displayed in the screen. By default, it sets to true for display

### Value

an object of S4 class [Dnetwork](#). It is a weighted and undirect graph, with following slots:

- nodeInfo: an object of S4 class, describing information on nodes/domains
- adjMatrix: an object of S4 class [AdjData](#), containing symmetric adjacency data matrix for pair-wise semantic similarity between domains

### Note

For the mode "shortest\_paths", the induced subgraph is the most concise, and thus informative for visualisation when there are many nodes in query, while the mode "all\_paths" results in the complete subgraph.

### See Also

[dcRDataLoader](#), [dcDAGannotate](#), [dcConverter](#), [Dnetwork-class](#)

### Examples

```
# 1) Semantic similarity between SCOP domain superfamilies (sf)
## 1a) load onto.GOMF (as Onto object)
g <- dcRDataLoader(onto.GOMF)
## 1b) load SCOP superfamilies annotated by GOMF (as Anno object)
Anno <- dcRDataLoader(SCOP.sf2GOMF)
## 1c) prepare for ontology appended with annotation information
dag <- dcDAGannotate(g, annotations=Anno, path.mode="shortest_paths",
verbose=FALSE)
## 1d) calculate pair-wise semantic similarity between 8 randomly chosen domains
alldomains <- unique(unlist(nInfo(dag)$annotations))
domains <- sample(alldomains,8)
dnetwork <- dcDAGdomainSim(g=dag, domains=domains,
method.domain="BM.average", method.term="Resnik", parallel=FALSE,
verbose=TRUE)
dnetwork
## 1e) convert it to an object of class igraph
ig <- dcConverter(dnetwork, from=Dnetwork, to=igraph)
ig
## 1f) visualise the domain network
### extract edge weight (with 2-digit precision)
x <- signif(E(ig)$weight, digits=2)
### rescale into an interval [1,4] as edge width
edge.width <- 1 + (x-min(x))/(max(x)-min(x))*3
### do visualisation
dnet::visNet(g=ig, vertex.shape="sphere", edge.width=edge.width,
edge.label=x, edge.label.cex=0.7)

#####
# 2) Semantic similarity between Pfam domains (Pfam)
## 2a) load onto.GOMF (as Onto object)
g <- dcRDataLoader(onto.GOMF)
## 2b) load Pfam domains annotated by GOMF (as Anno object)
Anno <- dcRDataLoader(Pfam2GOMF)
```

```

## 2c) prepare for ontology appended with annotation information
dag <- dcDAGannotate(g, annotations=Anno, path.mode="shortest_paths",
verbose=FALSE)
## 2d) calculate pair-wise semantic similarity between 8 randomly chosen domains
alldomains <- unique(unlist(nInfo(dag)$annotations))
domains <- sample(alldomains,8)
dnetwork <- dcDAGdomainSim(g=dag, domains=domains,
method.domain="BM.average", method.term="Resnik", parallel=FALSE,
verbose=TRUE)
dnetwork
## 2e) convert it to an object of class igraph
ig <- dcConverter(dnetwork, from=Dnetwork, to=igraph)
ig
## 2f) visualise the domain network
### extract edge weight (with 2-digit precision)
x <- signif(E(ig)$weight, digits=2)
### rescale into an interval [1,4] as edge width
edge.width <- 1 + (x-min(x))/(max(x)-min(x))*3
### do visualisation
dnet::visNet(g=ig, vertex.shape="sphere", edge.width=edge.width,
edge.label=x, edge.label.cex=0.7)

#####
# 3) Semantic similarity between InterPro domains (InterPro)
## 3a) load onto.GOMF (as Onto object)
g <- dcRDataLoader(onto.GOMF)
## 3b) load InterPro domains annotated by GOMF (as Anno object)
Anno <- dcRDataLoader(InterPro2GOMF)
## 3c) prepare for ontology appended with annotation information
dag <- dcDAGannotate(g, annotations=Anno, path.mode="shortest_paths",
verbose=FALSE)
## 3d) calculate pair-wise semantic similarity between 8 randomly chosen domains
alldomains <- unique(unlist(nInfo(dag)$annotations))
domains <- sample(alldomains,8)
dnetwork <- dcDAGdomainSim(g=dag, domains=domains,
method.domain="BM.average", method.term="Resnik", parallel=FALSE,
verbose=TRUE)
dnetwork
## 3e) convert it to an object of class igraph
ig <- dcConverter(dnetwork, from=Dnetwork, to=igraph)
ig
## 3f) visualise the domain network
### extract edge weight (with 2-digit precision)
x <- signif(E(ig)$weight, digits=2)
### rescale into an interval [1,4] as edge width
edge.width <- 1 + (x-min(x))/(max(x)-min(x))*3
### do visualisation
dnet::visNet(g=ig, vertex.shape="sphere", edge.width=edge.width,
edge.label=x, edge.label.cex=0.7)

#####
# 4) Semantic similarity between Rfam RNA families (Rfam)
## 4a) load onto.GOBP (as Onto object)
g <- dcRDataLoader(onto.GOBP)
## 4b) load Rfam families annotated by GOBP (as Anno object)
Anno <- dcRDataLoader(Rfam2GOBP)
## 4c) prepare for ontology appended with annotation information

```

```

dag <- dcDAGannotate(g, annotations=Anno, path.mode="shortest_paths",
verbose=FALSE)
## 4d) calculate pair-wise semantic similarity between 8 randomly chosen RNAs
alldomains <- unique(unlist(nInfo(dag)$annotations))
domains <- sample(alldomains,8)
dnetwork <- dcDAGdomainSim(g=dag, domains=domains,
method.domain="BM.average", method.term="Resnik", parallel=FALSE,
verbose=TRUE)
dnetwork
## 4e) convert it to an object of class igraph
ig <- dcConverter(dnetwork, from=Dnetwork, to=igraph)
ig
## 4f) visualise the domain network
### extract edge weight (with 2-digit precision)
x <- signif(E(ig)$weight, digits=2)
### rescale into an interval [1,4] as edge width
edge.width <- 1 + (x-min(x))/(max(x)-min(x))*3
### do visualisation
dnet::visNet(g=ig, vertex.shape="sphere", edge.width=edge.width,
edge.label=x, edge.label.cex=0.7)

#####
# 5) Advanced usage: customised data for ontology and annotations
# 5a) customise ontology
g <-
dcBuildOnto(relations.file="http://dcgor.r-forge.r-project.org/data/onto/igraph_GOMF_edges.txt",
nodes.file="http://dcgor.r-forge.r-project.org/data/onto/igraph_GOMF_nodes.txt",
output.file="ontology.RData")
# 5b) customise Anno
Anno <-
dcBuildAnno(domain_info.file="http://dcgor.r-forge.r-project.org/data/InterPro/InterPro.txt",
term_info.file="http://dcgor.r-forge.r-project.org/data/InterPro/GO.txt",
association.file="http://dcgor.r-forge.r-project.org/data/InterPro/Domain2GOMF.txt",
output.file="annotations.RData")
## 5c) prepare for ontology appended with annotation information
dag <- dcDAGannotate(g, annotations=Anno, path.mode="shortest_paths",
verbose=FALSE)
## 5d) calculate pair-wise semantic similarity between 8 randomly chosen domains
alldomains <- unique(unlist(nInfo(dag)$annotations))
domains <- sample(alldomains,8)
dnetwork <- dcDAGdomainSim(g=dag, domains=domains,
method.domain="BM.average", method.term="Resnik", parallel=FALSE,
verbose=TRUE)
dnetwork
## 5e) convert it to an object of class igraph
ig <- dcConverter(dnetwork, from=Dnetwork, to=igraph)
ig
## 5f) visualise the domain network
### extract edge weight (with 2-digit precision)
x <- signif(E(ig)$weight, digits=2)
### rescale into an interval [1,4] as edge width
edge.width <- 1 + (x-min(x))/(max(x)-min(x))*3
### do visualisation
dnet::visNet(g=ig, vertex.shape="sphere", edge.width=edge.width,
edge.label=x, edge.label.cex=0.7)

```

dcDuplicated

*Function to determine the duplicated patterns from input data matrix***Description**

dcDuplicated is supposed to determine the duplicated vectorised patterns from a matrix or data frame. The patterns can come from column-wise vectors or row-wise vectors. It returns an integer vector, in which the value indicates from which it duplicates.

**Usage**

```
dcDuplicated(data, pattern.wise = c("column", "row"), verbose = T)
```

**Arguments**

data	an input data matrix/frame
pattern.wise	a character specifying in which wise to define patterns from input data. It can be 'column' for column-wise vectors, and 'row' for row-wise vectors
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

**Value**

an interger vector, in which an entry indicates from which it duplicats. When viewing column-wise patterns (or row-wise patterns), the returned integer vector has the same length as the column number (or the row number) of input data.

**Note**

none

**See Also**

[dcAncestralMP](#), [dcAncestralMP](#), [dcAlgo](#)

**Examples**

```
# an input data matrix storing discrete states for tips (in rows) X four characters (in columns)
data1 <- matrix(c(0,rep(1,3),rep(0,2)), ncol=1)
data2 <- matrix(c(rep(0,4),rep(1,2)), ncol=1)
data3 <- matrix(c(1,rep(0,3),rep(1,2)), ncol=1)
data <- cbind(data1, data2, data1, data3)
colnames(data) <- c("C1", "C2", "C3", "C4")
data

# determine the duplicated patterns from inut data matrix
res <- dcDuplicated(data, pattern.wise="column")
## return an integer vector
res
## get index for unique patterns
ind <- sort(unique(res))
## As seen above, the returned integer vector tells there are 3 unique patterns:
## they are in columns (1, 2, 4). The column 3 is duplicated from column 1.
```

---

dcEnrichment	<i>Function to conduct ontology enrichment analysis given a group of domains</i>
--------------	--

---

## Description

dcEnrichment is supposed to conduct enrichment analysis for an input group of domains using a specified ontology. It returns an object of S4 class "Eoutput". Enrichment analysis is based on either Fisher's exact test or Hypergeometric test. The test can respect the hierarchy of the ontology. The user can customise the background domains; otherwise, the function will use all annotatable domains as the test background

## Usage

```
dcEnrichment(data, background = NULL, domain = c(NA, "SCOP.sf",
"SCOP.fa",
"Pfam", "InterPro", "Rfam"), ontology = c(NA, "GOBP", "GOMF", "GOCC",
"DO",
"HPPA", "HPMI", "HPON", "MP", "EC", "KW", "UP"), sizeRange = c(10,
1000),
min.overlap = 3, which_distance = NULL, test = c("HypergeoTest",
"FisherTest", "BinomialTest"), p.adjust.method = c("BH", "BY",
"bonferroni",
"holm", "hochberg", "hommel"), ontology.algorithm = c("none", "pc",
"elim",
"lea"), elim.pvalue = 0.01, lea.depth = 2, verbose = T,
domain.RData = NULL, ontology.RData = NULL, annotations.RData = NULL,
RData.location = "http://dcgor.r-forge.r-project.org/data")
```

## Arguments

data	an input vector. It contains id for a list of domains, for example, sunids for SCOP domains
background	a background vector. It contains id for a list of background domains, for example, sunids for SCOP domains. If NULL, by default all annotatable domains are used as background
domain	the domain identity. It can be one of 'SCOP.sf' for SCOP superfamilies, 'SCOP.fa' for SCOP families, 'Pfam' for Pfam domains, 'InterPro' for InterPro domains, 'Rfam' for Rfam RNA families
ontology	the ontology identity. It can be "GOBP" for Gene Ontology Biological Process, "GOMF" for Gene Ontology Molecular Function, "GOCC" for Gene Ontology Cellular Component, "DO" for Disease Ontology, "HPPA" for Human Phenotype Phenotypic Abnormality, "HPMI" for Human Phenotype Mode of Inheritance, "HPON" for Human Phenotype ONset and clinical course, "MP" for Mammalian Phenotype, "EC" for Enzyme Commission, "KW" for UniProtKB KeyWords, "UP" for UniProtKB UniPathway. For details on the eligibility for pairs of input domain and ontology, please refer to the online Documentations at <a href="http://supfam.org/dcGOR/docs.html">http://supfam.org/dcGOR/docs.html</a>
sizeRange	the minimum and maximum size of members of each term in consideration. By default, it sets to a minimum of 10 but no more than 1000

<code>min.overlap</code>	the minimum number of overlaps. Only those terms that overlap with input data at least <code>min.overlap</code> (3 domains by default) will be processed
<code>which_distance</code>	which distance of terms in the ontology is used to restrict terms in consideration. By default, it sets to 'NULL' to consider all distances
<code>test</code>	the statistic test used. It can be "FisherTest" for using fisher's exact test, "HypergeoTest" for using hypergeometric test, or "BinomialTest" for using binomial test. Fisher's exact test is to test the independence between domain group (domains belonging to a group or not) and domain annotation (domains annotated by a term or not), and thus compare sampling to the left part of background (after sampling without replacement). Hypergeometric test is to sample at random (without replacement) from the background containing annotated and non-annotated domains, and thus compare sampling to background. Unlike hypergeometric test, binomial test is to sample at random (with replacement) from the background with the constant probability. In terms of the ease of finding the significance, they are in order: hypergeometric test > binomial test > fisher's exact test. In other words, in terms of the calculated p-value, hypergeometric test < binomial test < fisher's exact test
<code>p.adjust.method</code>	the method used to adjust p-values. It can be one of "BH", "BY", "bonferroni", "holm", "hochberg" and "hommel". The first two methods "BH" (widely used) and "BY" control the false discovery rate (FDR: the expected proportion of false discoveries amongst the rejected hypotheses); the last four methods "bonferroni", "holm", "hochberg" and "hommel" are designed to give strong control of the family-wise error rate (FWER). Notes: FDR is a less stringent condition than FWER
<code>ontology.algorithm</code>	the algorithm used to account for the hierarchy of the ontology. It can be one of "none", "pc", "elim" and "lea". For details, please see 'Note'
<code>elim.pvalue</code>	the parameter only used when "ontology.algorithm" is "elim". It is used to control how to declare a significantly enriched term (and subsequently all domains in this term are eliminated from all its ancestors)
<code>lea.depth</code>	the parameter only used when "ontology.algorithm" is "lea". It is used to control how many maximum depth is used to consider the children of a term (and subsequently all domains in these children term are eliminated from the use for the recalculation of the significance at this term)
<code>verbose</code>	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display
<code>domain.RData</code>	a file name for RData-formatted file containing an object of S4 class 'InfoDataFrame' (i.g. domain). By default, it is NULL. It is only needed when the user wants to customise enrichment analysis using their own data. See <a href="#">dcBuildInfoDataFrame</a> for how to creat this object
<code>ontology.RData</code>	a file name for RData-formatted file containing an object of S4 class 'Onto' (i.g. ontology). By default, it is NULL. It is only needed when the user wants to customise enrichment analysis using their own data. See <a href="#">dcBuildOnto</a> for how to creat this object
<code>annotations.RData</code>	a file name for RData-formatted file containing an object of S4 class 'Anno' (i.g. annotations). By default, it is NULL. It is only needed when the user wants to customise enrichment analysis using their own data. See <a href="#">dcBuildAnno</a> for how to creat this object

`RData.location` the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as: *RData.location* = ".". If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

## Value

an object of S4 class `Eoutput`, with following slots:

- `domain`: a character specifying the domain identity
- `ontology`: a character specifying the ontology used
- `term_info`: a matrix of nTerm X 5 containing term information, where nTerm is the number of terms in consideration, and the 5 columns are "term\_id" (i.e. "Term ID"), "term\_name" (i.e. "Term Name"), "namespace" (i.e. "Term Namespace"), "distance" (i.e. "Term Distance") and "IC" (i.e. "Information Content for the term based on annotation frequency by it")
- `anno`: a list of terms, each storing annotated domain members (also within the background domains). Always, terms are identified by "term\_id" and domain members identified by their ids (e.g. sunids for SCOP domains)
- `data`: a vector containing input data in consideration. It is not always the same as the input data as only those mappable and annotatable are retained
- `background`: a vector containing background in consideration. It is not always the same as the input background as only those mappable/annotatable are retained
- `overlap`: a list of terms, each storing domains overlapped between domains annotated by a term and domains in the input data (i.e. the domains of interest). Always, terms are identified by "term\_id" and domain members identified by their IDs (e.g. sunids for SCOP domains)
- `zscore`: a vector containing z-scores
- `pvalue`: a vector containing p-values
- `adjp`: a vector containing adjusted p-values. It is the p value but after being adjusted for multiple comparisons

## Note

The interpretation of the algorithms used to account for the hierarchy of the ontology is:

- "none": does not consider the ontology hierarchy at all.
- "lea": computes the significance of a term in terms of the significance of its children at the maximum depth (e.g. 2). Precisely, once domains are already annotated to any children terms with a more significance than itself, then all these domains are eliminated from the use for the recalculation of the significance at that term. The final p-values takes the maximum of the original p-value and the recalculated p-value.
- "elim": computes the significance of a term in terms of the significance of its all children. Precisely, once domains are already annotated to a significantly enriched term under the cutoff of e.g.  $pvalue < 1e-2$ , all these domains are eliminated from the ancestors of that term).

- "pc": requires the significance of a term not only using the whole domains as background but also using domains annotated to all its direct parents/ancestors as background. The final p-value takes the maximum of both p-values in these two calculations.
- "Notes": the order of the number of significant terms is: "none" > "lea" > "elim" > "pc".

## See Also

[dcRDataLoader](#), [dcDAGannotate](#), [Eoutput-class](#), [visEnrichment](#), [dcConverter](#)

## Examples

```
# 1) Enrichment analysis for SCOP domain superfamilies (sf)
## 1a) load SCOP.sf (as InfoDataFrame object)
SCOP.sf <- dcRDataLoader(SCOP.sf)
### randomly select 50 domains as a list of domains of interest
data <- sample(rowNames(SCOP.sf), 50)
## 1b) perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, domain="SCOP.sf", ontology="GOMF")
eoutput
## 1c) view the top 10 significance terms
view(eoutput, top_num=10, sortBy="pvalue", details=TRUE)
## 1d) visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)
## 1e) the same as above but using a customised background
### randomly select 500 domains as background
background <- sample(rowNames(SCOP.sf), 500)
### perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, background=background, domain="SCOP.sf",
ontology="GOMF")
eoutput
### view the top 10 significance terms
view(eoutput, top_num=10, sortBy="pvalue", details=TRUE)
### visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)

#####
# 2) Enrichment analysis for Pfam domains (Pfam)
## 2a) load Pfam (as InfoDataFrame object)
Pfam <- dcRDataLoader(Pfam)
### randomly select 100 domains as a list of domains of interest
data <- sample(rowNames(Pfam), 100)
## 2b) perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, domain="Pfam", ontology="GOMF")
eoutput
## 2c) view the top 10 significance terms
view(eoutput, top_num=10, sortBy="pvalue", details=TRUE)
## 2d) visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)
## 2e) the same as above but using a customised background
### randomly select 1000 domains as background
background <- sample(rowNames(Pfam), 1000)
### perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, background=background, domain="Pfam",
```



```

ontology="GOMF")
eoutput
### view the top 10 significance terms
view(eoutput, top_num=10, sortBy="pvalue", details=TRUE)
### visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)

#####
# 3) Enrichment analysis for InterPro domains (InterPro)
## 3a) load InterPro (as InfoDataFrame object)
InterPro <- dcRDataLoader(InterPro)
### randomly select 100 domains as a list of domains of interest
data <- sample(rowNames(InterPro), 100)
## 3b) perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, domain="InterPro", ontology="GOMF")
eoutput
## 3c) view the top 10 significance terms
view(eoutput, top_num=10, sortBy="pvalue", details=TRUE)
## 3d) visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)
## 3e) the same as above but using a customised background
### randomly select 1000 domains as background
background <- sample(rowNames(InterPro), 1000)
### perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, background=background, domain="InterPro",
ontology="GOMF")
eoutput
### view the top 10 significance terms
view(eoutput, top_num=10, sortBy="pvalue", details=TRUE)
### visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)

#####
# 4) Enrichment analysis for Rfam RNA families (Rfam)
## 4a) load Rfam (as InfoDataFrame object)
Rfam <- dcRDataLoader(Rfam)
### randomly select 100 RNAs as a list of RNAs of interest
data <- sample(rowNames(Rfam), 100)
## 4b) perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, domain="Rfam", ontology="GOBP")
eoutput
## 4c) view the top 10 significance terms
view(eoutput, top_num=10, sortBy="pvalue", details=FALSE)
## 4d) visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)
## 4e) the same as above but using a customised background
### randomly select 1000 RNAs as background
background <- sample(rowNames(Rfam), 1000)
### perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, background=background, domain="Rfam",
ontology="GOBP")
eoutput
### view the top 10 significance terms

```

```

view(eoutput, top_num=10, sortBy="pvalue", details=FALSE)
### visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)

#####
# 5) Advanced usage: customised data for domain, ontology and annotations
# 5a) create domain, ontology and annotations
## for domain
domain <-
dcBuildInfoDataFrame(input.file="http://dcgor.r-forge.r-project.org/data/InterPro/InterPro.txt",
output.file="domain.RData")
## for ontology
dcBuildOnto(relations.file="http://dcgor.r-forge.r-project.org/data/onto/igraph_GOMF_edges.txt",
nodes.file="http://dcgor.r-forge.r-project.org/data/onto/igraph_GOMF_nodes.txt",
output.file="ontology.RData")
## for annotations
dcBuildAnno(domain_info.file="http://dcgor.r-forge.r-project.org/data/InterPro/InterPro.txt",
term_info.file="http://dcgor.r-forge.r-project.org/data/InterPro/GO.txt",
association.file="http://dcgor.r-forge.r-project.org/data/InterPro/Domain2GOMF.txt",
output.file="annotations.RData")
## 5b) prepare data and background
### randomly select 100 domains as a list of domains of interest
data <- sample(rowNames(domain), 100)
### randomly select 1000 domains as background
background <- sample(rowNames(domain), 1000)
## 5c) perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, background=background,
domain.RData=domain.RData, ontology.RData=ontology.RData,
annotations.RData=annotations.RData)
eoutput
## 5d) view the top 10 significance terms
view(eoutput, top_num=10, sortBy="pvalue", details=TRUE)
### visualise the top 10 significant terms in the ontology hierarchy
### color-coded according to 10-based negative logarithm of adjusted p-values (adjp)
visEnrichment(eoutput)

```

---

dcFunArgs

---

*Function to assign (and evaluate) arguments with default values for an input function*


---

## Description

dcFunArgs is supposed to assign (and evaluate) arguments with default values for an input function.

## Usage

```
dcFunArgs(fun, action = F, verbose = T)
```

## Arguments

fun	an input function name (character string)
action	logical to indicate whether the function will act as it should be (with assigned values in the current environment). By default, it sets to FALSE

**verbose**                      logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

### Value

a list containing arguments and their default values

### Note

This function is potentially useful when debugging. Because the developer does not have to specify default values for all arguments except those arguments are of interest

### See Also

[dcAlgoPredictMain](#)

### Examples

```
fun <- "dcAlgoPredictMain"
dcFunArgs(fun)
```

---

dcList2Matrix

*Function to convert a list into a matrix containing three columns*

---

### Description

dcList2Matrix is supposed to convert a list into a matrix containing three columns

### Usage

```
dcList2Matrix(x, verbose = T)
```

### Arguments

**x**                                a list, its each component must be a named vector

**verbose**                      logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

### Value

a matrix containing three columns: 1st for the input list names (if exist, otherises an increasing integer), 2nd for the vector names of each list component, and 3rd for the vector values of each list component

### Note

none

### See Also

[dcAlgoPropagate](#)

## Examples

```
# load an object HIS
Feature2GOMF.sf <- dcRDataLoader(RData=Feature2GOMF.sf)
# get a list
x <- Feature2GOMF.sf$hscore
# convert the list into a matrix
res <- dcList2Matrix(x)
dim(res)
res[1:10,]
```

---

dcNaivePredict

*Function to perform naive prediction from input known annotations*


---

## Description

dcNaivePredict is supposed to perform naive prediction from input known annotations. For each gene/protein, a term to be predicted are simply the frequency of that term appearing in the known annotations.

## Usage

```
dcNaivePredict(data, GSP.file, output.file = NULL, ontology = c(NA,
"GOBP",
"GOMF", "GOCC", "DO", "HPPA", "HPMI", "HPON", "MP", "EC", "KW", "UP"),
max.num = 1000, verbose = T, RData.ontology.customised = NULL,
RData.location = "http://dcgor.r-forge.r-project.org/data")
```

## Arguments

data	an input vector containing genes/proteins to be predicted
GSP.file	a Glod Standard Positive (GSP) file containing known annotations between proteins/genes and ontology terms. For example, a file containing annotations between human genes and HP terms can be found in <a href="http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt">http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt</a> . As seen in this example, the input file must contain the header (in the first row) and two columns: 1st column for 'SeqID' (actually these IDs can be anything), 2nd column for 'termID' (HP terms). Alternatively, the GSP.file can be a matrix or data frame, assuming that GSP file has been read. Note: the file should use the tab delimiter as the field separator between columns
output.file	an output file containing predicted results. If not NULL, a tab-delimited text file will be also written out; otherwise, there is no output file (by default)
ontology	the ontology identity. It can be "GOBP" for Gene Ontology Biological Process, "GOMF" for Gene Ontology Molecular Function, "GOCC" for Gene Ontology Cellular Component, "DO" for Disease Ontology, "HPPA" for Human Phenotype Phenotypic Abnormality, "HPMI" for Human Phenotype Mode of Inheritance, "HPON" for Human Phenotype ONset and clinical course, "MP" for Mammalian Phenotype, "EC" for Enzyme Commission, "KW" for UniProtKB KeyWords, "UP" for UniProtKB UniPathway. For details on the eligibility for pairs of input domain and ontology, please refer to the online Documentations at <a href="http://supfam.org/dcGOR/docs.html">http://supfam.org/dcGOR/docs.html</a> . If NA, then the user has to input a customised RData-formatted file (see RData.ontology.customised below)

<code>max.num</code>	an integer to specify how many terms will be predicted for each gene/protein
<code>verbose</code>	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display
<code>RData.ontology.customised</code>	a file name for RData-formatted file containing an object of S4 class 'Onto' (i.g. ontology). By default, it is NULL. It is only needed when the user wants to perform customised analysis using their own ontology. See <a href="#">dcBuildOnto</a> for how to create this object
<code>RData.location</code>	the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as: <i>RData.location</i> = ".". If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

**Value**

a data frame containing three columns: 1st column the same as the input file (e.g. 'SeqID'), 2nd for 'Term' (predicted ontology terms), 3rd for 'Score' (along with predicted scores)

**Note**

When 'output.file' is specified, a tab-delimited text file is written out, with the column names: 1st column the same as the input file (e.g. 'SeqID'), 2nd for 'Term' (predicted ontology terms), 3rd for 'Score' (along with predicted scores).

**See Also**

[dcRDataLoader](#), [dcAlgoPropagate](#)

**Examples**

```
# 1) prepare genes to be predicted
input.file <-
"http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt"
#input.file <- "http://dcgor.r-forge.r-project.org/data/Algo/SCOP_architecture.txt"
input <- utils::read.delim(input.file, header=T, sep="\t",
colClasses="character")
data <- unique(input[,1])

# 2) Calculate Precision and Recall
GSP.file <- "http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt"
res <- dcNaivePredict(data=data, GSP.file=GSP.file, ontology="HPPA")
res[1:10,]

# 3) calculate Precision and Recall
res_PR <- dcAlgoPredictPR(GSP.file=GSP.file, prediction.file=res,
ontology="HPPA")
res_PR
```

```
# 4) Plot PR-curve
plot(res_PR[,2], res_PR[,1], xlim=c(0,1), ylim=c(0,1), type="b",
     xlab="Recall", ylab="Precision")
```

dcRDataLoader

*Function to load dcGOR built-in RData*

## Description

dcRDataLoader is supposed to load RData that are used by package dcGOR.

## Usage

```
dcRDataLoader(RData = c(NA, "SCOP.sf", "SCOP.fa", "Pfam", "InterPro",
  "Rfam",
  "onto.GOBP", "onto.GOMF", "onto.GOCC", "onto.DO", "onto.HPPA",
  "onto.HPMI",
  "onto.HPON", "onto.MP", "onto.EC", "onto.KW", "onto.UP",
  "SCOP.sf2GOBP",
  "SCOP.sf2GOMF", "SCOP.sf2GOCC", "SCOP.sf2DO", "SCOP.sf2HPPA",
  "SCOP.sf2HPMI",
  "SCOP.sf2HPON", "SCOP.sf2MP", "SCOP.sf2EC", "SCOP.sf2KW", "SCOP.sf2UP",
  "SCOP.fa2GOBP", "SCOP.fa2GOMF", "SCOP.fa2GOCC", "SCOP.fa2DO",
  "SCOP.fa2HPPA",
  "SCOP.fa2HPMI", "SCOP.fa2HPON", "SCOP.fa2MP", "SCOP.fa2EC",
  "SCOP.fa2KW",
  "SCOP.fa2UP", "Pfam2GOBP", "Pfam2GOMF", "Pfam2GOCC", "InterPro2GOBP",
  "InterPro2GOMF", "InterPro2GOCC", "Rfam2GOBP", "Rfam2GOMF",
  "Rfam2GOCC",
  "Ancestral_domainome", "eTOL", "Feature2GOBP.sf", "Feature2GOMF.sf",
  "Feature2GOCC.sf", "Feature2HPPA.sf", "Feature2GOBP.pfam",
  "Feature2GOMF.pfam", "Feature2GOCC.pfam", "Feature2HPPA.pfam",
  "Feature2GOBP.interpro", "Feature2GOMF.interpro",
  "Feature2GOCC.interpro",
  "Feature2HPPA.interpro"), domain = c(NA, "SCOP.sf", "SCOP.fa", "Pfam",
  "InterPro", "Rfam"), ontology = c(NA, "GOBP", "GOMF", "GOCC", "DO",
  "HPPA",
  "HPMI", "HPON", "MP", "EC", "KW", "UP"), verbose = T,
  RData.location = "http://dcgor.r-forge.r-project.org/data")
```

## Arguments

RData	which built-in RData to load. If NOT NA, this RData will be always loaded. It can be: domains/RNAs (including 'SCOP.sf', 'SCOP.fa', 'Pfam', 'InterPro', 'Rfam'), ontologies (including 'onto.GOBP', 'onto.GOMF', 'onto.GOCC', 'onto.DO', 'onto.HPPA', 'onto.HPMI', 'onto.HPON', 'onto.MP', 'onto.EC', 'onto.KW', 'onto.UP'), annotations (including 'SCOP.sf2GOBP', 'SCOP.sf2GOMF', 'SCOP.sf2GOCC', 'SCOP.sf2DO', 'SCOP.sf2HPPA', 'SCOP.sf2HPMI', 'SCOP.sf2HPON', 'SCOP.sf2MP', 'SCOP.sf2EC', 'SCOP.sf2KW', 'SCOP.sf2UP', 'SCOP.fa2GOBP', 'SCOP.fa2GOMF', 'SCOP.fa2GOCC', 'SCOP.fa2DO', 'SCOP.fa2HPPA', 'SCOP.fa2HPMI', 'SCOP.fa2HPON', 'SCOP.fa2MP', 'SCOP.fa2EC', 'SCOP.fa2KW', 'SCOP.fa2UP', 'Pfam2GOBP',
-------	--

	'Pfam2GOMF', 'Pfam2GOCC', 'InterPro2GOBP', 'InterPro2GOMF', 'InterPro2GOCC', 'Rfam2GOBP', 'Rfam2GOMF', 'Rfam2GOCC'), domainome in eukaryotic genomes (including 'Ancestral_domainome', 'eTOL'), and databases used for predicting ontology terms from input protein domain contents. On the meanings, please refer to the Documentations
domain	domain part of annotation RData to load. When RData is NA and this plus next are NOT NA, then this plus next one are used to specify which annotation RData to load. In addition to NA, it can also be: 'SCOP.sf', 'SCOP.fa', 'Pfam' and 'InterPro'
ontology	ontology part of annotation RData to load. This only works together with the previous 'domain' parameter. In addition to NA, it can also be: 'GOBP', 'GOMF', 'GOCC', 'DO', 'HPPA', 'HPMI', 'HPON', 'MP', 'EC', 'KW', 'UP'
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display
RData.location	the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as: <i>RData.location = "."</i> . If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

### Value

any use-specified variable that is given on the right side of the assignment sign '`<-`', which contains the loaded RData.

### Note

If there are no use-specified variable that is given on the right side of the assignment sign '`<-`', then no RData will be loaded onto the working environment.

### See Also

[dcEnrichment](#)

### Examples

```
# Always, load from specified RData directly
SCOP.sf <- dcRDataLoader(RData=SCOP.sf)
Pfam <- dcRDataLoader(RData=Pfam)
InterPro <- dcRDataLoader(RData=InterPro)
Rfam <- dcRDataLoader(RData=Rfam)
onto.GOMF <- dcRDataLoader(RData=onto.GOMF)
# But for annotaion data, there are two ways to do so:
# 1) in a direct way
SCOP.sf2GOMF <- dcRDataLoader(RData=SCOP.sf2GOMF)
# 2) in an indirect way: specify both domain and ontology
SCOP.sf2GOMF <- dcRDataLoader(domain=SCOP.sf, ontology=GOMF)
```

---

dcRWRpipeline	<i>Function to setup a pipeline to estimate RWR-based contact strength between samples from an input domain-sample data matrix and an input graph</i>
---------------	---

---

## Description

dcRWRpipeline is supposed to estimate sample relationships (ie. contact strength between samples) from an input domain-sample matrix and an input graph (such as a domain-domain semantic network). The pipeline includes: 1) random walk restart (RWR) of the input graph using the input matrix as seeds; 2) calculation of contact strength (inner products of RWR-smoothed columns of input matrix); 3) estimation of the contact significance by a randomisation procedure. It supports two methods how to use RWR: 'direct' for directly applying RWR in the given seeds; 'indirectly' for first pre-computing affinity matrix of the input graph, and then deriving the affinity score. Parallel computing is also supported for Linux or Mac operating systems.

## Usage

```
dcRWRpipeline(data, g, method = c("indirect", "direct"),
normalise = c("laplacian", "row", "column", "none"), restart = 0.75,
normalise.affinity.matrix = c("none", "quantile"),
permutation = c("random", "degree"), num.permutation = 100,
p.adjust.method = c("BH", "BY", "bonferroni", "holm", "hochberg",
"hommel"),
adjp.cutoff = 0.05, parallel = TRUE, multicores = NULL, verbose = T)
```

## Arguments

data	an input domain-sample data matrix used for seeds. Each value in input domain-sample matrix does not necessarily have to be binary (non-zeros will be used as a weight, but should be non-negative for easy interpretation).
g	an object of class "igraph" or <a href="#">Dnetwork</a>
method	the method used to calculate RWR. It can be 'direct' for directly applying RWR, 'indirect' for indirectly applying RWR (first pre-compute affinity matrix and then derive the affinity score)
normalise	the way to normalise the adjacency matrix of the input graph. It can be 'laplacian' for laplacian normalisation, 'row' for row-wise normalisation, 'column' for column-wise normalisation, or 'none'
restart	the restart probability used for RWR. The restart probability takes the value from 0 to 1, controlling the range from the starting nodes/seeds that the walker will explore. The higher the value, the more likely the walker is to visit the nodes centered on the starting nodes. At the extreme when the restart probability is zero, the walker moves freely to the neighbors at each step without restarting from seeds, i.e., following a random walk (RW)
normalise.affinity.matrix	the way to normalise the output affinity matrix. It can be 'none' for no normalisation, 'quantile' for quantile normalisation to ensure that columns (if multiple) of the output affinity matrix have the same quantiles
permutation	how to do permutation. It can be 'degree' for degree-preserving permutation, 'random' for permutation in random



num.permutation	the number of permutations used to for generating the distribution of contact strength under randomisation
p.adjust.method	the method used to adjust p-values. It can be one of "BH", "BY", "bonferroni", "holm", "hochberg" and "hommel". The first two methods "BH" (widely used) and "BY" control the false discovery rate (FDR: the expected proportion of false discoveries amongst the rejected hypotheses); the last four methods "bonferroni", "holm", "hochberg" and "hommel" are designed to give strong control of the family-wise error rate (FWER). Notes: FDR is a less stringent condition than FWER
adjp.cutoff	the cutoff of adjusted pvalue to construct the contact graph
parallel	logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R"); biocLite(c("foreach", "doMC"))</code> . If not yet installed, this option will be disabled
multicores	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to true for display

### Value

an object of class "iContact", a list with following components:

- ratio: a symmetric matrix storing ratio (the observed against the expected) between pairwise samples
- zscore: a symmetric matrix storing zscore between pairwise samples
- pval: a symmetric matrix storing pvalue between pairwise samples
- adjpval: a symmetric matrix storing adjusted pvalue between pairwise samples
- icontact: the constructed contact graph (as an 'igraph' object) under the cutoff of adjusted value
- Amatrix: a pre-computed affinity matrix when using 'indirect' method; NULL otherwise
- call: the call that produced this result

### Note

The choice of which method to use RWR depends on the number of seed sets and the number of permutations for statistical test. If the total product of both numbers are huge, it is better to use 'indirect' method (for a single run).

### See Also

[dcRDataLoader](#), [dcDAGannotate](#), [dcDAGdomainSim](#), [dcConverter](#)

## Examples

```
# 1) load onto.GOMF (as Onto object)
g <- dcRDataLoader(onto.GOMF)

# 2) load SCOP superfamilies annotated by GOMF (as Anno object)
Anno <- dcRDataLoader(SCOP.sf2GOMF)

# 3) prepare for ontology appended with annotation information
dag <- dcDAGannotate(g, annotations=Anno, path.mode="shortest_paths",
verbose=TRUE)

# 4) calculate pair-wise semantic similarity between 10 randomly chosen domains
alldomains <- unique(unlist(nInfo(dag)$annotations))
domains <- sample(alldomains,10)
dnetwork <- dcDAGdomainSim(g=dag, domains=domains,
method.domain="BM.average", method.term="Resnik", parallel=FALSE,
verbose=TRUE)
dnetwork

# 5) estimate RWR dating based sample/term relationships
# define sets of seeds as data
# each seed with equal weight (i.e. all non-zero entries are 1)
data <- data.frame(aSeeds=c(1,0,1,0,1), bSeeds=c(0,0,1,0,1))
rownames(data) <- id(dnetwork)[1:5]
# calculate their two contact graph
coutput <- dcRWRpipeline(data=data, g=dnetwork, parallel=FALSE)
coutput
```

---

dcRWRpredict

---

*Function to perform RWR-based ontology term predictions from input known annotations and an input graph*


---

## Description

dcRWRpredict is supposed to perform ontology term predictions based on Random Walk with Restart (RWR) from input known annotations and an input graph.

## Usage

```
dcRWRpredict(data, g, output.file = NULL, ontology = c(NA, "GOBP",
"GOMF",
"GOCC", "DO", "HPPA", "HPMI", "HPON", "MP", "EC", "KW", "UP"),
method = c("indirect", "direct"), normalise = c("laplacian", "row",
"column", "none"), restart = 0.75, normalise.affinity.matrix =
c("none",
"quantile"), leave.one.out = T, propagation = c("max", "sum"),
scale.method = c("log", "linear", "none"), parallel = TRUE,
multicores = NULL, verbose = T, RData.ontology.customised = NULL,
RData.location = "http://dcgor.r-forge.r-project.org/data")
```

**Arguments**

data	an input gene-term data matrix containing known annotations used for seeds. Each value in input matrix does not necessarily have to be binary (non-zeros will be used as a weight, but should be non-negative for easy interpretation). Also, data can be a list, each containing the known annotated genes
g	an object of class "igraph" or <a href="#">Dnetwork</a>
output.file	an output file containing predicted results. If not NULL, a tab-delimited text file will be also written out; otherwise, there is no output file (by default)
ontology	the ontology identity. It can be "GOBP" for Gene Ontology Biological Process, "GOMF" for Gene Ontology Molecular Function, "GOCC" for Gene Ontology Cellular Component, "DO" for Disease Ontology, "HPPA" for Human Phenotype Phenotypic Abnormality, "HPMI" for Human Phenotype Mode of Inheritance, "HPON" for Human Phenotype ONset and clinical course, "MP" for Mammalian Phenotype, "EC" for Enzyme Commission, "KW" for UniProtKB KeyWords, "UP" for UniProtKB UniPathway. For details on the eligibility for pairs of input domain and ontology, please refer to the online Documentations at <a href="http://supfam.org/dcGOR/docs.html">http://supfam.org/dcGOR/docs.html</a> . If NA, then the user has to input a customised RData-formatted file (see <code>RData.ontology.customised</code> below)
method	the method used to calculate RWR. It can be 'direct' for directly applying RWR, 'indirect' for indirectly applying RWR (first pre-compute affinity matrix and then derive the affinity score)
normalise	the way to normalise the adjacency matrix of the input graph. It can be 'laplacian' for laplacian normalisation, 'row' for row-wise normalisation, 'column' for column-wise normalisation, or 'none'
restart	the restart probability used for RWR. The restart probability takes the value from 0 to 1, controlling the range from the starting nodes/seeds that the walker will explore. The higher the value, the more likely the walker is to visit the nodes centered on the starting nodes. At the extreme when the restart probability is zero, the walker moves freely to the neighbors at each step without restarting from seeds, i.e., following a random walk (RW)
normalise.affinity.matrix	the way to normalise the output affinity matrix. It can be 'none' for no normalisation, 'quantile' for quantile normalisation to ensure that columns (if multiple) of the output affinity matrix have the same quantiles
leave.one.out	logical to indicate whether the leave-one-out test is used for predictions. By default, it sets to true for doing leave-one-out test (that is, known seeds are removed)
propagation	how to propagate the score. It can be "max" for retaining the maximum score (by default), "sum" for additively accumulating the score
scale.method	the method used to scale the predictive scores. It can be: "none" for no scaling, "linear" for being linearly scaled into the range between 0 and 1, "log" for the same as "linear" but being first log-transformed before being scaled. The scaling between 0 and 1 is done via: $\frac{S-S_{min}}{S_{max}-S_{min}}$ , where $S_{min}$ and $S_{max}$ are the minimum and maximum values for $S$
parallel	logical to indicate whether parallel computation with multicores is used. By default, it sets to true, but not necessarily does so. Partly because parallel backends available will be system-specific (now only Linux or Mac OS). Also, it will depend on whether these two packages "foreach" and "doMC" have been installed. It can be installed via: <code>source("http://bioconductor.org/biocLite.R");</code>

	<code>biocLite(c("foreach", "doMC"))</code> . If not yet installed, this option will be disabled
<code>multicores</code>	an integer to specify how many cores will be registered as the multicore parallel backend to the 'foreach' package. If NULL, it will use a half of cores available in a user's computer. This option only works when parallel computation is enabled
<code>verbose</code>	logical to indicate whether the messages will be displayed in the screen. By default, it sets to true for display
<code>RData.ontology.customised</code>	a file name for RData-formatted file containing an object of S4 class 'Onto' (i.g. ontology). By default, it is NULL. It is only needed when the user wants to perform customised analysis using their own ontology. See <a href="#">dcBuildOnto</a> for how to create this object
<code>RData.location</code>	the characters to tell the location of built-in RData files. By default, it remotely locates at "http://supfam.org/dcGOR/data" or "http://dcgor.r-forge.r-project.org/data". For the user equipped with fast internet connection, this option can be just left as default. But it is always advisable to download these files locally. Especially when the user needs to run this function many times, there is no need to ask the function to remotely download every time (also it will unnecessarily increase the runtime). For examples, these files (as a whole or part of them) can be first downloaded into your current working directory, and then set this option as: <code>RData.location = "."</code> . If RData to load is already part of package itself, this parameter can be ignored (since this function will try to load it via function data first)

### Value

a data frame containing three columns: 1st column the same as the input file (e.g. 'SeqID'), 2nd for 'Term' (predicted ontology terms), 3rd for 'Score' (along with predicted scores)

### Note

When 'output.file' is specified, a tab-delimited text file is written out, with the column names: 1st column the same as the input file (e.g. 'SeqID'), 2nd for 'Term' (predicted ontology terms), 3rd for 'Score' (along with predicted scores). The choice of which method to use RWR depends on the number of seed sets and whether using leave-one-out test. If the total product of both numbers are huge, it is better to use 'indirect' method (for a single run). Also, when using leave-one-out test, it has to be use 'indirect' method.

### See Also

[dcRDataLoader](#), [dcAlgoPropagate](#), [dcList2Matrix](#)

### Examples

```
# 1) define an input network
## 1a) an igraph object that contains a functional protein association network in human.
### The network is extracted from the STRING database (version 9.1).
### Only those associations with medium confidence (score>=400) are retained
org.Hs.string <- dnet::dRDataLoader(RData=org.Hs.string)
## 1b) restrict to those edges with confidence score>=999
### keep the largest connected component
network <- igraph::subgraph.edges(org.Hs.string,
eids=E(org.Hs.string)[combined_score>=999])
```

```

g <- dnet::dNetInduce(g=network, nodes_query=V(network)$name,
largest.comp=TRUE)
## Notably, in reality, 1b) can be replaced by:
#g <- igraph::subgraph.edges(org.Hs.string, eids=E(org.Hs.string)[combined_score>=400])
## 1c) make sure there is a weight edge attribute
E(g)$weight <- E(g)$combined_score
### use EntrezGene ID as default name node attribute
V(g)$name <- V(g)$geneid
g

# 2) define the known annotations as seeds
anno.file <- "http://dcgor.r-forge.r-project.org/data/Algo/HP_anno.txt"
data <- dcSparseMatrix(anno.file)

# 3) perform RWR-based ontology term predictions
res <- dcRWRpredict(data=data, g=g, ontology="HPPA", parallel=FALSE)
res[1:10,]
# 4) calculate Precision and Recall
GSP.file <- anno.file
prediction.file <- res
res_PR <- dcAlgoPredictPR(GSP.file=GSP.file,
prediction.file=prediction.file, ontology="HPPA")
res_PR

# 5) Plot PR-curve
plot(res_PR[,2], res_PR[,1], xlim=c(0,1), ylim=c(0,1), type="b",
xlab="Recall", ylab="Precision")

```

dcSparseMatrix

*Function to create a sparse matrix for an input file with three columns***Description**

dcSparseMatrix is supposed to create a sparse matrix for an input file with three columns.

**Usage**

```
dcSparseMatrix(input.file, verbose = T)
```

**Arguments**

input.file	an input file containing three columns: 1st column for rows, 2nd for columns, and 3rd for numeric values. Alternatively, the input.file can be a matrix or data frame, assuming that input file has been read. Note: the file should use the tab delimiter as the field separator between columns
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

**Value**

a list containing arguments and their default values

**Note**

This function is potentially useful when debugging. Because the developer does not have to specify default values for all arguments except those arguments are of interest

**See Also**

[dcAlgoPredictMain](#)

**Examples**

```
# create a sparse matrix of 4 X 2
input.file <- rbind(c(R1,C1,1), c(R2,C1,1), c(R2,C2,1),
c(R3,C2,1), c(R4,C1,1))
res <- dcSparseMatrix(input.file)
res
# get a full matrix
as.matrix(res)
```

---

dcSplitArch

---

*Function to obtain a list of features via splitting an input architecture*


---

**Description**

dcSplitArch is supposed to obtain a list of features via splitting an input architecture.

**Usage**

```
dcSplitArch(da, feature.mode = c("supra", "individual", "comb"), sep =
",",
ignore = "_gap_", verbose = T)
```

**Arguments**

da	an input architecture. For example, a comma-separated string
feature.mode	the mode of how to define the features thereof. It can be: "supra" for combinations of one or two successive domains (including individual domains; considering the order), "individual" for individual domains only, and "comb" for all possible combinations (including individual domains; ignoring the order)
sep	a character string to separate. By default, it is comma ','
ignore	a character string to ignore. By default, it is '_gap_'. This ignored character will affect the features defined as being 'supra' (see examples below)
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

**Value**

a vector containing splitted features.

**Note**

none

**See Also**

[dcAlgo](#), [dcAlgoPredict](#)

**Examples**

```
da <- "_gap_,100895,57610,_gap_,57610,47473"
# get features defined as being "supra"
dcSplitArch(da, feature.mode="supra")
# get features defined as being "individual"
dcSplitArch(da, feature.mode="individual")
# get features defined as being "comb"
dcSplitArch(da, feature.mode="comb")
```

---

dcSubtreeClade	<i>Function to extract a subtree under a given clade from a phylo-formatted phylogenetic tree</i>
----------------	---

---

**Description**

dcSubtreeClade is supposed to extract a subtree under a given clade from a phylo-formatted phylogenetic tree. In addition to the tree in subject, another input is a built-in integer specifying an internal node/clade of interest. Alternatively, the internal node of interest can be given by its label (if there are internal node labels). As a result, a subtree under a given clade is also represented as an object of class 'phylo'.

**Usage**

```
dcSubtreeClade(phy, choose.node = NULL, choose.node.label = NULL,
  verbose = T)
```

**Arguments**

phy	an object of class 'phylo'
choose.node	an integer specifying which internal node is chosen. For an object of class 'phylo', the tree has built-in ID for internal nodes, ranging from $Ntip + 1$ to $Ntip + Nnode$ , where $Ntip$ and $Nnode$ are the number of tips and internal nodes. Internal nodes are indexed in a pre-ordered manner. The subtree under the given internal node will be extracted
choose.node.label	a character specifying which internal node is chosen. For the tree with internal node labels, the extraction of subtree can be done in this way
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

**Value**

an object of class 'phylo'

**Note**

If a valid 'choose.node' is given, then 'choose.node.label' will be ignored.

**See Also**[dcTreeConnectivity](#)**Examples**

```
# 1) a newick tree without internal node labels
tree <- "(((t1:5,t2:5):2,(t3:4,t4:4):3):2,(t5:4,t6:4):6);"
phy <- ape::read.tree(text=tree)
phy
Ntip <- ape::Ntip(phy)
Nnode <- ape::Nnode(phy)
ape::plot.phylo(phy, type="p", use.edge.length=TRUE)
ape::nodelabels(node=Ntip+1:Nnode, col="red", bg="white")
# a subtree specified via a built-in internal node ID
subphy <- dcSubtreeClade(phy, choose.node=Ntip+2)
subphy
ape::plot.phylo(subphy, type="p", use.edge.length=TRUE)

# 2) a newick tree with internal node labels
tree <- "(((t1:5,t2:5)i3:2,(t3:4,t4:4)i4:3)i2:2,(t5:4,t6:4)i5:6)i1;"
phy <- ape::read.tree(text=tree)
phy
ape::plot.phylo(phy, type="p", use.edge.length=TRUE,
show.node.label=TRUE)
# a subtree specified via an internal node label
subphy <- dcSubtreeClade(phy, choose.node.label=i2)
subphy
ape::plot.phylo(subphy, type="p", use.edge.length=TRUE,
show.node.label=TRUE)
```

dcSubtreeTips

---

*Function to extract a tip-induced subtree from a phylo-formatted phylogenetic tree*


---

**Description**

dcSubtreeTips is supposed to extract a tip-induced subtree from a phylo-formatted phylogenetic tree. In addition to the tree in subject, another input is a vector containing tip labels of interest. From valid tip labels, there are two types of subtree to extract. One is first induce clade (an internal node) from tip labels, and then the subtree is extracted under the induced clade. Another type is to extract a subtree only containing given tip labels; in this situation, some internal nodes perhaps need to further trimmed. The resulting subtree is also represented as an object of class 'phylo'.

**Usage**

```
dcSubtreeTips(phy, choose.tip.labels = NULL, subtree.type = c("clade",
"tips_only"), verbose = T)
```

**Arguments**

```
phy                an object of class 'phylo'
choose.tip.labels  a character specifying which tips are chosen
```



subtree.type	a character specifying how to extract subtree from given tips. It can be 'clade' or 'tips_only'. The former is first induce clade (an internal node) from tip labels, and then to extract the subtree under the induced clade. The latter is to directly extract the subtree only containing given tip labels, (if necessary), after trimming out unnecessary internal nodes
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

**Value**

an object of class 'phylo'

**Note**

nonde

**See Also**

[dcTreeConnectivity](#), [dcSubtreeClade](#)

**Examples**

```
# 1) with internal node labels
tree <- "(((t1:5,t2:5)i3:2,(t3:4,t4:4)i4:3)i2:2,(t5:4,t6:4)i5:6)i1;"
phy <- ape::read.tree(text=tree)
ape::plot.phylo(phy, type="p", use.edge.length=TRUE,
show.node.label=TRUE)

# 2) tip labels of interest
choose.tip.labels <- c(t1,t2,t3)
# 2a) extract subtree via an induced clade
subphy <- dcSubtreeTips(phy, choose.tip.labels, subtree.type="clade")
ape::plot.phylo(subphy, type="p", use.edge.length=TRUE,
show.node.label=TRUE)
# 2b) extract subtree containing only tips
subphy <- dcSubtreeTips(phy, choose.tip.labels,
subtree.type="tips_only")
ape::plot.phylo(subphy, type="p", use.edge.length=TRUE,
show.node.label=TRUE)
```

---

dcSupraBetter

*Function to find supra-domains with better scores than their individual domains*

---

**Description**

dcSupraBetter is supposed to find supra-domains with better scores than their individual domains.

**Usage**

```
dcSupraBetter(input.file, output.file = NULL, verbose = T)
```

**Arguments**

<code>input.file</code>	an input file used to build the object. This input file contains original annotations between domains/features and ontology terms, along with the hypergeometric scores (hscore) in support for their annotations. For example, a file containing original annotations between SCOP domain architectures and GO terms can be found in <a href="http://dcbior.r-forge.r-project.org/data/Feature/Feature2GO.sf.txt">http://dcbior.r-forge.r-project.org/data/Feature/Feature2GO.sf.txt</a> . As seen in this example, the input file must contain the header (in the first row) and three columns: 1st column for 'Feature_id' (here SCOP domain architectures), 2nd column for 'Term_id' (GO terms), and 3rd column for 'Score' (hscore)
<code>output.file</code>	an output file containing results. If not NULL, a tab-delimited text file will be also written out, with 1st column 'Feature_id' for features/domains, 2nd column 'Term_id' for ontology terms, 3rd column 'Score' for hypergeometric scores (indicative of strength for feature-term associations). Otherwise, there is no output file (by default)
<code>verbose</code>	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

**Value**

a data frame containing three columns: 1st column 'Feature\_id' for features, 2nd 'Term\_id' for terms, and 3rd 'Score' for the hypergeometric score indicative of strength of associations between features and terms

**Note**

When 'output.file' is specified, a tab-delimited text file is output, with the column names: 1st column 'Feature\_id' for features, 2nd 'Term\_id' for terms, and 3rd 'Score' for the hypergeometric score indicative of strength of associations between features and terms

**See Also**

[dcList2Matrix](#)

**Examples**

```
input.file <-
"http://dcbior.r-forge.r-project.org/data/Feature/Feature2GO.sf.txt"
res <- dcSupraBetter(input.file)
res[1:10,]
```

---

<code>dcTreeConnectivity</code>	<i>Function to calculate the sparse connectivity matrix between parents and children from a phylo-formatted phylogenetic tree</i>
---------------------------------	---

---

**Description**

`dcTreeConnectivity` is supposed to calculate the sparse connectivity matrix between parents and children from a phylo-formatted phylogenetic tree. The matrix has internal nodes (in rows) and tips plus internal nodes (in columns). For a row (an internal node; as a parent), the non-zeros indicate all its descendants/children.

**Usage**

```
dcTreeConnectivity(phy, verbose = T)
```

**Arguments**

phy	an object of class 'phylo'
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to TRUE for display

**Value**

a sparse matrix of  $Nnode \times Ntip + Nnode$ , where  $Ntip$  and  $Nnode$  are the number of tips and internal nodes. A non-zero entry indicates a pair of a parent and its child.

**Note**

None

**See Also**

[dcTreeConnectivity](#)

**Examples**

```
# a newick tree
tree <- "(((t1:5,t2:5):2,(t3:4,t4:4):3):2,(t5:4,t6:4):6);"
phy <- ape::read.tree(text=tree)

# connectivity matrix
res <- dcTreeConnectivity(phy)
dim(res)
# convert to a full Matrix
as.matrix(res)
```

---

Dnetwork-class

---

*Definition for S4 class Dnetwork*


---

**Description**

Dnetwork is an S4 class to store a domain network, such as the one from semantic similarity between pairs of domains by [dcDAGdomainSim](#). It has 2 slots: nodeInfo and adjMatrix

**Value**

Class Dnetwork

**Slots**

nodeInfo	An object of S4 class <a href="#">InfoDataFrame</a> , describing information on nodes/domains.
adjMatrix	An object of S4 class <a href="#">AdjData</a> , containing symmetric adjacency data matrix for an indirect domain network

## Creation

An object of this class can be created via: `new("Dnetwork", nodeInfo, adjMatrix)`

## Methods

Class-specific methods:

- `dim()`: retrieve the dimension in the object
- `adjMatrix()`: retrieve the slot 'adjMatrix' in the object
- `nodeInfo()`: retrieve the slot 'nodeInfo' (as class `InfoDataFrame`) in the object
- `nInfo()`: retrieve nodeInfo (as `data.frame`) in the object
- `nodeNames()`: retrieve node/term names (ie, row names of nodeInfo) in the object
- `id()`: retrieve domain id (ie, column 'id' of nodeInfo) in the object, if any
- `level()`: retrieve domain level (ie, column 'level' of nodeInfo) in the object, if any
- `description()`: retrieve domain description (ie, column 'description' of nodeInfo) in the object, if any

Standard generic methods:

- `str()`: compact display of the content in the object
- `show()`: abbreviated display of the object
- `as(matrix, "Dnetwork")`: convert a matrix to an object of class `Dnetwork`
- `as(dgCMatrix, "Dnetwork")`: convert a `dgCMatrix` (a sparse matrix) to an object of class `Dnetwork`
- `[i]`: get the subset of the same class

## Access

Ways to access information on this class:

- `showClass("Dnetwork")`: show the class definition
- `showMethods(classes="Dnetwork")`: show the method definition upon this class
- `getSlots("Dnetwork")`: get the name and class of each slot in this class
- `slotNames("Dnetwork")`: get the name of each slot in this class
- `selectMethod(f, signature="Dnetwork")`: retrieve the definition code for the method 'f' defined in this class

## See Also

[Dnetwork-method](#)

## Examples

```
# create an object of class Dnetwork, only given a matrix
adjM <- matrix(runif(25), nrow=5, ncol=5)
as(adjM, "Dnetwork")
```

```
# create an object of class Dnetwork, given a matrix plus information on nodes
# 1) create nodeI: an object of class InfoDataFrame
data <- data.frame(id=paste("Domain", 1:5, sep="_"),
```

```

level=rep("SCOP",5), description=I(LETTERS[1:5]),
row.names=paste("Domain", 1:5, sep="_"))
nodeI <- new("InfoDataFrame", data=data)
nodeI
# 2) create an object of class Dnetwork
# VERY IMPORTANT: make sure having consistent names between nodeInfo and adjMatrix
adjM <- matrix(runif(25),nrow=5,ncol=5)
colnames(adjM) <- rownames(adjM) <- rowNames(nodeI)
x <- new("Dnetwork", adjMatrix=adjM, nodeInfo=nodeI)
x
# 3) look at various methods defined on class Dnetwork
dim(x)
adjMatrix(x)
nodeInfo(x)
nInfo(x)
nodeNames(x)
id(x)
level(x)
description(x)
# 4) get the subset
x[1:2]

```

---

Dnetwork-method

*Methods defined for S4 class Dnetwork*


---

## Description

Methods defined for class Dnetwork.

## Usage

```
## S4 method for signature Dnetwork
dim(x)
```

```
## S4 method for signature Dnetwork
adjMatrix(x)
```

```
## S4 method for signature Dnetwork
nodeInfo(x)
```

```
## S4 method for signature Dnetwork
nInfo(object)
```

```
## S4 method for signature Dnetwork
nodeNames(object)
```

```
## S4 method for signature Dnetwork
id(object)
```

```
## S4 method for signature Dnetwork
level(object)
```

```
## S4 method for signature Dnetwork
```

```
description(object)

## S4 method for signature Dnetwork
show(object)

## S4 method for signature Dnetwork,ANY,ANY,ANY
x[i, j, ..., drop = FALSE]
```

### Arguments

x	an object of class Dnetwork
object	an object of class Dnetwork
i	an index
j	an index
...	additional parameters
drop	a logic for matrices and arrays. If TRUE the result is coerced to the lowest possible dimension. This only works for extracting elements, not for the replacement

### See Also

[Dnetwork-class](#)

---

Eoutput-class

*Definition for S4 class Eoutput*

---

### Description

Eoutput is an S4 class to store output from enrichment analysis by [dcEnrichment](#).

### Value

Class Eoutput

### Slots

domain A character specifying the domain identity

ontology A character specifying the ontology identity

term\_info A data.frame of nTerm X 5 containing term information, where nTerm is the number of terms in consideration, and the 5 columns are "term\_id" (i.e. "Term ID"), "term\_name" (i.e. "Term Name"), "namespace" (i.e. "Term Namespace"), "distance" (i.e. "Term Distance") and "IC" (i.e. "Information Content for the term based on annotation frequency by it")

anno A list of terms, each storing annotated domains (also within the background domains). Always, terms are identified by "term\_id" and domain members identified by their ids (e.g. sunids for SCOP domains)

data A vector containing input data in [dcEnrichment](#). It is not always the same as the input data as only those mappable are retained

background A vector containing background in [dcEnrichment](#). It is not always the same as the input background (if provided by the user) as only those mappable are retained

**overlap** A list of terms, each storing domains overlapped between domains annotated by a term and domains in the input data (i.e. the domains of interest). Always, terms are identified by "term\_id" and domain members identified by their ids (e.g. sunids for SCOP domains)

**zscore** A vector of terms, containing z-scores

**pvalue** A vector of terms, containing p-values

**adjp** A vector of terms, containing adjusted p-values. It is the p value but after being adjusted for multiple comparisons

## Creation

An object of this class can be created via: `new("Eoutput", domain, ontology, term_info, anno, data, overlap,`

## Methods

Class-specific methods:

- `zscore()`: retrieve the slot 'zscore' in the object
- `pvalue()`: retrieve the slot 'pvalue' in the object
- `adjp()`: retrieve the slot 'adjp' in the object
- `view()`: retrieve an integrated data.frame used for viewing the object
- `write()`: write the object into a local file

Standard generic methods:

- `str()`: compact display of the content in the object
- `show()`: abbreviated display of the object

## Access

Ways to access information on this class:

- `showClass("Eoutput")`: show the class definition
- `showMethods(classes="Eoutput")`: show the method definition upon this class
- `getSlots("Eoutput")`: get the name and class of each slot in this class
- `slotNames("Eoutput")`: get the name of each slot in this class
- `selectMethod(f, signature="Eoutput")`: retrieve the definition code for the method 'f' defined in this class

## See Also

[Eoutput-method](#)

## Examples

```
# 1) load SCOP.sf (as InfoDataFrame object)
SCOP.sf <- dcRDataLoader(SCOP.sf)
# randomly select 20 domains
data <- sample(rowNames(SCOP.sf), 20)

# 2) perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, domain="SCOP.sf", ontology="GOMF")
eoutput
```

```
# 3) write into the file Eoutput.txt in your local directory
write(eoutput, file=Eoutput.txt)

# 4) view the top 5 significant terms
view(eoutput, top_num=5, sortBy="pvalue", details=TRUE)

# 4) retrieve several slots directly
zscore(eoutput)[1:5]
pvalue(eoutput)[1:5]
adjp(eoutput)[1:5]
```

Eoutput-method

*Methods defined for S4 class Eoutput*

## Description

Methods defined for S4 class Eoutput.

## Usage

```
## S4 method for signature Eoutput
show(object)

## S4 method for signature Eoutput
zscore(x)

## S4 method for signature Eoutput
pvalue(x)

## S4 method for signature Eoutput
adjp(x)

## S4 method for signature Eoutput
view(x, top_num = 5, sortBy = c("pvalue", "adjp",
"zscore", "nAnno", "nOverlap", "none"), decreasing = NULL, details = T)

## S4 method for signature Eoutput
write(x, file = "Eoutput.txt", verbose = T)
```

## Arguments

object	an object of S4 class Eoutput. Usually this is an output from <a href="#">dcEnrichment</a>
x	an object of S4 class Eoutput. Usually this is an output from <a href="#">dcEnrichment</a>
top_num	the maximum number (5, by default) of terms will be viewed. If NULL or NA, all terms will be viewed (this can be used for the subsequent saving)
sortBy	which statistics will be used for sorting and viewing terms. It can be "pvalue" for p value, "adjp" for adjusted p value, "zscore" for enrichment z-score, "nAnno" for the number in domains annotated by a term, "nOverlap" for the number in overlaps, and "none" for ordering simply according to ID of terms



decreasing	logical to indicate whether to sort in a decreasing order. If it is null, by default it will be true for "zscore", "nAnno" or "nOverlap"; otherwise false
details	logical to indicate whether the detailed information of terms is also viewed. By default, it sets to TRUE for the inclusion
file	a character specifying a file name written into. By default, it is 'Eoutput.txt'
verbose	logical to indicate whether the messages will be displayed in the screen. By default, it sets to true for display

## Value

view(x) returns a data frame with following components:

- term\_id: term ID
- nAnno: number in domains annotated by a term
- nGroup: number in domains from the input group
- nOverlap: number in overlaps
- zscore: enrichment z-score
- pvalue: p value
- adjp: adjusted p value
- term\_name: term name
- term\_namespace: term namespace; optional, it is only appended when "details" is true
- term\_distance: term distance; optional, it is only appended when "details" is true
- members: members (represented as domain IDs) in overlaps; optional, it is only appended when "details" is true

write(x) also returns the same data frame as view(x), in addition to a specified local file.

## See Also

[Eoutput-class](#)

---

eTOL

*eukaryotic Tree Of Life (eTOL)*

---

## Description

A 'phylo' object that contains information about eukaryotic part of species tree of life (eTOL). It is a rooted binary tree. Tips represent extant genomes. Since its reconstruction is guided under the NCBI taxonomy, each internal node is either mapped onto a unique taxonomic identifier or left empty (assumedly a hypothetical unknown ancestral genome).

## Usage

```
data(eTOL)
```

## Value

an object of class "phylo" with the following components:

- Nnode: the number of (internal) nodes
- tip.label: a vector giving the names of the tips (i.e., "left\_id" to define the post-ordered binary tree structure)
- node.label: a vector giving the names of the internal nodes (i.e., "left\_id" to define the post-ordered binary tree structure)
- genome\_info: a matrix of all nodes (including tips and internal nodes) X 8, giving extant/ancestral genome information: "left\_id" (unique and used as internal id), "right\_id" (used in combination with "left\_id" to define the post-ordered binary tree structure), "taxon\_id" (NCBI taxonomy id, if matched), "genome" (2-letter genome identifiers used in SUPER-FAMILY, if being extant), "name" (NCBI taxonomy name, if matched), "rank" (NCBI taxonomy rank, if matched), "branchlength" (branch length in relevance to the parent), and "common\_name" (NCBI taxonomy common name, if matched and existed)
- edge: a two-column matrix of mode numeric where each row represents an edge of the tree; the nodes and the tips are symbolized with numbers; the tips are numbered 1, 2, ..., and the internal nodes are numbered after the tips. For each row, the first column gives the ancestor
- edge.length: a numeric vector giving the lengths of the branches given by 'edge'
- root.length: a numeric value giving the length of the branch at the root
- connectivity: a matrix of internal nodes X all nodes (including tips and internal nodes), with 1 for the presence of an ancestor-descendant path, and 0 otherwise

## References

Fang et al. (2013) A daily-updated tree of (sequenced) life as a reference for genome research. *Scientific reports*, 3:2015.

## Examples

```
data(eTOL)
eTOL
# list all components
names(eTOL)
# extract information about the first 5 genomes
eTOL$genome_info[1:5,]
# look at the dimension of connectivity
dim(eTOL$connectivity)
## Not run:
# visualise the connectivity matrix
Ntip <- length(eTOL$tip.label) # number of tips
Nnode <- eTOL$Nnode # number of internal nodes
data <- eTOL$connectivity
visHeatmapAdv(data, Rowv=FALSE, Colv=FALSE, zlim=c(0,1), colormap="gray-black", add.expr=abline(v=c(1,Ntip+1)))
## End(Not run)
```

---

Feature2GOBP.interpro    *Annotations and scores between InterPro domains and Gene Ontology Biological Process (GOBP).*

---

## Description

An object of class "HIS" that contains annotations and scores between Gene Ontology Biological Process terms and InterPro domains. This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
Feature2GOBP.interpro <- dcRDataLoader(RData=Feature2GOBP.interpro)
```

## Value

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

## Examples

```
# load data
Feature2GOBP.interpro <- dcRDataLoader(RData=Feature2GOBP.interpro)
names(Feature2GOBP.interpro)
```

---

Feature2GOBP.pfam    *Annotations and scores between Pfam domains/combinations and Gene Ontology Biological Process (GOBP).*

---

## Description

An object of class "HIS" that contains annotations and scores between Gene Ontology Biological Process terms and Pfam domains/combinations. This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

**Usage**

```
Feature2GOBP.pfam <- dcRDataLoader(RData=Feature2GOBP.pfam)
```

**Value**

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

**References**

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

**Examples**

```
# load data
Feature2GOBP.pfam <- dcRDataLoader(RData=Feature2GOBP.pfam)
names(Feature2GOBP.pfam)
```

---

Feature2GOBP.sf	<i>Annotations and scores between SCOP domains/combinations (at the superfamily level; sf) and Gene Ontology Biological Process (GOBP).</i>
-----------------	---

---

**Description**

An object of class "HIS" that contains annotations and scores between Gene Ontology Biological Process terms and SCOP domains/combinations (at the superfamily level; sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

**Usage**

```
Feature2GOBP.sf <- dcRDataLoader(RData=Feature2GOBP.sf)
```

**Value**

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first

- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

## Examples

```
# load data
Feature2GOBP.sf <- dcRDataLoader(RData=Feature2GOBP.sf)
names(Feature2GOBP.sf)
```

---

Feature2GOCC.interpro    *Annotations and scores between InterPro domains and Gene Ontology Cellular Component (GOCC).*

---

## Description

An object of class "HIS" that contains annotations and scores between Gene Ontology Cellular Component terms and InterPro domains. This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
Feature2GOCC.interpro <- dcRDataLoader(RData=Feature2GOCC.interpro)
```

## Value

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

**Examples**

```
# load data
Feature2GOCC.interpro <- dcRDataLoader(RData=Feature2GOCC.interpro)
names(Feature2GOCC.interpro)
```

---

Feature2GOCC.pfam	<i>Annotations and scores between Pfam domains/combinations and Gene Ontology Cellular Component (GOCC).</i>
-------------------	--

---

**Description**

An object of class "HIS" that contains annotations and scores between Gene Ontology Cellular Component terms and Pfam domains/combinations. This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

**Usage**

```
Feature2GOCC.pfam <- dcRDataLoader(RData=Feature2GOCC.pfam)
```

**Value**

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

**References**

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

**Examples**

```
# load data
Feature2GOCC.pfam <- dcRDataLoader(RData=Feature2GOCC.pfam)
names(Feature2GOCC.pfam)
```

---

Feature2GOCC.sf	<i>Annotations and scores between SCOP domains/combinations (at the superfamily level; sf) and Gene Ontology Cellular Component (GOCC).</i>
-----------------	---

---

## Description

An object of class "HIS" that contains annotations and scores between Gene Ontology Cellular Component terms and SCOP domains/combinations (at the superfamily level; sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
Feature2GOCC.sf <- dcRDataLoader(RData=Feature2GOCC.sf)
```

## Value

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

## Examples

```
# load data
Feature2GOCC.sf <- dcRDataLoader(RData=Feature2GOCC.sf)
names(Feature2GOCC.sf)
```

---

Feature2GOMF.interpro    *Annotations and scores between InterPro domains and Gene Ontology Molecular Function (GOMF).*

---

### Description

An object of class "HIS" that contains annotations and scores between Gene Ontology Molecular Function terms and InterPro domains. This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

### Usage

```
Feature2GOMF.interpro <- dcRDataLoader(RData=Feature2GOMF.interpro)
```

### Value

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

### References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

### Examples

```
# load data
Feature2GOMF.interpro <- dcRDataLoader(RData=Feature2GOMF.interpro)
names(Feature2GOMF.interpro)
```

---

Feature2GOMF.pfam    *Annotations and scores between Pfam domains/combinations and Gene Ontology Molecular Function (GOMF).*

---

### Description

An object of class "HIS" that contains annotations and scores between Gene Ontology Molecular Function terms and Pfam domains/combinations. This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).



**Usage**

```
Feature2GOMF.pfam <- dcRDataLoader(RData=Feature2GOMF.pfam)
```

**Value**

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

**References**

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

**Examples**

```
# load data
Feature2GOMF.pfam <- dcRDataLoader(RData=Feature2GOMF.pfam)
names(Feature2GOMF.pfam)
```

---

Feature2GOMF.sf	<i>Annotations and scores between SCOP domains/combinations (at the superfamily level; sf) and Gene Ontology Molecular Function (GOMF).</i>
-----------------	---

---

**Description**

An object of class "HIS" that contains annotations and scores between Gene Ontology Molecular Function terms and SCOP domains/combinations (at the superfamily level; sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

**Usage**

```
Feature2GOMF.sf <- dcRDataLoader(RData=Feature2GOMF.sf)
```

**Value**

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)

- **ic**: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- **slim**: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

## Examples

```
# load data
Feature2GOMF.sf <- dcRDataLoader(RData=Feature2GOMF.sf)
names(Feature2GOMF.sf)
```

---

Feature2HPPA.interpro    *Annotations and scores between InterPro domains and Human Phenotype Phenotypic Abnormality (HPPA).*

---

## Description

An object of class "HIS" that contains annotations and scores between Human Phenotype Phenotypic Abnormality terms and InterPro domains. This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
Feature2HPPA.interpro <- dcRDataLoader(RData=Feature2HPPA.interpro)
```

## Value

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- **hscore**: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- **ic**: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- **slim**: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

**Examples**

```
# load data
Feature2HPPA.interpro <- dcRDataLoader(RData=Feature2HPPA.interpro)
names(Feature2HPPA.interpro)
```

---

Feature2HPPA.pfam	<i>Annotations and scores between Pfam domains/combinations and Human Phenotype Phenotypic Abnormality (HPPA).</i>
-------------------	--

---

**Description**

An object of class "HIS" that contains annotations and scores between Human Phenotype Phenotypic Abnormality terms and Pfam domains/combinations. This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

**Usage**

```
Feature2HPPA.pfam <- dcRDataLoader(RData=Feature2HPPA.pfam)
```

**Value**

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

**References**

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

**Examples**

```
# load data
Feature2HPPA.pfam <- dcRDataLoader(RData=Feature2HPPA.pfam)
names(Feature2HPPA.pfam)
```

---

Feature2HPPA.sf	<i>Annotations and scores between SCOP domains/combinations (at the superfamily level; sf) and Human Phenotype Phenotypic Abnormality (HPPA).</i>
-----------------	---

---

## Description

An object of class "HIS" that contains annotations and scores between Human Phenotype Phenotypic Abnormality terms and SCOP domains/combinations (at the superfamily level; sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
Feature2HPPA.sf <- dcRDataLoader(RData=Feature2HPPA.sf)
```

## Value

an object of class HIS. It has three components for "hscore", "ic" and "slim":

- hscore: a list of domain-related features, each with a term-named vector containing hypergeometric score (hscore)
- ic: a term-named vector containing information content (IC). Terms are ordered first by IC and then by longest-path level, making sure that for terms with the same IC, parental terms always come first
- slim: a list of four slims, each with a term-named vector containing information content (IC). Slim '1' for very general terms, '2' for general terms, '3' for specific terms, '4' for very specific terms

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.  
 Fang H and Gough J. (2013) A domain-centric solution to functional genomics via dcGO Predictor. *BMC Bioinformatics*, 14(Suppl 3):S9.

## Examples

```
# load data
Feature2HPPA.sf <- dcRDataLoader(RData=Feature2HPPA.sf)
names(Feature2HPPA.sf)
```

---

InfoDataFrame-class     *Definition for S4 class InfoDataFrame*


---

**Description**

InfoDataFrame has two slots: data and dimLabels.

**Value**

Class InfoDataFrame

**Slots**

data A data.frame containing terms (rows) and measured variables (columns).

dimLabels A character describing labels for rows and columns.

**Creation**

An object of this class can be created via: `new("InfoDataFrame", data, dimLabels)`

**Methods**

Class-specific methods:

- `dim()`: retrieve the dimension in the object
- `nrow()`: retrieve number of rows in the object
- `ncol()`: retrieve number of columns in the object
- `rowNames()`: retrieve names of rows in the object
- `colNames()`: retrieve names of columns in the object
- `dimLabels()`: retrieve the slot 'dimLabels', containing labels used for display of rows and columns in the object
- `Data()`: retrieve the slot 'data' in the object

Standard generic methods:

- `str()`: compact display of the content in the object
- `show()`: abbreviated display of the object
- `as(data.frame, "InfoDataFrame")`: convert a data.frame to an object of class InfoDataFrame
- `[i, j]`: get the subset of the same class

**Access**

Ways to access information on this class:

- `showClass("InfoDataFrame")`: show the class definition
- `showMethods(classes="InfoDataFrame")`: show the method definition upon this class
- `getSlots("InfoDataFrame")`: get the name and class of each slot in this class
- `slotNames("InfoDataFrame")`: get the name of each slot in this class
- `selectMethod(f, signature="InfoDataFrame")`: retrieve the definition code for the method 'f' defined in this class

**See Also**

[InfoDataFrame-method](#)

**Examples**

```
# generate data on domain information on
data <- data.frame(x=1:10, y=I(LETTERS[1:10]),
  row.names=paste("Domain", 1:10, sep="_"))
dimLabels <- c("rowLabels", "colLabels")
# create an object of class InfoDataFrame
x <- new("InfoDataFrame", data=data, dimLabels=dimLabels)
x
# alternatively, using coerce methods
x <- as(data, "InfoDataFrame")
x
# look at various methods defined on class Anno
dimLabels(x)
dim(x)
nrow(x)
ncol(x)
rowNames(x)
colNames(x)
Data(x)
x[1:3,]
```

---

InfoDataFrame-method    *Methods defined for S4 class InfoDataFrame*

---

**Description**

Methods defined for class InfoDataFrame.

**Usage**

```
dimLabels(x)

## S4 method for signature InfoDataFrame
dimLabels(x)

## S4 method for signature InfoDataFrame
dim(x)

## S4 method for signature InfoDataFrame
nrow(x)

## S4 method for signature InfoDataFrame
ncol(x)

## S4 method for signature InfoDataFrame
rowNames(x)

## S4 method for signature InfoDataFrame
```

```
colNames(x)

## S4 method for signature InfoDataFrame
Data(x)

## S4 method for signature InfoDataFrame
show(object)

## S4 method for signature InfoDataFrame,ANY,ANY,ANY
x[i, j, ..., drop = FALSE]
```

### Arguments

x	an object of class InfoDataFrame
object	an object of class InfoDataFrame
i	an index
j	an index
...	additional parameters
drop	a logic for matrices and arrays. If TRUE the result is coerced to the lowest possible dimension. This only works for extracting elements, not for the replacement

### See Also

[InfoDataFrame-class](#)

---

InterPro	<i>InterPro domains (InterPro).</i>
----------	-------------------------------------

---

### Description

An object of class "InfoDataFrame" that contains information on InterPro domains (InterPro). This data is prepared based on <ftp://anonymous@ftp.ebi.ac.uk/pub/databases/interpro/Current/entry.list>.

### Usage

```
data(InterPro)
```

### Value

an object of class [InfoDataFrame](#). It has slots for data and dimLabels:

- data: a data.frame containing information about 11638 annotatable domains (in rows), with 3 columns ("id" for InterPro ID, and "level" always equals "InterPro", "description" for InterPro description)
- dimLabels: a character describing labels for rows and columns in data

### References

Hunter et al. (2012) InterPro in 2011: new developments in the family and domain prediction database. *Nucleic Acids Res*, 40(Database issue):D306-12.

**See Also**

[InfoDataFrame-class](#)

**Examples**

```
# load data
data(InterPro)
InterPro
# retrieve the dimension
dim(InterPro)
# retrieve names of columns
colNames(InterPro)
# retrieve the first 5 rows of data
Data(InterPro)[1:5,]
```

---

InterPro2GOBP

*Annotations of InterPro domains by Gene Ontology Biological Process (GOBP).*

---

**Description**

An object of class "Anno" that contains associations between Gene Ontology Biological Process terms and InterPro domains. This data is prepared based on the InterPro database (see <http://www.ebi.ac.uk/interpro/>) and <ftp://anonymous@ftp.ebi.ac.uk/pub/databases/interpro/Current/interpro2go>.

**Usage**

```
data(InterPro2GOBP)
```

**Value**

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for InterPro ID, and "level" always equals "InterPro", "description" for InterPro description

**References**

Hunter et al. (2012) Manual GO annotation of predictive protein signatures: the InterPro approach to GO curation. *Database (Oxford)*, 2012:bar068.

**See Also**

[Anno-class](#)



## Examples

```
# load data
data(InterPro2GOBP)
InterPro2GOBP
# retrieve info on ontology terms
termData(InterPro2GOBP)
# retrieve info on InterPro domains
domainData(InterPro2GOBP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(InterPro2GOBP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

InterPro2GOCC	<i>Annotations of InterPro domains by Gene Ontology Cellular Component (GOCC).</i>
---------------	--

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Cellular Component terms and InterPro domains. This data is prepared based on the InterPro database (see <http://www.ebi.ac.uk/interpro/>) and <ftp://anonymous@ftp.ebi.ac.uk/pub/databases/interpro/Current/interpro2go>.

## Usage

```
data(InterPro2GOCC)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for InterPro ID, and "level" always equals "InterPro", "description" for InterPro description

## References

Hunter et al. (2012) Manual GO annotation of predictive protein signatures: the InterPro approach to GO curation. *Database (Oxford)*, 2012:bar068.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(InterPro2GOCC)
InterPro2GOCC
# retrieve info on ontology terms
termData(InterPro2GOCC)
# retrieve info on InterPro domains
domainData(InterPro2GOCC)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(InterPro2GOCC)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

InterPro2GOMF	<i>Annotations of InterPro domains by Gene Ontology Molecular Function (GOMF).</i>
---------------	--

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Molecular Function terms and InterPro domains. This data is prepared based on the InterPro database (see <http://www.ebi.ac.uk/interpro/>) and <ftp://anonymous@ftp.ebi.ac.uk/pub/databases/interpro/Current/interpro2go>.

## Usage

```
data(InterPro2GOMF)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for InterPro ID, and "level" always equals "InterPro", "description" for InterPro description

## References

Hunter et al. (2012) Manual GO annotation of predictive protein signatures: the InterPro approach to GO curation. *Database (Oxford)*, 2012:bar068.

## See Also

[Anno-class](#)

**Examples**

```
# load data
data(InterPro2GOMF)
InterPro2GOMF
# retrieve info on ontology terms
termData(InterPro2GOMF)
# retrieve info on InterPro domains
domainData(InterPro2GOMF)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(InterPro2GOMF)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

Onto-class

*Definition for S4 class Onto***Description**

Onto has 2 slots: nodeInfo and adjMatrix

**Value**

Class Onto

**Slots**

nodeInfo An object of S4 class [InfoDataFrame](#), describing information on nodes/terms.

adjMatrix An object of S4 class [AdjData](#), containing adjacency data matrix (for a direct graph), with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

**Creation**

An object of this class can be created via: `new("Onto", nodeInfo, adjMatrix)`

**Methods**

Class-specific methods:

- `dim()`: retrieve the dimension in the object
- `adjMatrix()`: retrieve the slot 'adjMatrix' in the object
- `nodeInfo()`: retrieve the slot 'nodeInfo' (as class `InfoDataFrame`) in the object
- `nInfo()`: retrieve nodeInfo (as `data.frame`) in the object
- `nodeName()`: retrieve node/term names (ie, row names of nodeInfo) in the object
- `term_id()`: retrieve term id (ie, column 'term\_id' of nodeInfo) in the object, if any
- `term_name()`: retrieve term id (ie, column 'term\_name' of nodeInfo) in the object, if any
- `term_namespace()`: retrieve term id (ie, column 'term\_namespace' of nodeInfo) in the object, if any
- `term_distance()`: retrieve term id (ie, column 'term\_distance' of nodeInfo) in the object, if any

Standard generic methods:

- `str()`: compact display of the content in the object
- `show()`: abbreviated display of the object
- `as(matrix, "Onto")`: convert a matrix to an object of class `Onto`
- `as(dgCMatrix, "Onto")`: convert a `dgCMatrix` (a sparse matrix) to an object of class `Onto`
- `[i]`: get the subset of the same class

## Access

Ways to access information on this class:

- `showClass("Onto")`: show the class definition
- `showMethods(classes="Onto")`: show the method definition upon this class
- `getSlots("Onto")`: get the name and class of each slot in this class
- `slotNames("Onto")`: get the name of each slot in this class
- `selectMethod(f, signature="Onto")`: retrieve the definition code for the method 'f' defined in this class

## See Also

[Onto-method](#)

## Examples

```
# create an object of class Onto, only given a matrix
adjM <- matrix(runif(25),nrow=5,ncol=5)
as(adjM, "Onto")

# create an object of class Onto, given a matrix plus information on nodes
# 1) create nodeI: an object of class InfoDataFrame
data <- data.frame(term_id=paste("Term", 1:5, sep="_"),
  term_name=LETTERS[1:5], term_namespace=rep("Namespace",5),
  term_distance=1:5, row.names=paste("Term", 1:5, sep="_"))
nodeI <- new("InfoDataFrame", data=data)
nodeI
# 2) create an object of class Onto
# VERY IMPORTANT: make sure having consistent names between nodeInfo and adjMatrix
adjM <- matrix(runif(25),nrow=5,ncol=5)
colnames(adjM) <- rownames(adjM) <- rowNames(nodeI)
x <- new("Onto", adjMatrix=adjM, nodeInfo=nodeI)
x
# 3) look at various methods defined on class Onto
dim(x)
adjMatrix(x)
nodeInfo(x)
nInfo(x)
nodeNames(x)
term_id(x)
term_namespace(x)
term_distance(x)
# 4) get the subset
x[1:2]
```

Onto-method

*Methods defined for S4 class Onto***Description**

Methods defined for class Onto.

**Usage**

```
## S4 method for signature Onto
dim(x)

## S4 method for signature Onto
adjMatrix(x)

## S4 method for signature Onto
nodeInfo(x)

## S4 method for signature Onto
nInfo(object)

## S4 method for signature Onto
nodeName(object)

## S4 method for signature Onto
term_id(object)

## S4 method for signature Onto
term_name(object)

## S4 method for signature Onto
term_namespace(object)

## S4 method for signature Onto
term_distance(object)

## S4 method for signature Onto
show(object)

## S4 method for signature Onto,ANY,ANY,ANY
x[i, j, ..., drop = FALSE]
```

**Arguments**

x	an object of class Onto
object	an object of class Onto
i	an index
j	an index
...	additional parameters
drop	a logic for matrices and arrays. If TRUE the result is coerced to the lowest possible dimension. This only works for extracting elements, not for the replacement

## See Also

[Onto-class](#)

---

onto.DO

*Disease Ontology (DO).*

---

## Description

An R object that contains information on Gene Ontology Biological Process terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). This data is prepared based on <http://sourceforge.net/p/diseaseontology/code/HEAD/tree/trunk/HumanDO.obo>.

## Usage

```
data(onto.DO)
```

## Value

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

## References

Schriml et al. (2012) Disease Ontology: a backbone for disease semantic integration. *Nucleic Acids Res*, 40:D940-946.  
Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## Examples

```
data(onto.DO)  
onto.DO
```

---

onto.EC	<i>Enzyme Commission (EC).</i>
---------	--------------------------------

---

## Description

An R object that contains information on Enzyme Commission terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). Enzyme Commission (EC) is a resource focused on enzyme nomenclature, which is a system of naming enzymes (protein catalysts) with Cross-references to UniProt sequences. It uses four-digit EC numbers to define the reaction catalysed. The first three digits are to define the reaction catalysed and the fourth for a unique identifier (serial number).

## Usage

```
onto.EC <- dcRDataLoader(RData=onto.EC)
```

## Value

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

## References

Fleischmann et al. (2004) IntEnz, the integrated relational enzyme database. *Nucleic Acids Res*, 32:D434-7.  
 Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## Examples

```
onto.EC <- dcRDataLoader(RData=onto.EC)
onto.EC
```

---

onto.GOBP	<i>Gene Ontology Biological Process (GOBP).</i>
-----------	---

---

## Description

An R object that contains information on Gene Ontology Biological Process terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). This data is prepared based on [http://www.geneontology.org/ontology/obo\\_format\\_1\\_2/gene\\_ontology.1\\_2.obo](http://www.geneontology.org/ontology/obo_format_1_2/gene_ontology.1_2.obo). Only the edges with the relation (either 'is\_a' or 'part\_of') are retained.

**Usage**

```
data(onto.GOBP)
```

**Value**

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

**References**

Ashburner et al. (2000) Gene ontology: tool for the unification of biology. *Nat Genet*, 25:25-29.  
 Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

**Examples**

```
data(onto.GOBP)
onto.GOBP
```

---

onto.GOCC

*Gene Ontology Cellular Component (GOCC).*

---

**Description**

An R object that contains information on Gene Ontology Cellular Component terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). This data is prepared based on [http://www.geneontology.org/ontology/obo\\_format\\_1\\_2/gene\\_ontology.1\\_2.obo](http://www.geneontology.org/ontology/obo_format_1_2/gene_ontology.1_2.obo). Only the edges with the relation (either 'is\_a' or 'part\_of') are retained.

**Usage**

```
data(onto.GOCC)
```

**Value**

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)



## References

Ashburner et al. (2000) Gene ontology: tool for the unification of biology. *Nat Genet*, 25:25-29.  
 Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## Examples

```
data(onto.GOCC)
onto.GOCC
```

---

onto.GOMF	<i>Gene Ontology Molecular Function (GOMF).</i>
-----------	---

---

## Description

An R object that contains information on Gene Ontology Molecular Function terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). This data is prepared based on [http://www.geneontology.org/ontology/obo\\_format\\_1\\_2/gene\\_ontology.1\\_2.obo](http://www.geneontology.org/ontology/obo_format_1_2/gene_ontology.1_2.obo). Only the edges with the relation (either 'is\_a' or 'part\_of') are retained.

## Usage

```
data(onto.GOMF)
```

## Value

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

## References

Ashburner et al. (2000) Gene ontology: tool for the unification of biology. *Nat Genet*, 25:25-29.  
 Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## Examples

```
data(onto.GOMF)
onto.GOMF
```

---

onto.HPMI

*Human Phenotype Mode of Inheritance (HPMI).*

---

### Description

An R object that contains information on Human Phenotype Mode of Inheritance terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). This data is prepared based on <http://compbio.charite.de/svn/hpo/trunk/src/ontology/human-phenotype-ontology.obo>.

### Usage

```
data(onto.HPMI)
```

### Value

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

### References

Robinson et al. (2012) The Human Phenotype Ontology: a tool for annotating and analyzing human hereditary disease. *Am J Hum Genet*, 83:610-615.  
 Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

### Examples

```
data(onto.HPMI)
onto.HPMI
```

---

onto.HPON

*Human Phenotype ONset and clinical course (HPON).*

---

### Description

An R object that contains information on Human Phenotype ONset and clinical course terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). This data is prepared based on <http://compbio.charite.de/svn/hpo/trunk/src/ontology/human-phenotype-ontology.obo>.

## Usage

```
data(onto.HPON)
```

## Value

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

## References

Robinson et al. (2012) The Human Phenotype Ontology: a tool for annotating and analyzing human hereditary disease. *Am J Hum Genet*, 83:610-615.  
 Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## Examples

```
data(onto.HPON)
onto.HPON
```

---

onto.HPPA

*Human Phenotype Phenotypic Abnormality (HPPA).*

---

## Description

An R object that contains information on Human Phenotype Phenotypic Abnormality terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). This data is prepared based on <http://compbio.charite.de/svn/hpo/trunk/src/ontology/human-phenotype-ontology.obo>.

## Usage

```
data(onto.HPPA)
```

## Value

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

## References

Robinson et al. (2012) The Human Phenotype Ontology: a tool for annotating and analyzing human hereditary disease. *Am J Hum Genet*, 83:610-615.

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## Examples

```
data(onto.HPPA)
onto.HPPA
```

---

onto.KW

*UniProtKB KeyWords (KW).*

---

## Description

An R object that contains information on UniProtKB KeyWords terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). UniProtKB KeyWords (KW) controlled vocabulary provides a summary of the entry content and is used to index UniProtKB/Swiss-Prot entries based on 10 categories (the category "Technical term" being excluded here).

## Usage

```
onto.KW <- dcRDataLoader(RData=onto.KW)
```

## Value

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

## References

Bairoch et al. (2005) The Universal Protein Resource (UniProt). *Nucleic Acids Res*, 33:D154-9.

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## Examples

```
onto.KW <- dcRDataLoader(RData=onto.KW)
onto.KW
```

---

onto.MP	<i>Mammalian Phenotype (MP).</i>
---------	----------------------------------

---

## Description

An R object that contains information on Mammalian Phenotype terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). This data is prepared based on <http://sourceforge.net/p/diseaseontology/code/HEAD/tree/trunk/HumanMP.obo>.

## Usage

```
data(onto.MP)
```

## Value

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

## References

Smith et al. (2009) The Mammalian Phenotype Ontology: enabling robust annotation and comparative analysis. *Wiley Interdiscip Rev Syst Biol Med*, 1:390-399.  
 Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## Examples

```
data(onto.MP)
onto.MP
```

---

onto.UP	<i>UniProtKB UniPathway (UP).</i>
---------	-----------------------------------

---

## Description

An R object that contains information on UniProtKB UniPathway terms. These terms are organised as a direct acyclic graph (DAG), which is further stored as an object of the class 'igraph' (see <http://igraph.org/r/doc/aaa-igraph-package.html>). UniProtKB UniPathway (UP) is a fully manually curated resource for the representation and annotation of metabolic pathways, being used as a controlled vocabulary for pathway annotation in UniProtKB.

## Usage

```
onto.UP <- dcRDataLoader(RData=onto.UP)
```

**Value**

an object of S4 class [Onto](#). It has slots for "nodeInfo" and "adjMatrix"

- nodeInfo: an object of S4 class [InfoDataFrame](#), describing information on nodes/terms including: "term\_id" (i.e. Term ID), "term\_name" (i.e. Term Name), "term\_namespace" (i.e. Term Namespace), and "term\_distance" (i.e. Term Distance: the distance to the root; always 0 for the root itself)
- adjMatrix: an object of S4 class [AdjData](#), containing adjacency data matrix, with rows for parent (arrow-outbound) and columns for children (arrow-inbound)

**References**

Morgat et al. (2006) UniPathway: a resource for the exploration and annotation of metabolic pathways. *Nucleic Acids Res*, 40:D761-9.  
 Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

**Examples**

```
onto.UP <- dcRDataLoader(RData=onto.UP)
onto.UP
```

---

 Pfam

*Pfam domains (Pfam).*


---

**Description**

An object of class "InfoDataFrame" that contains information on Pfam domains (Pfam). This data is prepared based on [ftp://ftp.sanger.ac.uk/pub/databases/Pfam/current\\_release/database\\_files/pfamA.txt.gz](ftp://ftp.sanger.ac.uk/pub/databases/Pfam/current_release/database_files/pfamA.txt.gz).

**Usage**

```
data(Pfam)
```

**Value**

an object of class [InfoDataFrame](#). It has slots for data and dimLabels:

- data: a data.frame containing information about 14831 domains (in rows), with 3 columns ("id" for Pfam accession ID, and "level" always equals "Pfam", "description" for Pfam description)
- dimLabels: a character describing labels for rows and columns in data

**References**

Finn et al. (2014) The Pfam protein families database. *Nucleic Acids Res*, 42(Database issue):D222-D230.

**See Also**

[InfoDataFrame-class](#)

## Examples

```
# load data
data(Pfam)
Pfam
# retrieve the dimension
dim(Pfam)
# retrieve names of columns
colNames(Pfam)
# retrieve the first 5 rows of data
Data(Pfam)[1:5,]
```

---

Pfam2GOBP

*Annotations of Pfam domains by Gene Ontology Biological Process (GOBP).*

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Biological Process terms and Pfam domains. This data is prepared based on the Pfam database (see <http://pfam.xfam.org>) and <ftp://ftp.geneontology.org/pub/go/external2go/pfam2go>.

## Usage

```
data(Pfam2GOBP)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for Pfam accession ID, and "level" always equals "Pfam", "description" for Pfam description

## References

Finn et al. (2014) The Pfam protein families database. *Nucleic Acids Res*, 42(Database issue):D222-D230.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(Pfam2GOBP)
Pfam2GOBP
# retrieve info on ontology terms
termData(Pfam2GOBP)
# retrieve info on Pfam domains
domainData(Pfam2GOBP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(Pfam2GOBP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

Pfam2GOCC	<i>Annotations of Pfam domains by Gene Ontology Cellular Component (GOCC).</i>
-----------	--

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Cellular Component terms and Pfam domains. This data is prepared based on the Pfam database (see <http://pfam.xfam.org>) and <ftp://ftp.geneontology.org/pub/go/external2go/pfam2go>.

## Usage

```
data(Pfam2GOCC)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for Pfam accession ID, and "level" always equals "Pfam", "description" for Pfam description

## References

Finn et al. (2014) The Pfam protein families database. *Nucleic Acids Res*, 42(Database issue):D222-D230.

## See Also

[Anno-class](#)



## Examples

```
# load data
data(Pfam2GOCC)
Pfam2GOCC
# retrieve info on ontology terms
termData(Pfam2GOCC)
# retrieve info on Pfam domains
domainData(Pfam2GOCC)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(Pfam2GOCC)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

Pfam2GOMF	<i>Annotations of Pfam domains by Gene Ontology Molecular Function (GOMF).</i>
-----------	--

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Molecular Function terms and Pfam domains. This data is prepared based on the Pfam database (see <http://pfam.xfam.org>) and <ftp://ftp.geneontology.org/pub/go/external2go/pfam2go>.

## Usage

```
data(Pfam2GOMF)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for Pfam accession ID, and "level" always equals "Pfam", "description" for Pfam description

## References

Finn et al. (2014) The Pfam protein families database. *Nucleic Acids Res*, 42(Database issue):D222-D230.

## See Also

[Anno-class](#)

**Examples**

```
# load data
data(Pfam2GOMF)
Pfam2GOMF
# retrieve info on ontology terms
termData(Pfam2GOMF)
# retrieve info on Pfam domains
domainData(Pfam2GOMF)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(Pfam2GOMF)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

Rfam

*RNA families (Rfam).***Description**

An object of class "InfoDataFrame" that contains information on RNA families (Rfam). This data is prepared based on [ftp://anonymous@ftp.sanger.ac.uk/pub/databases/Rfam/11.0/database\\_files/rfam.txt.gz](ftp://anonymous@ftp.sanger.ac.uk/pub/databases/Rfam/11.0/database_files/rfam.txt.gz).

**Usage**

```
data(Rfam)
```

**Value**

an object of class [InfoDataFrame](#). It has slots for data and dimLabels:

- data: a data.frame containing information about 2208 RNA families (in rows), with 3 columns ("id" for Rfam accession ID, and "level" always equals "Rfam", "description" for Rfam description)
- dimLabels: a character describing labels for rows and columns in data

**References**

Gardner et al. (2011) Rfam: Wikipedia, clans and the "decimal" release. *Nucleic Acids Res*, 39(Database issue):D141-D145.

**See Also**

[InfoDataFrame-class](#)

**Examples**

```
# load data
data(Rfam)
Rfam
# retrieve the dimension
dim(Rfam)
# retrieve names of columns
```

```
colNames(Rfam)
# retrieve the first 5 rows of data
Data(Rfam)[1:5,]
```

Rfam2GOBP

*Annotations of Rfam RNA families by Gene Ontology Biological Process (GOBP).*

## Description

An object of class "Anno" that contains associations between Gene Ontology Biological Process terms and Rfam RNA families. This data is prepared based on the Rfam database (see <http://rfam.xfam.org>) and <http://geneontology.org/external2go/rfam2go>.

## Usage

```
data(Rfam2GOBP)
```

## Value

an object of class `Anno`. It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of RNAs X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing RNAs (i.e. rows in annoData), including: "id" for Rfam accession ID, and "level" always equals "Rfam", "description" for Rfam description

## References

Gardner et al. (2011) Rfam: Wikipedia, clans and the "decimal" release. *Nucleic Acids Res*, 39(Database issue):D141-D145.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(Rfam2GOBP)
Rfam2GOBP
# retrieve info on ontology terms
termData(Rfam2GOBP)
# retrieve info on Rfam RNAs
domainData(Rfam2GOBP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(Rfam2GOBP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

Rfam2GOCC

*Annotations of Rfam RNA families by Gene Ontology Cellular Component (GOCC).*

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Cellular Component terms and Rfam RNA families. This data is prepared based on the Rfam database (see <http://rfam.xfam.org>) and <http://geneontology.org/external2go/rfam2go>.

## Usage

```
data(Rfam2GOCC)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of RNAs X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing RNAs (i.e. rows in annoData), including: "id" for Rfam accession ID, and "level" always equals "Rfam", "description" for Rfam description

## References

Gardner et al. (2011) Rfam: Wikipedia, clans and the "decimal" release. *Nucleic Acids Res*, 39(Database issue):D141-D145.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(Rfam2GOCC)
Rfam2GOCC
# retrieve info on ontology terms
termData(Rfam2GOCC)
# retrieve info on Rfam RNAs
domainData(Rfam2GOCC)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(Rfam2GOCC)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

Rfam2GOMF*Annotations of Rfam RNA families by Gene Ontology Molecular Function (GOMF).*

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Molecular Function terms and Rfam RNA families. This data is prepared based on the Rfam database (see <http://rfam.xfam.org>) and <http://geneontology.org/external2go/rfam2go>.

## Usage

```
data(Rfam2GOMF)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of RNAs X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing RNAs (i.e. rows in annoData), including: "id" for Rfam accession ID, and "level" always equals "Rfam", "description" for Rfam description

## References

Gardner et al. (2011) Rfam: Wikipedia, clans and the "decimal" release. *Nucleic Acids Res*, 39(Database issue):D141-D145.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(Rfam2GOMF)
Rfam2GOMF
# retrieve info on ontology terms
termData(Rfam2GOMF)
# retrieve info on Rfam RNAs
domainData(Rfam2GOMF)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(Rfam2GOMF)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.fa	<i>SCOP domain families (fa).</i>
---------	-----------------------------------

---

## Description

An object of class "InfoDataFrame" that contains information on SCOP domain families (fa).

## Usage

```
data(SCOP.fa)
```

## Value

an object of class [InfoDataFrame](#). It has slots for data and dimLabels:

- data: a data.frame containing information about 2223 domains (in rows), with 3 columns ("id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description)
- dimLabels: a character describing labels for rows and columns in data

## References

Morais et al. (2011) SUPERFAMILY 1.75 including a domain-centric gene ontology method. *Nucleic Acids Res*, 39(Database issue):D427-34.  
Andreeva et al. (2008) Data growth and its impact on the SCOP database: new developments. *Nucleic Acids Res*, 36(Database issue):D419-425

## See Also

[InfoDataFrame-class](#)

## Examples

```
# load data
data(SCOP.fa)
SCOP.fa
# retrieve the dimension
dim(SCOP.fa)
# retrieve names of columns
colNames(SCOP.fa)
# retrieve the first 5 rows of data
Data(SCOP.fa)[1:5,]
```

---

SCOP.fa2DO*Annotations of SCOP domain families (fa) by Disease Ontology (DO).*

---

## Description

An object of class "Anno" that contains associations between Disease Ontology terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.fa2DO)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.fa2DO)
SCOP.fa2DO
# retrieve info on ontology terms
termData(SCOP.fa2DO)
# retrieve info on SCOP domains
domainData(SCOP.fa2DO)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2DO)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

SCOP.fa2EC

*Annotations of SCOP domain families (fa) by Enzyme Commission (EC).***Description**

An object of class "Anno" that contains associations between Enzyme Commission terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

**Usage**

```
SCOP.fa2EC <- dcRDataLoader(RData=SCOP.fa2EC)
```

**Value**

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

**References**

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

**See Also**

[Anno-class](#)

**Examples**

```
# load data
SCOP.fa2EC <- dcRDataLoader(RData=SCOP.fa2EC)
SCOP.fa2EC
# retrieve info on ontology terms
termData(SCOP.fa2EC)
# retrieve info on SCOP domains
domainData(SCOP.fa2EC)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2EC)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```



---

SCOP.fa2GOBP*Annotations of SCOP domain families (fa) by Gene Ontology Biological Process (GOBP).*

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Biological Process terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.fa2GOBP)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.fa2GOBP)
SCOP.fa2GOBP
# retrieve info on ontology terms
termData(SCOP.fa2GOBP)
# retrieve info on SCOP domains
domainData(SCOP.fa2GOBP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2GOBP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.fa2GOCC

*Annotations of SCOP domain families (fa) by Gene Ontology Cellular Component (GOCC).*


---

## Description

An object of class "Anno" that contains associations between Gene Ontology Cellular Component terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.fa2GOCC)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.fa2GOCC)
SCOP.fa2GOCC
# retrieve info on ontology terms
termData(SCOP.fa2GOCC)
# retrieve info on SCOP domains
domainData(SCOP.fa2GOCC)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2GOCC)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.fa2GOMF	<i>Annotations of SCOP domain families (fa) by Gene Ontology Molecular Function (GOMF).</i>
--------------	---

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Molecular Function terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.fa2GOMF)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.fa2GOMF)
SCOP.fa2GOMF
# retrieve info on ontology terms
termData(SCOP.fa2GOMF)
# retrieve info on SCOP domains
domainData(SCOP.fa2GOMF)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2GOMF)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.fa2HPMI

*Annotations of SCOP domain families (fa) by Human Phenotype Mode of Inheritance (HPMI).*


---

## Description

An object of class "Anno" that contains associations between HPMI terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.fa2HPMI)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.fa2HPMI)
SCOP.fa2HPMI
# retrieve info on ontology terms
termData(SCOP.fa2HPMI)
# retrieve info on SCOP domains
domainData(SCOP.fa2HPMI)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2HPMI)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.fa2HPON*Annotations of SCOP domain families (fa) by Human Phenotype ONset and clinical course (HPON).*

---

## Description

An object of class "Anno" that contains associations between HPON terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.fa2HPON)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.fa2HPON)
SCOP.fa2HPON
# retrieve info on ontology terms
termData(SCOP.fa2HPON)
# retrieve info on SCOP domains
domainData(SCOP.fa2HPON)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2HPON)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.fa2HPPA

*Annotations of SCOP domain families (fa) by Human Phenotype Phenotypic Abnormality (HPPA).*


---

## Description

An object of class "Anno" that contains associations between HPPA terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.fa2HPPA)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.fa2HPPA)
SCOP.fa2HPPA
# retrieve info on ontology terms
termData(SCOP.fa2HPPA)
# retrieve info on SCOP domains
domainData(SCOP.fa2HPPA)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2HPPA)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.fa2KW	<i>Annotations of SCOP domain families (fa) by UniProtKB KeyWords (KW).</i>
------------	---

---

## Description

An object of class "Anno" that contains associations between UniProtKB KeyWords terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
SCOP.fa2KW <- dcRDataLoader(RData=SCOP.fa2KW)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
SCOP.fa2KW <- dcRDataLoader(RData=SCOP.fa2KW)
SCOP.fa2KW
# retrieve info on ontology terms
termData(SCOP.fa2KW)
# retrieve info on SCOP domains
domainData(SCOP.fa2KW)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2KW)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

`SCOP.fa2MP`*Annotations of SCOP domain families (fa) by Mammalian Phenotype (MP).*

---

## Description

An object of class "Anno" that contains associations between Mammalian Phenotype terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.fa2MP)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.fa2MP)
SCOP.fa2MP
# retrieve info on ontology terms
termData(SCOP.fa2MP)
# retrieve info on SCOP domains
domainData(SCOP.fa2MP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2MP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```



---

SCOP.fa2UP	<i>Annotations of SCOP domain families (fa) by UniProtKB UniPathway (UP).</i>
------------	---

---

## Description

An object of class "Anno" that contains associations between UniProtKB UniPathway terms and SCOP domain families (fa). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
SCOP.fa2UP <- dcRDataLoader(RData=SCOP.fa2UP)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
SCOP.fa2UP <- dcRDataLoader(RData=SCOP.fa2UP)
SCOP.fa2UP
# retrieve info on ontology terms
termData(SCOP.fa2UP)
# retrieve info on SCOP domains
domainData(SCOP.fa2UP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.fa2UP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.sf	<i>SCOP domain superfamilies (sf).</i>
---------	--

---

## Description

An object of class "InfoDataFrame" that contains information on SCOP domain superfamilies (sf).

## Usage

```
data(SCOP.sf)
```

## Value

an object of class [InfoDataFrame](#). It has slots for data and dimLabels:

- data: a data.frame containing information about 2223 domains (in rows), with 3 columns ("id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description)
- dimLabels: a character describing labels for rows and columns in data

## References

Morais et al. (2011) SUPERFAMILY 1.75 including a domain-centric gene ontology method. *Nucleic Acids Res*, 39(Database issue):D427-34.  
Andreeva et al. (2008) Data growth and its impact on the SCOP database: new developments. *Nucleic Acids Res*, 36(Database issue):D419-425

## See Also

[InfoDataFrame-class](#)

## Examples

```
# load data
data(SCOP.sf)
SCOP.sf
# retrieve the dimension
dim(SCOP.sf)
# retrieve names of columns
colNames(SCOP.sf)
# retrieve the first 5 rows of data
Data(SCOP.sf)[1:5,]
```

---

SCOP.sf2DO*Annotations of SCOP domain superfamilies (sf) by Disease Ontology (DO).*

---

## Description

An object of class "Anno" that contains associations between Disease Ontology terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.sf2DO)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.sf2DO)
SCOP.sf2DO
# retrieve info on ontology terms
termData(SCOP.sf2DO)
# retrieve info on SCOP domains
domainData(SCOP.sf2DO)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2DO)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

`SCOP.sf2EC`*Annotations of SCOP domain superfamilies (sf) by Enzyme Commission (EC).*

---

## Description

An object of class "Anno" that contains associations between Enzyme Commission terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
SCOP.sf2EC <- dcRDataLoader(RData=SCOP.sf2EC)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
SCOP.sf2EC <- dcRDataLoader(RData=SCOP.sf2EC)
SCOP.sf2EC
# retrieve info on ontology terms
termData(SCOP.sf2EC)
# retrieve info on SCOP domains
domainData(SCOP.sf2EC)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2EC)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.sf2GOBP*Annotations of SCOP domain superfamilies (sf) by Gene Ontology Biological Process (GOBP).*

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Biological Process terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.sf2GOBP)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.sf2GOBP)
SCOP.sf2GOBP
# retrieve info on ontology terms
termData(SCOP.sf2GOBP)
# retrieve info on SCOP domains
domainData(SCOP.sf2GOBP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2GOBP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.sf2GOCC

*Annotations of SCOP domain superfamilies (sf) by Gene Ontology Cellular Component (GOCC).*


---

## Description

An object of class "Anno" that contains associations between Gene Ontology Cellular Component terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.sf2GOCC)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.sf2GOCC)
SCOP.sf2GOCC
# retrieve info on ontology terms
termData(SCOP.sf2GOCC)
# retrieve info on SCOP domains
domainData(SCOP.sf2GOCC)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2GOCC)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.sf2GOMF	<i>Annotations of SCOP domain superfamilies (sf) by Gene Ontology Molecular Function (GOMF).</i>
--------------	--

---

## Description

An object of class "Anno" that contains associations between Gene Ontology Molecular Function terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.sf2GOMF)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.sf2GOMF)
SCOP.sf2GOMF
# retrieve info on ontology terms
termData(SCOP.sf2GOMF)
# retrieve info on SCOP domains
domainData(SCOP.sf2GOMF)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2GOMF)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.sf2HPMI

*Annotations of SCOP domain superfamilies (sf) by Human Phenotype Mode of Inheritance (HPMI).*


---

## Description

An object of class "Anno" that contains associations between HPMI terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.sf2HPMI)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.sf2HPMI)
SCOP.sf2HPMI
# retrieve info on ontology terms
termData(SCOP.sf2HPMI)
# retrieve info on SCOP domains
domainData(SCOP.sf2HPMI)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2HPMI)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```



---

`SCOP.sf2HPON`*Annotations of SCOP domain superfamilies (sf) by Human Phenotype ONset and clinical course (HPON).*

---

## Description

An object of class "Anno" that contains associations between HPON terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.sf2HPON)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.sf2HPON)
SCOP.sf2HPON
# retrieve info on ontology terms
termData(SCOP.sf2HPON)
# retrieve info on SCOP domains
domainData(SCOP.sf2HPON)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2HPON)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

`SCOP.sf2HPPA`*Annotations of SCOP domain superfamilies (sf) by Human Phenotype Phenotypic Abnormality (HPPA).*

---

### Description

An object of class "Anno" that contains associations between HPPA terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

### Usage

```
data(SCOP.sf2HPPA)
```

### Value

an object of class `Anno`. It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

### References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

### See Also

[Anno-class](#)

### Examples

```
# load data
data(SCOP.sf2HPPA)
SCOP.sf2HPPA
# retrieve info on ontology terms
termData(SCOP.sf2HPPA)
# retrieve info on SCOP domains
domainData(SCOP.sf2HPPA)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2HPPA)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.sf2KW*Annotations of SCOP domain superfamilies (sf) by UniProtKB KeyWords (KW).*

---

## Description

An object of class "Anno" that contains associations between UniProtKB KeyWords terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
SCOP.sf2KW <- dcRDataLoader(RData=SCOP.sf2KW)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
SCOP.sf2KW <- dcRDataLoader(RData=SCOP.sf2KW)
SCOP.sf2KW
# retrieve info on ontology terms
termData(SCOP.sf2KW)
# retrieve info on SCOP domains
domainData(SCOP.sf2KW)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2KW)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.sf2MP

*Annotations of SCOP domain superfamilies (sf) by Mammalian Phenotype (MP).*


---

## Description

An object of class "Anno" that contains associations between Mammalian Phenotype terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

## Usage

```
data(SCOP.sf2MP)
```

## Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

## References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

## See Also

[Anno-class](#)

## Examples

```
# load data
data(SCOP.sf2MP)
SCOP.sf2MP
# retrieve info on ontology terms
termData(SCOP.sf2MP)
# retrieve info on SCOP domains
domainData(SCOP.sf2MP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2MP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

---

SCOP.sf2UP*Annotations of SCOP domain superfamilies (sf) by UniProtKB Uni-Pathway (UP).*

---

### Description

An object of class "Anno" that contains associations between UniProtKB UniPathway terms and SCOP domain superfamilies (sf). This data is prepared based on the dcGO database (see <http://supfam.org/SUPERFAMILY/dcGO/>).

### Usage

```
SCOP.sf2UP <- dcRDataLoader(RData=SCOP.sf2UP)
```

### Value

an object of class [Anno](#). It has slots for "annoData", "termData" and "domainData":

- annoData: a sparse matrix of domains X terms
- termData: variables describing ontology terms (i.e. columns in annoData), including: "ID" (i.e. term ID), "Name" (i.e. term Names), "Namespace" (i.e. term Namespace), and "Distance" (i.e. term Distance to the ontology root)
- domainData: variables describing domains (i.e. rows in annoData), including: "id" for SCOP sunid, and "level" for SCOP level, "description" for SCOP description

### References

Fang H and Gough J. (2013) dcGO: database of domain-centric ontologies on functions, phenotypes, diseases and more. *Nucleic Acids Res*, 41(Database issue):D536-44.

### See Also

[Anno-class](#)

### Examples

```
# load data
SCOP.sf2UP <- dcRDataLoader(RData=SCOP.sf2UP)
SCOP.sf2UP
# retrieve info on ontology terms
termData(SCOP.sf2UP)
# retrieve info on SCOP domains
domainData(SCOP.sf2UP)
# retrieve the first 5 rows and columns of annotation data
x <- annoData(SCOP.sf2UP)[1:5,1:5]
x
# convert the above retrieval to the full matrix
as.matrix(x)
```

visEnrichment

*Function to visualise enrichment analysis outputs in the context of the ontology hierarchy*

## Description

visEnrichment is supposed to visualise enrichment analysis outputs (represented as an 'Eoutput' object) in the context of the ontology hierarchy (direct acyclic graph; DAG). Only part of DAG induced by those nodes/terms specified in query nodes (and the mode defining the paths to the root of DAG) will be visualised. Nodes in query are framed in black (by default), and all nodes (in query plus induced) will be color-coded according to a given data.type ('zscore'; otherwise taking the form of 10-based negative logarithm for 'adjp' or 'pvalue'). If no nodes in query, the top 5 significant terms (in terms of adjusted p-value) will be used for visualisation

## Usage

```
visEnrichment(e, nodes_query = NULL, num_top_nodes = 5,
  path.mode = c("all_shortest_paths", "shortest_paths", "all_paths"),
  data.type = c("adjp", "pvalue", "zscore"), height = 7, width = 7,
  margin = rep(0.1, 4), colormap = c("yr", "bwr", "jet", "gbr", "wyr",
    "br",
    "rainbow", "wb", "lightyellow-orange"), ncolors = 40, zlim = NULL,
  colorbar = T, colorbar.fraction = 0.1, newpage = T,
  layout.orientation = c("left_right", "top_bottom", "bottom_top",
    "right_left"), node.info = c("both", "none", "term_id", "term_name",
    "full_term_name"), graph.node.attrs = NULL, graph.edge.attrs = NULL,
  node.attrs = NULL)
```

## Arguments

e	an object of S4 class <a href="#">Eoutput</a>
nodes_query	a vector containing a list of nodes/terms in query. These nodes are used to produce a subgraph of the ontology DAG induced by them. If NULL, the top significant terms (in terms of p-value) will be determined by the next 'num_top_nodes'
num_top_nodes	a numeric value specifying the number of the top significant terms (in terms of p-value) will be used. This parameter does not work if the previous 'nodes_query' has been specified
path.mode	the mode of paths induced by nodes in query. It can be "all_paths" for all possible paths to the root, "shortest_paths" for only one path to the root (for each node in query), "all_shortest_paths" for all shortest paths to the root (i.e. for each node, find all shortest paths with the equal lengths)
data.type	a character telling which data type for nodes in query is used to color-code nodes. It can be one of 'adjp' for adjusted p-values (by default), 'pvalue' for p-values and 'zscore' for z-scores. When 'adjp' or 'pvalue' is used, 10-based negative logarithm is taken. For the style of how to color-code, please see the next arguments: colormap, ncolors, zlim and colorbar
height	a numeric value specifying the height of device
width	a numeric value specifying the width of device
margin	margins as units of length 4 or 1

<code>colormap</code>	short name for the colormap. It can be one of "yr" (yellow-red colormap; by default), "jet" (jet colormap), "bwr" (blue-white-red colormap), "gbr" (green-black-red colormap), "wyr" (white-yellow-red colormap), "br" (black-red colormap), "wb" (white-black colormap), and "rainbow" (rainbow colormap, that is, red-yellow-green-cyan-blue-magenta). Alternatively, any hyphen-separated HTML color names, e.g. "lightyellow-orange" (by default), "blue-black-yellow", "royalblue-white-sandybrown", "darkgreen-white-darkviolet". A list of standard color names can be found in <a href="http://html-color-codes.info/color-names">http://html-color-codes.info/color-names</a>
<code>ncolors</code>	the number of colors specified over the colormap
<code>zlim</code>	the minimum and maximum z/data values for which colors should be plotted, defaulting to the range of the finite values of z. Each of the given colors will be used to color an equispaced interval of this range. The midpoints of the intervals cover the range, so that values just outside the range will be plotted
<code>colorbar</code>	logical to indicate whether to append a colorbar. If data is null, it always sets to false
<code>colorbar.fraction</code>	the relative fraction of colorbar block against the device size
<code>newpage</code>	logical to indicate whether to open a new page. By default, it sets to true for opening a new page
<code>layout.orientation</code>	the orientation of the DAG layout. It can be one of "left_right" for the left-right layout (viewed from the DAG root point; by default), "top_bottom" for the top-bottom layout, "bottom_top" for the bottom-top layout, and "right_left" for the right-left layout
<code>node.info</code>	tells the ontology term information used to label nodes. It can be one of "both" for using both of Term ID and Name (the first 15 characters; by default), "none" for no node labeling, "term_id" for using Term ID, "term_name" for using Term Name (the first 15 characters), and "full_term_name" for using the full Term Name
<code>graph.node.attrs</code>	a list of global node attributes. These node attributes will be changed globally. See 'Note' below for details on the attributes
<code>graph.edge.attrs</code>	a list of global edge attributes. These edge attributes will be changed globally. See 'Note' below for details on the attributes
<code>node.attrs</code>	a list of local edge attributes. These node attributes will be changed locally; as such, for each attribute, the input value must be a named vector (i.e. using Term ID as names). See 'Note' below for details on the attributes

## Value

An object of class 'Ragraph'

## Note

A list of global node attributes used in "graph.node.attrs":

- "shape": the shape of the node: "circle", "rectangle", "rect", "box" and "ellipse"
- "fixedsize": the logical to use only width and height attributes. By default, it sets to true for not expanding for the width of the label
- "fillcolor": the background color of the node

- "color": the color for the node, corresponding to the outside edge of the node
- "fontcolor": the color for the node text/labelings
- "fontsize": the font size for the node text/labelings
- "height": the height (in inches) of the node: 0.5 by default
- "width": the width (in inches) of the node: 0.75 by default
- "style": the line style for the node: "solid", "dashed", "dotted", "invis" and "bold"

A list of global edge attributes used in "graph.edge.attrs":

- "color": the color of the edge: gray by default
- "weight": the weight of the edge: 1 by default
- "style": the line style for the edge: "solid", "dashed", "dotted", "invis" and "bold"

A list of local node attributes used in "node.attrs" (only those named Term IDs will be changed locally!):

- "label": a named vector specifying the node text/labelings
- "shape": a named vector specifying the shape of the node: "circle", "rectangle", "rect", "box" and "ellipse"
- "fixedsize": a named vector specifying whether it sets to true for not expanding for the width of the label
- "fillcolor": a named vector specifying the background color of the node
- "color": a named vector specifying the color for the node, corresponding to the outside edge of the node
- "fontcolor": a named vector specifying the color for the node text/labelings
- "fontsize": a named vector specifying the font size for the node text/labelings
- "height": a named vector specifying the height (in inches) of the node: 0.5 by default
- "width": a named vector specifying the width (in inches) of the node: 0.75 by default
- "style": a named vector specifying the line style for the node: "solid", "dashed", "dotted", "invis" and "bold"

## See Also

[dcEnrichment](#), [dcRDataLoader](#), [dcConverter](#)

## Examples

```
# 1) load SCOP.sf (as InfoDataFrame object)
SCOP.sf <- dcRDataLoader(SCOP.sf)
# randomly select 20 domains
data <- sample(rowNames(SCOP.sf), 20)

# 2) perform enrichment analysis, producing an object of S4 class Eoutput
eoutput <- dcEnrichment(data, domain="SCOP.sf", ontology="GOMF")
eoutput

# 3) visualise the top 10 significant terms
# color-coded according to 10-based negative logarithm of p-values
visEnrichment(eoutput)
# color-coded according to zscore
visEnrichment(eoutput, data.type=zscore)
```



```
# 4) visualise the top 5 significant terms in the ontology hierarchy
nodes_query <- names(sort(adjp(eoutput))[1:5])
visEnrichment(eoutput, nodes_query=nodes_query)
# change the frame color: highlight (framed in blue) nodes/terms in query
nodes.highlight <- rep("blue", length(nodes_query))
names(nodes.highlight) <- nodes_query
visEnrichment(eoutput, nodes_query=nodes_query,
node.attrs=list(color=nodes.highlight))
```

# Index

## \*Topic **S4**

- AdjData-class, [4](#)
- Anno-class, [5](#)
- Anno-method, [7](#)
- AnnoData-class, [8](#)
- Cnetwork-class, [9](#)
- Cnetwork-method, [10](#)
- Coutput-class, [11](#)
- Coutput-method, [13](#)
- Dnetwork-class, [67](#)
- Dnetwork-method, [69](#)
- Eoutput-class, [70](#)
- Eoutput-method, [72](#)
- InfoDataFrame-class, [85](#)
- InfoDataFrame-method, [86](#)
- Onto-class, [91](#)
- Onto-method, [93](#)

## \*Topic **classes**

- AdjData-class, [4](#)
- Anno-class, [5](#)
- AnnoData-class, [8](#)
- Cnetwork-class, [9](#)
- Coutput-class, [11](#)
- Dnetwork-class, [67](#)
- Eoutput-class, [70](#)
- InfoDataFrame-class, [85](#)
- Onto-class, [91](#)

## \*Topic **datasets**

- Ancestral\_domainome, [4](#)
- eTOL, [73](#)
- Feature2GOBP.interpro, [75](#)
- Feature2GOBP.pfam, [75](#)
- Feature2GOBP.sf, [76](#)
- Feature2GOCC.interpro, [77](#)
- Feature2GOCC.pfam, [78](#)
- Feature2GOCC.sf, [79](#)
- Feature2GOMF.interpro, [80](#)
- Feature2GOMF.pfam, [80](#)
- Feature2GOMF.sf, [81](#)
- Feature2HPPA.interpro, [82](#)
- Feature2HPPA.pfam, [83](#)
- Feature2HPPA.sf, [84](#)
- InterPro, [87](#)

- InterPro2GOBP, [88](#)
- InterPro2GOCC, [89](#)
- InterPro2GOMF, [90](#)
- onto.DO, [94](#)
- onto.EC, [95](#)
- onto.GOBP, [95](#)
- onto.GOCC, [96](#)
- onto.GOMF, [97](#)
- onto.HPMI, [98](#)
- onto.HPON, [98](#)
- onto.HPPA, [99](#)
- onto.KW, [100](#)
- onto.MP, [101](#)
- onto.UP, [101](#)
- Pfam, [102](#)
- Pfam2GOBP, [103](#)
- Pfam2GOCC, [104](#)
- Pfam2GOMF, [105](#)
- Rfam, [106](#)
- Rfam2GOBP, [107](#)
- Rfam2GOCC, [108](#)
- Rfam2GOMF, [109](#)
- SCOP.fa, [110](#)
- SCOP.fa2D0, [111](#)
- SCOP.fa2EC, [112](#)
- SCOP.fa2GOBP, [113](#)
- SCOP.fa2GOCC, [114](#)
- SCOP.fa2GOMF, [115](#)
- SCOP.fa2HPMI, [116](#)
- SCOP.fa2HPON, [117](#)
- SCOP.fa2HPPA, [118](#)
- SCOP.fa2KW, [119](#)
- SCOP.fa2MP, [120](#)
- SCOP.fa2UP, [121](#)
- SCOP.sf, [122](#)
- SCOP.sf2D0, [123](#)
- SCOP.sf2EC, [124](#)
- SCOP.sf2GOBP, [125](#)
- SCOP.sf2GOCC, [126](#)
- SCOP.sf2GOMF, [127](#)
- SCOP.sf2HPMI, [128](#)
- SCOP.sf2HPON, [129](#)
- SCOP.sf2HPPA, [130](#)

- SCOP.sf2KW, [131](#)
- SCOP.sf2MP, [132](#)
- SCOP.sf2UP, [133](#)
- \*Topic methods**
  - Anno-method, [7](#)
  - Cnetwork-method, [10](#)
  - Coutput-method, [13](#)
  - Dnetwork-method, [69](#)
  - Eoutput-method, [72](#)
  - InfoDataFrame-method, [86](#)
  - Onto-method, [93](#)
- [, Anno, ANY, ANY, ANY-method  
(Anno-method), [7](#)
- [, Anno-method (Anno-method), [7](#)
- [, Cnetwork, ANY, ANY, ANY-method  
(Cnetwork-method), [10](#)
- [, Cnetwork-method (Cnetwork-method), [10](#)
- [, Dnetwork, ANY, ANY, ANY-method  
(Dnetwork-method), [69](#)
- [, Dnetwork-method (Dnetwork-method), [69](#)
- [, InfoDataFrame, ANY, ANY, ANY-method  
(InfoDataFrame-method), [86](#)
- [, InfoDataFrame-method  
(InfoDataFrame-method), [86](#)
- [, Onto, ANY, ANY, ANY-method  
(Onto-method), [93](#)
- [, Onto-method (Onto-method), [93](#)
- AdjData, [9](#), [41](#), [67](#), [91](#), [94–102](#)
- AdjData (AdjData-class), [4](#)
- AdjData-class, [4](#)
- adjMatrix (Onto-method), [93](#)
- adjMatrix, Cnetwork-method  
(Cnetwork-method), [10](#)
- adjMatrix, Dnetwork-method  
(Dnetwork-method), [69](#)
- adjMatrix, Onto-method (Onto-method), [93](#)
- adjp (Eoutput-method), [72](#)
- adjp, Coutput-method (Coutput-method), [13](#)
- adjp, Eoutput-method (Eoutput-method), [72](#)
- Ancestral\_domainome, [4](#)
- Anno, [5](#), [33](#), [34](#), [38](#), [88–90](#), [103–105](#), [107–109](#),  
[111–121](#), [123–133](#)
- Anno (Anno-class), [5](#)
- Anno-class, [5](#)
- Anno-method, [7](#)
- AnnoData, [6](#)
- AnnoData (AnnoData-class), [8](#)
- annoData (Anno-method), [7](#)
- annoData, Anno-method (Anno-method), [7](#)
- AnnoData-class, [8](#)
- Cnetwork, [11](#)
- Cnetwork (Cnetwork-class), [9](#)
- cnetwork (Coutput-method), [13](#)
- cnetwork, Coutput-method  
(Coutput-method), [13](#)
- Cnetwork-class, [9](#)
- Cnetwork-method, [10](#)
- colNames (InfoDataFrame-method), [86](#)
- colNames, InfoDataFrame-method  
(InfoDataFrame-method), [86](#)
- Coutput (Coutput-class), [11](#)
- Coutput-class, [11](#)
- Coutput-method, [13](#)
- Data (InfoDataFrame-method), [86](#)
- Data, InfoDataFrame-method  
(InfoDataFrame-method), [86](#)
- data.frame2InfoDataFrame  
(InfoDataFrame-method), [86](#)
- dcAlgo, [14](#), [28](#), [44](#), [63](#)
- dcAlgoPredict, [16](#), [21](#), [24](#), [63](#)
- dcAlgoPredictGenome, [18](#), [19](#)
- dcAlgoPredictMain, [18](#), [22](#), [25](#), [26](#), [51](#), [62](#)
- dcAlgoPredictPR, [24](#)
- dcAlgoPropagate, [16](#), [18](#), [21](#), [23](#), [24](#), [26](#), [51](#),  
[53](#), [60](#)
- dcAncestralML, [28](#), [32](#)
- dcAncestralMP, [30](#), [31](#), [44](#)
- dcBuildAnno, [33](#), [46](#)
- dcBuildInfoDataFrame, [34](#), [46](#)
- dcBuildOnto, [15](#), [25](#), [27](#), [35](#), [46](#), [53](#), [60](#)
- dcConverter, [16](#), [18](#), [26](#), [28](#), [37](#), [39](#), [41](#), [48](#),  
[57](#), [136](#)
- dcDAGannotate, [38](#), [40](#), [41](#), [48](#), [57](#)
- dcDAGdomainSim, [39](#), [39](#), [57](#), [67](#)
- dcDuplicated, [16](#), [26](#), [30](#), [32](#), [44](#)
- dcEnrichment, [39](#), [45](#), [55](#), [70](#), [72](#), [136](#)
- dcFunArgs, [50](#)
- dcList2Matrix, [28](#), [51](#), [60](#), [66](#)
- dcNaivePredict, [52](#)
- dcRDataLoader, [16](#), [18](#), [21](#), [24](#), [26](#), [28](#), [37](#), [39](#),  
[41](#), [48](#), [53](#), [54](#), [57](#), [60](#), [136](#)
- dcRWRpipeline, [9](#), [11](#), [13](#), [56](#)
- dcRWRpredict, [58](#)
- dcSparseMatrix, [61](#)
- dcSplitArch, [16](#), [18](#), [62](#)
- dcSubtreeClade, [63](#), [65](#)
- dcSubtreeTips, [64](#)
- dcSupraBetter, [65](#)
- dcTreeConnectivity, [32](#), [64](#), [65](#), [66](#), [67](#)
- dData (Anno-method), [7](#)
- dData, Anno-method (Anno-method), [7](#)
- description (Dnetwork-method), [69](#)

- description, Dnetwork-method (Dnetwork-method), 69
- dgCMatix2Anno (Anno-method), 7
- dgCMatix2Cnetwork (Cnetwork-method), 10
- dgCMatix2Dnetwork (Dnetwork-method), 69
- dgCMatix2Onto (Onto-method), 93
- dim, Anno-method (Anno-method), 7
- dim, Cnetwork-method (Cnetwork-method), 10
- dim, Dnetwork-method (Dnetwork-method), 69
- dim, InfoDataFrame-method (InfoDataFrame-method), 86
- dim, Onto-method (Onto-method), 93
- dimLabels (InfoDataFrame-method), 86
- dimLabels, InfoDataFrame-method (InfoDataFrame-method), 86
- Dnetwork, 41, 56, 59
- Dnetwork (Dnetwork-class), 67
- Dnetwork-class, 67
- Dnetwork-method, 69
- domainData (Anno-method), 7
- domainData, Anno-method (Anno-method), 7
- domainNames (Anno-method), 7
- domainNames, Anno-method (Anno-method), 7
- Eoutput, 47, 134
- Eoutput (Eoutput-class), 70
- Eoutput-class, 70
- Eoutput-method, 72
- eTOL, 73
- Feature2GOBP.interpro, 75
- Feature2GOBP.pfam, 75
- Feature2GOBP.sf, 76
- Feature2GOCC.interpro, 77
- Feature2GOCC.pfam, 78
- Feature2GOCC.sf, 79
- Feature2GOMF.interpro, 80
- Feature2GOMF.pfam, 80
- Feature2GOMF.sf, 81
- Feature2HPPA.interpro, 82
- Feature2HPPA.pfam, 83
- Feature2HPPA.sf, 84
- id (Dnetwork-method), 69
- id, Dnetwork-method (Dnetwork-method), 69
- InfoDataFrame, 6, 9, 34, 35, 67, 87, 91, 94–102, 106, 110, 122
- InfoDataFrame (InfoDataFrame-class), 85
- InfoDataFrame-class, 85
- InfoDataFrame-method, 86
- InterPro, 87
- InterPro2GOBP, 88
- InterPro2GOCC, 89
- InterPro2GOMF, 90
- level (Dnetwork-method), 69
- level, Dnetwork-method (Dnetwork-method), 69
- matrix2Anno (Anno-method), 7
- matrix2Cnetwork (Cnetwork-method), 10
- matrix2Dnetwork (Dnetwork-method), 69
- matrix2Onto (Onto-method), 93
- ncol (InfoDataFrame-method), 86
- ncol, InfoDataFrame-method (InfoDataFrame-method), 86
- nInfo (Onto-method), 93
- nInfo, Cnetwork-method (Cnetwork-method), 10
- nInfo, Dnetwork-method (Dnetwork-method), 69
- nInfo, Onto-method (Onto-method), 93
- nodeInfo (Onto-method), 93
- nodeInfo, Cnetwork-method (Cnetwork-method), 10
- nodeInfo, Dnetwork-method (Dnetwork-method), 69
- nodeInfo, Onto-method (Onto-method), 93
- nodeName (Onto-method), 93
- nodeName, Cnetwork-method (Cnetwork-method), 10
- nodeName, Dnetwork-method (Dnetwork-method), 69
- nodeName, Onto-method (Onto-method), 93
- nrow (InfoDataFrame-method), 86
- nrow, InfoDataFrame-method (InfoDataFrame-method), 86
- Onto, 35, 36, 38, 40, 94–102
- Onto (Onto-class), 91
- Onto-class, 91
- Onto-method, 93
- onto.DO, 94
- onto.EC, 95
- onto.GOBP, 95
- onto.GOCC, 96
- onto.GOMF, 97
- onto.HPMI, 98
- onto.HPON, 98
- onto.HPPA, 99
- onto.KW, 100
- onto.MP, 101
- onto.UP, 101

- Pfam, 102
- Pfam2GOBP, 103
- Pfam2GOCC, 104
- Pfam2GOMF, 105
- pvalue (Eoutput-method), 72
- pvalue, Coutput-method (Coutput-method), 13
- pvalue, Eoutput-method (Eoutput-method), 72
- ratio (Coutput-method), 13
- ratio, Coutput-method (Coutput-method), 13
- Rfam, 106
- Rfam2GOBP, 107
- Rfam2GOCC, 108
- Rfam2GOMF, 109
- rowNames (InfoDataFrame-method), 86
- rowNames, InfoDataFrame-method (InfoDataFrame-method), 86
- SCOP.fa, 110
- SCOP.fa2DO, 111
- SCOP.fa2EC, 112
- SCOP.fa2GOBP, 113
- SCOP.fa2GOCC, 114
- SCOP.fa2GOMF, 115
- SCOP.fa2HPMI, 116
- SCOP.fa2HPON, 117
- SCOP.fa2HPPA, 118
- SCOP.fa2KW, 119
- SCOP.fa2MP, 120
- SCOP.fa2UP, 121
- SCOP.sf, 122
- SCOP.sf2DO, 123
- SCOP.sf2EC, 124
- SCOP.sf2GOBP, 125
- SCOP.sf2GOCC, 126
- SCOP.sf2GOMF, 127
- SCOP.sf2HPMI, 128
- SCOP.sf2HPON, 129
- SCOP.sf2HPPA, 130
- SCOP.sf2KW, 131
- SCOP.sf2MP, 132
- SCOP.sf2UP, 133
- show, Anno-method (Anno-method), 7
- show, Cnetwork-method (Cnetwork-method), 10
- show, Coutput-method (Coutput-method), 13
- show, Dnetwork-method (Dnetwork-method), 69
- show, Eoutput-method (Eoutput-method), 72
- show, InfoDataFrame-method (InfoDataFrame-method), 86
- show, Onto-method (Onto-method), 93
- tData (Anno-method), 7
- tData, Anno-method (Anno-method), 7
- term\_distance (Onto-method), 93
- term\_distance, Onto-method (Onto-method), 93
- term\_id (Onto-method), 93
- term\_id, Onto-method (Onto-method), 93
- term\_name (Onto-method), 93
- term\_name, Onto-method (Onto-method), 93
- term\_namespace (Onto-method), 93
- term\_namespace, Onto-method (Onto-method), 93
- termData (Anno-method), 7
- termData, Anno-method (Anno-method), 7
- termNames (Anno-method), 7
- termNames, Anno-method (Anno-method), 7
- view (Eoutput-method), 72
- view, Eoutput-method (Eoutput-method), 72
- visEnrichment, 48, 134
- write (Eoutput-method), 72
- write, Coutput-method (Coutput-method), 13
- write, Eoutput-method (Eoutput-method), 72
- zscore (Eoutput-method), 72
- zscore, Coutput-method (Coutput-method), 13
- zscore, Eoutput-method (Eoutput-method), 72