Title Biobase: Base functions for Bioconductor
Version 2.34.0
Author R. Gentleman, V. Carey, M. Morgan, S. Falcon
Description Functions that are needed by many other packages or which replace R functions.
Suggests tools, tkWidgets, ALL, RUnit, golubEsets
Depends R (>= 2.10), BiocGenerics (>= 0.3.2), utils
Imports methods
Maintainer Bioconductor Package Maintainer
License Artistic-2.0
AllGenerics.R VersionsClass.R VersionedClasses.R
methods-VersionsNull.R methods-VersionedClass.R DataClasses.R
methods-MIAME.R methods-AssayData.R
methods-AnnotatedDataFrame.R methods-eSet.R
methods-ExpressionSet.R methods-MultiSet.R methods-SnpSet.R
updateObjectTo.R methods-ScalarObject.R zzz.R
LazyLoad yes
biocViews Infrastructure
NeedsCompilation yes

R topics documented:

Biobase-package .................................................. 3
abstract .......................................................... 4
addVigs2WinMenu ................................................ 4
Aggregate ......................................................... 5
aggregator .......................................................... 6
AnnotatedDataFrame ............................................... 7
annotatedDataFrameFrom-methods ................................. 9
anyMissing ......................................................... 10
assayData .......................................................... 10
<table>
<thead>
<tr>
<th>R topics documented:</th>
</tr>
</thead>
<tbody>
<tr>
<td>AssayData-class</td>
</tr>
<tr>
<td>cache</td>
</tr>
<tr>
<td>channel</td>
</tr>
<tr>
<td>channelNames</td>
</tr>
<tr>
<td>class:characterORMIAME</td>
</tr>
<tr>
<td>classVersion</td>
</tr>
<tr>
<td>container</td>
</tr>
<tr>
<td>contents</td>
</tr>
<tr>
<td>copyEnv</td>
</tr>
<tr>
<td>copySubstitute</td>
</tr>
<tr>
<td>createPackage</td>
</tr>
<tr>
<td>data:aaMap</td>
</tr>
<tr>
<td>data:geneData</td>
</tr>
<tr>
<td>data:sample.ExpressionSet</td>
</tr>
<tr>
<td>data:sample.MultiSet</td>
</tr>
<tr>
<td>description</td>
</tr>
<tr>
<td>dims</td>
</tr>
<tr>
<td>dumpPackTxt</td>
</tr>
<tr>
<td>esApply</td>
</tr>
<tr>
<td>eSet</td>
</tr>
<tr>
<td>ExpressionSet</td>
</tr>
<tr>
<td>exprs</td>
</tr>
<tr>
<td>featureData</td>
</tr>
<tr>
<td>featureNames</td>
</tr>
<tr>
<td>getPkgVigs</td>
</tr>
<tr>
<td>isCurrent</td>
</tr>
<tr>
<td>isUnique</td>
</tr>
<tr>
<td>isVersioned</td>
</tr>
<tr>
<td>lcSuffix</td>
</tr>
<tr>
<td>listLen</td>
</tr>
<tr>
<td>makeDataPackage</td>
</tr>
<tr>
<td>matchpt</td>
</tr>
<tr>
<td>MIAME</td>
</tr>
<tr>
<td>MIAXE</td>
</tr>
<tr>
<td>multiassign</td>
</tr>
<tr>
<td>MultiSet</td>
</tr>
<tr>
<td>NChannelSet-class</td>
</tr>
<tr>
<td>note</td>
</tr>
<tr>
<td>notes</td>
</tr>
<tr>
<td>openPDF</td>
</tr>
<tr>
<td>openVignette</td>
</tr>
<tr>
<td>package.version</td>
</tr>
<tr>
<td>phenoData</td>
</tr>
<tr>
<td>protocolData</td>
</tr>
<tr>
<td>read.AnnotatedDataFrame</td>
</tr>
<tr>
<td>read.MIAME</td>
</tr>
<tr>
<td>readExpressionSet</td>
</tr>
<tr>
<td>reporter</td>
</tr>
<tr>
<td>reverseSplit</td>
</tr>
<tr>
<td>rowMedians</td>
</tr>
<tr>
<td>rowQ</td>
</tr>
<tr>
<td>ScalarObject-class</td>
</tr>
</tbody>
</table>
Biobase Package

Description

Biobase Package Overview

Details

Important data classes: ExpressionSet, AnnotatedDataFrame MIAME. Full help on methods and associated functions is available from within class help pages.

Additional data classes: eSet, MIAxE, MultiSet. Additional manipulation and data structuring classes: Versioned, VersionedBiobase, aggregator, container.

Vignette routines: openVignette, getPkgVigs, openPDF.

Package manipulation functions: createPackage and package.version

Data sets: aaMap, sample.ExpressionSet, geneData.

Introductory information is available from vignettes, type openVignette().

Full listing of documented articles is available in HTML view by typing help.start() and selecting Biobase package from the Packages menu or via library(help="Biobase").

Author(s)

O. Sklyar
**abstract**  
Retrieve Meta-data from eSets and ExpressionSets.

**Description**  
These generic functions access generic data, abstracts, PubMed IDs and experiment data from instances of the eSet-class or ExpressionSet-class.

**Usage**  
```r  
abstract(object)  
pubMedIds(object)  
pubMedIds(object) <- value  
experimentData(object)  
experimentData(object) <- value  
```

**Arguments**  
- **object** Object, possibly derived from eSet-class or MIAME-class  
- **value** Value to be assigned; see class of object (e.g., eSet-class) for specifics.

**Value**  
- **abstract** returns a character vector containing the abstract (as in a published paper) associated with object.  
- **pubMedIds** returns a character vector of PUBMED IDs associated with the experiment.  
- **experimentData** returns an object representing the description of an experiment, e.g., an object of MIAME-class

**Author(s)**  
Biocore

**See Also**  
ExpressionSet-class, eSet-class, MIAME-class

---

**addVigs2WinMenu**  
Add Menu Items to an Existing/New Menu of Window

**Description**  
This function adds a menu item for a package’s vignettes.

**Usage**  
```r  
addVigs2WinMenu(pkgName)  
```
Aggregate

Arguments
pkgName pkgName - a character string for the name of an R package

Details
The original functions addVig2Menu, addVig4Win, addVig4Unix, addNonExisting, addPDF2Vig have been replaced by addVigs2WinMenu, please use those instead.

Value
The functions do not return any value.

Author(s)
Jianhua Zhang and Jeff Gentry

Examples
# Only works for windows now
if(interactive() && .Platform$OS.type == "windows" &&
   .Platform$GUI == "Rgui"){
   addVigs2WinMenu("Biobase")
}

Aggregate
A Simple Aggregation Mechanism.

Description
Given an environment and an aggregator (an object of class aggregate simple aggregations are made.

Usage
 Aggregate(x, agg)

Arguments
x The data to be aggregated.
agg The aggregator to be used.

Details
Given some data, x the user can accumulate (or aggregate) information in env using the two supplied functions. See the accompanying documentation for a more complete example of this function and its use.

Value
No value is returned. This function is evaluated purely for side effects. The symbols and values in env are altered.
Author(s)
R. Gentleman

See Also
new.env, class:aggregator

Examples
agg1 <- new("aggregator")
Aggregate(letters[1:10], agg1)
  # the first 10 letters should be symbols in env1 with values of 1
Aggregate(letters[5:11], agg1)
  # now letters[5:10] should have value 2
bb <- mget(letters[1:11], env=aggenv(agg1), ifnotfound=NA)
t1 <- as.numeric(bb); names(t1) <- names(bb)
t1
  # a b c d e f g h i j k
  # 1 1 1 1 2 2 2 2 2 2 1

aggregator  A Simple Class for Aggregators

Description
A class of objects designed to help aggregate calculations over an iterative computation. The aggregator consists of three objects. An environment to hold the values. A function that sets up an initial value the first time an object is seen. An aggregate function that increments the value of an object seen previously.

Details
This class is used to help aggregate different values over function calls. A very simple example is to use leave one out cross-validation for prediction. At each stage we first perform feature selection and then cross-validate. To keep track of how often each feature is selected we can use an aggregator. At the end of the cross-validation we can extract the names of the features chosen from aggenv.

Creating Objects
new('aggregator', aggenv = [environment], initfun = [function], aggfun = [function])

Slots
tagenv: Object of class 'environment', holds the values between iterations
initfun: Object of class 'function' specifies how to initialize the value for a name the first time it is encountered
aggfun: Object of class 'function' used to increment (or perform any other function) on a name

Methods
tagenv(aggregate): Used to access the environment of the aggregator
tagfun(aggregate): Used to access the function that aggregates
initfun(aggregate): Used to access the initializer function
AnnotatedDataFrame

See Also

Aggregate

AnnotatedDataFrame

Class Containing Measured Variables and Their Meta-Data Description.

Description

An AnnotatedDataFrame consists of two parts. There is a collection of samples and the values of variables measured on those samples. There is also a description of each variable measured. The components of an AnnotatedDataFrame can be accessed with pData and varMetadata.

Extends

Versioned

Creating Objects

AnnotatedDataFrame(data, varMetadata, dimLabels=c("rowNames", "columnNames"), ...)

AnnotatedDataFrame instances are created using AnnotatedDataFrame. The function can take three arguments, data is a data.frame of the samples (rows) and measured variables (columns), varMetadata is a data.frame with the number of rows equal to the number of columns of the data argument. varMetadata describes aspects of each measured variable. dimLabels provides aesthetic control for labeling rows and columns in the show method. varMetadata and dimLabels can be missing.

as(data.frame, "AnnotatedDataFrame") coerces a data.frame to an AnnotatedDataFrame.

annotatedDataFrameFrom may be a convenient way to create an AnnotatedDataFrame from AssayData-class.

Slots

Class-specific slots:

data: A data.frame containing samples (rows) and measured variables (columns).
dimLabels: A character vector of length 2 that provides labels for the rows and columns in the show method.
varMetadata: A data.frame with number of rows equal number of columns in data, and at least one column, named labelDescription, containing a textual description of each variable.
__classVersion__: A Versions object describing the R and Biobase version numbers used to created the instance. Intended for developer use.

Methods

Class-specific methods.

as(annotatedDataFrame, "data.frame") Coerce objects of AnnotatedDataFrame to data.frame.
combine(AnnotatedDataFrame, AnnotatedDataFrame): Bind data from one AnnotatedDataFrame to a second AnnotatedDataFrame, returning the result as an AnnotatedDataFrame. Row (sample) names in each argument must be unique. Variable names present in both arguments occupy a single column in the resulting AnnotatedDataFrame. Variable names unique to either argument create columns with values assigned for those samples where the variable is present. varMetadata in the returned AnnotatedDataFrame is updated to reflect the combination.

pData(AnnotatedDataFrame), pData(AnnotatedDataFrame) <- data.frame: Set and retrieve the data (samples and variables) in the AnnotatedDataFrame.

varMetadata(AnnotatedDataFrame), varMetadata(AnnotatedDataFrame) <- data.frame: Set and retrieve the meta-data (variables and their descriptions) in the AnnotatedDataFrame.

featureNames(AnnotatedDataFrame), featureNames(AnnotatedDataFrame) <- ANY: Set and retrieve the feature names in AnnotatedDataFrame; a synonym for sampleNames.

sampleNames(AnnotatedDataFrame), sampleNames(AnnotatedDataFrame) <- ANY: Set and retrieve the sample names in AnnotatedDataFrame.

varLabels(AnnotatedDataFrame), varLabels(AnnotatedDataFrame) <- data.frame: Set and retrieve the variable labels in the AnnotatedDataFrame.

dimLabels(AnnotatedDataFrame), dimLabels(AnnotatedDataFrame) <- character: Retrieve labels used for display of AnnotatedDataFrame, e.g., 'rowNames', 'columnNames'.

Standard generic methods:
initialize(AnnotatedDataFrame)): Object instantiation, used by new; not to be called directly by the user.

as(data.frame, "AnnotatedDataFrame"): Convert a data.frame to an AnnotatedDataFrame.

as(phenoData, AnnotatedDataFrame)): Convert old-style phenoData-class objects to AnnotatedDataFrame, issuing warnings as appropriate.

validObject(AnnotatedDataFrame): Validity-checking method, ensuring coordination between data and varMetadata elements.

updateObject(object, ..., verbose=FALSE) Update instance to current version, if necessary. See updateObject.

isCurrent(object) Determine whether version of object is current. See isCurrent.

isVersioned(object) Determine whether object contains a 'version' string describing its structure. See isVersioned.

show(AnnotatedDataFrame) Abbreviated display of object.

[[sample], [variable]: Subset operation, taking two arguments and indexing the sample and variable. Returns an AnnotatedDataFrame, i.e., including relevant metadata. Unlike a data.frame, setting drop=TRUE generates an error.

[[variable], $<variable>: Selector returning a variable (column of pData).

[[variable], ...]] $<new_value>, $<variable> <- <new_value>: Replace or add a variable to pData. ... can include named arguments (especially labelDescription) to be added to varMetadata.

head(AnnotatedDataFrame, n = 6L, ...), tail(AnnotatedDataFrame, n=6L, ...) Select the first (last for tail) n rows; negative n returns the first (last) nrow() - n rows.

dim(AnnotatedDataFrame), ncol(AnnotatedDataFrame)): Number of samples and variables (dim) and variables (ncol) in the argument.

dimnames(AnnotatedDataFrame), rownames(AnnotatedDataFrame), colnames(AnnotatedDataFrame): row and column names.
annotatedDataFrameFrom-methods

Author(s)

V. J. Carey, after initial design by R. Gentleman

See Also

eSet, ExpressionSet, read.AnnotatedDataFrame

Examples

df <- data.frame(x=1:6,
                 y=rep(c("Low", "High"),3),
                 z=I(LETTERS[1:6]),
                 row.names=paste("Sample", 1:6, sep="_"))

metaData <-
    data.frame(labelDescription=c(
      "Numbers",
      "Factor levels",
      "Characters"))

AnnotatedDataFrame()
AnnotatedDataFrame(data=df)
AnnotatedDataFrame(data=df, varMetadata=metaData)
as(df, "AnnotatedDataFrame")

obj <- AnnotatedDataFrame()
pData(obj) <- df
varMetadata(obj) <- metaData
validObject(obj)

annotatedDataFrameFrom-methods

Methods for Function annotatedDataFrameFrom in Package
'Biobase'

Description

annotatedDataFrameFrom is a convenience for creating AnnotatedDataFrame objects.

Methods

Use the method with annotatedDataFrameFrom(object, byrow=FALSE, ...); the argument
byrow must be specified.

signature(object="assayData")  This method creates an AnnotatedDataFrame using sample
(when byrow=FALSE) or feature (byrow=TRUE) names and dimensions of an AssayData object
as a template.

signature(object="matrix")    This method creates an AnnotatedDataFrame using column (when
byrow=FALSE) or row (byrow=TRUE) names and dimensions of a matrix object as a template.

signature(object="NULL")     This method (called with 'NULL' as the object) creates an empty
AnnotatedDataFrame; provides dimLabels based on value of byrow.

Author(s)

Biocore team
**anyMissing**

*Checks if there are any missing values in an object or not*

**Description**

Checks if there are any missing values in an object or not.

**Usage**

```r
anyMissing(x=NULL)
```

**Arguments**

- `x` A vector.

**Details**

The implementation of this method is optimized for both speed and memory.

**Value**

Returns **TRUE** if a missing value was detected, otherwise **FALSE**.

**Author(s)**

Henrik Bengtsson (http://www.braju.com/R/)

**Examples**

```r
x <- rnorm(n=1000)
x[seq(300,length(x),by=100)] <- NA
stopifnot(anyMissing(x) == any(is.na(x)))
```

---

**assayData**

*Retrieve assay data from eSets and ExpressionSets.*

**Description**

This generic function accesses assay data stored in an object derived from the eSet or ExpressionSet class.

**Usage**

```r
assayData(object)
assayData(object) <- value
```

**Arguments**

- `object` Object derived from class eSet
- `value` Named list or environment containing one or more matrices with identical dimensions
### AssayData-class

#### Description

Container class defined as a class union of list and environment. Designed to contain one or more matrices of the same dimension.

#### Methods

- **combine** signature(x = "AssayData", y = "AssayData"): This method uses cbind to create new AssayData elements that contain the samples of both arguments x and y. Both AssayData arguments to combine must have the same collection of elements. The elements must have identical numbers of rows (features). The numerical contents of any columns (samples) present in the same element of different AssayData must be identical. The storageMode of the AssayData arguments must be identical, and the function returns an AssayData with storageMode matching the incoming mode. See also combine,eSet,eSet-method

- **featureNames** signature(object = "AssayData")

- **featureNames<-** signature(object = "AssayData", value = "ANY"): Return or set the feature names as a character vector. These are the row names of the AssayData elements. value can be a character or numeric vector; all entries must be unique.

- **sampleNames** signature(object = "AssayData")

- **sampleNames<-** signature(object = "AssayData", value="ANY"): Return or set the sample names. These are the column names of the the AssayData elements and the row names of phenoData. value can be a character or numeric vector.

- **storageMode** signature(object = "AssayData")

- **storageMode<-** signature(object = "AssayData", value="character"): Return or set the storage mode for the instance. value can be one of three choices: "lockedEnvironment", "environment", and "list". Environments offer a mechanism for storing data that avoids some of the copying that occurs when using lists. Locked environment help to ensure data integrity. Note that environments are one of the few R objects that are pass-by-reference. This means that if you modify a copy of an environment, you also modify the original. For this reason, we recommend using lockedEnvironment whenever possible.

Additional functions operating on AssayData include:

- **assayData[[name]]** Select element name from assayData.
assayDataNew(storage.mode = c("lockedEnvironment", "environment", "list"), ...) Use storage.mode to create a new list or environment containing the named elements in ...

assayDataValidMembers(assayData, required) Validate assayData, ensuring that the named elements required are present, matrices are of the same dimension, and featureNames (row names) are consistent (identical or NULL) across entries.

assayDataElement(object, element) See eSet-class

assayDataElementReplace(object, element, value, validate=TRUE) See eSet-class

assayDataElementNames(object) See eSet-class

Author(s)
Biocore

See Also

eSet-class ExpressionSet-class

---

**cache**

*Evaluate an expression if its value is not already cached.*

**Description**

Cache the evaluation of an expression in the file system.

**Usage**

```r
cache(expr, dir=".", prefix="tmp_R_cache_")
```

**Arguments**

- `expr` An expression of the form `LHS <- RHS`, where `LHS` is a variable name, `RHS` is any valid expression, and `<-` must be used (=` will not work).
- `dir` A string specifying the directory into which cache files should be written (also where to go searching for an appropriate cache file).
- `prefix` A string giving the prefix to use when naming and searching for cache files. The default is "tmp_R_cache_"

**Details**

This function can be useful during the development of computationally intensive workflows, for example in vignettes or scripts. The function uses a cache file in `dir` which defaults to the current working directory whose name is obtained by `paste(prefix, name, ".RData", sep="")`. When `cache` is called and the cache file exists, it is loaded and the object whose name is given on the left of `<-` in `expr` is returned. In this case, `expr` is *not* evaluated.

When `cache` is called and the cache file does not exist, `expr` is evaluated, its value is saved into a cache file, and then its value is returned.

The `expr` argument must be of the form of `someVar <- {expressions}`. That is, the left hand side must be a single symbol name and the next syntactic token must be `<-`.

To flush the cache and force recomputation, simply remove the cache files. You can use `file.remove` to do this.
Value

The (cached) value of expr.

Note

The first version of this function had a slightly different interface which is no longer functional. The old version has arguments name and expr and the intended usage is: foo <- cache("foo", expr).

Author(s)

Wolfgang Huber, <huber@ebi.ac.uk> Seth Falcon, <sfalcon@fhcrc.org>

Examples

```r
bigCalc <- function() runif(10)
cache(myComplicatedObject <- bigCalc())
aCopy <- myComplicatedObject
remove(myComplicatedObject)
cache(myComplicatedObject <- bigCalc())
stopifnot(all.equal(myComplicatedObject, aCopy))
allCacheFiles <-
  list.files(".", pattern="^tmp_R_cache_.*\.RData$", full.name=TRUE)
file.remove(allCacheFiles)
```

Description

This generic function extracts a specific element from an object, returning a instance of the ExpressionSet class.

Usage

```r
channel(object, name, ...)
```

Arguments

- **object**: An S4 object, typically derived from class eSet
- **name**: The name of the channel, a (length one) character vector.
- **...**: Additional arguments.

Value

An instance of class `ExpressionSet`.

Author(s)

Biocore
Examples

```r
obj <- NChannelSet(
  R=matrix(runif(100), 20, 5),
  G=matrix(runif(100), 20, 5))
## G channel as ExpressionSet
channel(obj, "G")
```

channelNames

Retrieve and set channel names from object

Description

This generic function reports or updates the channels in an object.

Usage

```r
channelNames(object, ...)  
channelNames(object, ...) <- value
```

Arguments

- `object` An S4 object, typically derived from class `eSet`
- `value` Replacement value, either a character vector (to re-order existing channel names or a named character vector or list (to change channel names from the vector elements to the corresponding names).
- `...` Additional argument, not currently used.

Details

`channelNames` returns the names of the channels in a defined order. Change the order using the replacement method with a permutation of the channel names as `value`. Rename channels using the replacement method with a named list, where the vector elements are a permutation of the current channels, with corresponding names the new identifier for the channel.

Value

character.

Author(s)

Biocore

Examples

```r
## channelNames default to alphabetical order of channels
obj <- NChannelSet(
  R=matrix(runif(100), 20, 5),
  G=matrix(-runif(100), 20, 5))
channelNames(obj)
channelNames(obj) <- c(Gn="G", Rd="R")  ## rename
channelNames(obj) <- c("Rd", "Gn")  ## reorder
```
channelNames(obj)
all(assayData(obj)["Gn"] <= 0)
all(assayData(obj)["Rd"] >= 0)

---

class:characterORMIAME

*Class to Make Older Versions Compatible*

---

**Description**

This class can be either `character` or `MIAME`.

**Methods**

No methods defined with class "characterORMIAME" in the signature.

**See Also**

See also [MIAME](#)

---

classVersion

*Retrieve information about versioned classes*

---

**Description**

These generic functions return version information for classes derived from `Versioned-class`, or `VersionsNull-class` for unversioned objects. The version information is an object of `Versions-class`. By default, `classVersion` has the following behaviors:

classVersion(Versioned-instance) Returns a `Versions-class` object obtained from the object.
classVersion("class") Consults the definition of `class` and return the current version information, if available.
classVersion(ANY) Return a `VersionsNull-class` object to indicate no version information available.

By default, the `classVersion<-` method has the following behavior:

classVersion(Versioned-instance)["id"] <- value Assign (update or add) value to `Versions-instance`. value is coerced to a valid version description. see [Versions-class](#) for additional access methods.

**Usage**

```
classVersion(object)
classVersion(object) <- value
```

**Arguments**

- **object** Object whose version is to be determined, as described above.
- **value** Version-class object to assign to object of Versioned-class object.
container

Value

classVersion returns an instance of Versions-class

Author(s)

Biocore team

See Also

Versions-class

Examples

obj <- new("VersionedBiobase")
classVersion(obj)
classVersion(obj)["Biobase"]
classVersion(1:10) # no version
classVersion("ExpressionSet") # consult ExpressionSet prototype

classVersion(obj)["MyVersion"] <- "1.0.0"
classVersion(obj)

A Lockable List Structure with Constraints on Content

Description

Container class that specializes the list construct of R to provide content and access control

Creating Objects

new('container', x = [list], content = [character], locked = [logical])

Slots

x list of entities that are guaranteed to share a certain property
content tag describing container contents
locked boolean indicator of locked status. Value of TRUE implies assignments into the container are not permitted

Methods

Class-specific methods:

content(container) returns content slot of argument
locked(container) returns locked slot of argument

Standard methods defined for 'container':

show(container) prints container

length(container) returns number of elements in the container

[[index] and [[index, value)] access and replace elements in the container

[(index) make a subset of a container (which will itself be a container)
**contents**

**Function to retrieve contents of environments**

**Description**

The contents method is used to retrieve the values stored in an environment.

**Usage**

```r
contents(object, all.names)
```

**Arguments**

- **object**: The environment (data table) that you want to get all contents from.
- **all.names**: A logical indicating whether to copy all values in `as.list.environment`.

**Value**

A named list is returned, where the elements are the objects stored in the environment. The names of the elements are the names of the objects.

The `all.names` argument is identical to the one used in `as.list.environment`.

**Author(s)**

R. Gentleman

**See Also**

`as.list.environment`

**Examples**

```r
z <- new.env()
multiassign(letters, 1:26, envir=z)
contents(z)
```
**copyEnv**

*List-Environment interactions*

**Description**

These functions can be used to make copies of environments, or to get/assign all of the objects inside of an environment.

**Usage**

```r
copyEnv(oldEnv, newEnv, all.names=FALSE)
```

**Arguments**

- **oldEnv**: An environment to copy from
- **newEnv**: An environment to copy to. If missing, a new environment with the same parent environment as oldEnv.
- **all.names**: Whether to retrieve objects with names that start with a dot.

**Details**

*copyEnv*: This function will make a copy of the contents from `oldEnv` and place them into `newEnv`.

**Author(s)**

Jeff Gentry and R. Gentleman

**See Also**

`environment`, `as.list`

**Examples**

```r
z <- new.env(hash=TRUE, parent=emptyenv(), size=29L)
multiassign(c("a","b","c"), c(1,2,3), z)
a <- copyEnv(z)
ls(a)
```

---

**copySubstitute**

*Copy Between Connections or Files with Configure-Like Name-Value Substitution*

**Description**

Copy files, directory trees or between connections and replace all occurrences of a symbol by the corresponding value.
copySubstitute

Usage

copySubstitute(src, dest, symbolValues, symbolDelimiter="@", allowUnresolvedSymbols=FALSE, recursive = FALSE, removeExtension = "\.

Arguments

src Source, either a character vector with filenames and/or directory names, or a connection object.
dest Destination, either a character vector of length 1 with the name of an existing, writable directory, or a connection object. The class of the dest argument must match that of the src argument.
symbolValues A named list of character strings.
symbolDelimiter A character string of length one with a single character in it.
allowUnresolvedSymbols Logical. If FALSE, then the function will execute stop if it comes across symbols that are not defined in symbolValues.
recursive Logical. If TRUE, the function works recursively down a directory tree (see details).
removeExtension Character. Matches to this regular expression are removed from filenames and directory names.

Details

Symbol substitution: this is best explained with an example. If the list symbolValues contains an element with name FOO and value bar, and symbolDelimiter is @, then any occurrence of @FOO@ is replaced by bar. This applies both the text contents of the files in src as well as to the filenames. See examples.

If recursive is FALSE, both src and dest must be connection or a filenames. The text in src is read through the function readLines, symbols are replaced by their values, and the result is written to dest through the function writeLines.

If recursive is TRUE, copySubstitute works recursively down a directory tree (see details and example). src must be a character vector with multiple filenames or directory names, dest a directory name.

One use of this function is in createPackage for the automatic generation of packages from a template package directory.

Value

None. The function is called for its side effect.

Author(s)

Wolfgang Huber http://www.dkfz.de/mga/whuber
Examples

```r
## create an example file
infile = tempfile()
outfile = tempfile()

writeLines(text=c("We will perform in @WHAT@: ",
                   "So, thanks to @WHOM@ at once and to each one,
                   Whom we invite to see us crown'd at @WHERE@."),
           con = infile)

## create the symbol table
z = list(WHAT="measure, time and place", WHOM="all", WHERE="Scone")

## run copySubstitute
copySubstitute(infile, outfile, z)

## display the results
readLines(outfile)

#--------------------------------------------------------------
# This is a slightly more complicated example that demonstrates
# how copySubstitute works on nested directories
#--------------------------------------------------------------
d = tempdir()
my.dir.create = function(x) {dir.create(x); return(x)}
unlink(file.path(d, "src"), recursive=TRUE)
unlink(file.path(d, "dest"), recursive=TRUE)

## create some directories and files:
src = my.dir.create(file.path(d, "src"))
dest = file.path(d, "dest")
d1 = my.dir.create(file.path(src, "dir1.in"))
d2 = my.dir.create(file.path(src, "dir2@FOO@.in"))
d3 = my.dir.create(file.path(d2, "dir3"))
d4 = my.dir.create(file.path(d3, "dir4"))
d5 = my.dir.create(file.path(d4, "dir5@BAR@"))
writeLines(c("File1: ", "FOO: @FOO@"), file.path(d1, "file1.txt.in"))
writeLines(c("File2: ", "BAR: @BAR@"), file.path(d2, "file2.txt.in"))
writeLines(c("File3: ", "SUN: @SUN@"), file.path(d3, "file3.txt.in"))
writeLines(c("File4: ", "MOON: @MOON@"), file.path(d4, "@SUN@.txt"))

## call copySubstitute
copySubstitute(src, dest, recursive=TRUE,
               symbolValues = list(FOO="thefoo", BAR="thebar",
                                 SUN="thesun", MOON="themoon"))

## view the result
listsrc = dir(src, full.names=TRUE, recursive=TRUE)
listdest = dir(dest, full.names=TRUE, recursive=TRUE)
listsrc
listdest

cat(unlist(lapply(listsrc, readLines)), sep="\n")
```
createPackage

\[
\text{cat(unlist(lapply(listdest, readLines)), sep="\n")}
\]

createPackage  
*Create a Package Directory from a Template*

**Description**
Create a package directory from a template, with symbol-value substitution

**Usage**

\[
\text{createPackage(pkgname, destinationDir, originDir, symbolValues, unlink=FALSE, quiet=FALSE)}
\]

**Arguments**

- **pkgname**  
  Character. The name of the package to be written.

- **destinationDir**  
  Character. The path to a directory where the package is to be written.

- **originDir**  
  Character. The path to a directory that contains the template package. Usually, this will contain a file named `DESCRIPTION`, and subdirectories `R`, `man`, `data`. In all files and filenames, symbols will be replaced by their respective values, see the parameter `symbolValues`.

- **symbolValues**  
  Named list of character strings. The symbol-to-value mapping. See `copySubstitute` for details.

- **unlink**  
  Logical. If `TRUE`, and `destinationDir` already contains a file or directory with the name `pkgname`, try to unlink (remove) it.

- **quiet**  
  Logical. If `TRUE`, do not print information messages.

**Details**

The intended use of this function is for the automated mass production of data packages, such as the microarray annotation, CDF, and probe sequence packages.

No syntactic or other checking of the package is performed. For this, use R CMD check.

The symbols `@PKGNAME@` and `@DATE@` are automatically defined with the values of `pkgname` and `date()`, respectively.

**Value**

The function returns a list with one element `pkgdir`: the path to the package.

**Author(s)**

Wolfgang Huber [http://www.dkfz.de/mga/whuber](http://www.dkfz.de/mga/whuber)

**See Also**

`copySubstitute`, the reference manual *Writing R extensions*. 
Examples

```r
sym = list(AUTHOR = "Hesiod", VERSION = "1.0", 
           TITLE = "the nine muses", 
           FORMAT = "Character vector containg the names of the 9 muses."
)

res = createPackage("muses", 
                   destinationDir = tempdir(), 
                   originDir = system.file("Code", package="Biobase"), 
                   symbolValues = sym, 
                   unlink = TRUE, quiet = FALSE)

muses = c("Calliope", "Clio", "Erato", "Euterpe", "Melpomene", 
          "Polyhymnia", "Terpsichore", "Thalia", "Urania")

dir.create(file.path(res$pkgdir, "data"))

save(muses, file = file.path(res$pkgdir, "data", "muses.rda"))

res$pkgdir
```

---

**data:aaMap**  
*Dataset: Names and Characteristics of Amino Acids*

**Description**

The `aaMap` data frame has 20 rows and 6 columns. Includes elementary information about amino acids.

**Usage**

```r
data(aaMap)
```

**Format**

This data frame contains the following columns:

- `name` amino acid name
- `let.1` one-letter code
- `let.3` three-letter code
- `scProp` side chain property at pH 7 (polar/nonpolar)
- `hyPhilic` logical: side chain is hydrophilic at pH 7
- `acidic` logical: side chain is acidic at pH 7

**Source**

Nei M and Kumar S: Molecular evolution and phylogenetics (Oxford 2000), Table 1.2

**Examples**

```r
data(aaMap)
```
data:geneData

Sample expression matrix and phenotype data.frames.

Description
The geneData data.frame has 500 rows and 26 columns. It consists of a subset of real expression data from an Affymetrix U95v2 chip. The data are anonymous. The covariate data geneCov and geneCovariate are made up. The standard error data seD is also made up.

Usage
data(geneData)

Format
A 500 by 26 data frame.

Source
The J. Ritz Laboratory (S. Chiaretti).

Examples
data(geneData)
data(geneCovariate)
data(seD)

data:sample.ExpressionSet

dataset of class 'ExpressionSet'

Description
The expression data are real but anonymized. The data are from an experiment that used Affymetrix U95v2 chips. The data were processed by dChip and then exported to R for analysis.

The data illustrate ExpressionSet-class, with assayData containing the required matrix element exprs and an additional matrix se.exprs. se.exprs has the same dimensions as exprs.

The phenoData and standard error estimates (se.exprs) are made up. The information in the "description" slot is fake.

Usage
data(sample.ExpressionSet)

Format
The data for 26 cases, labeled A to Z and 500 genes. Each case has three covariates: sex (male/female); type (case/control); and score (testing score).

Examples
data(sample.ExpressionSet)
data: sample.MultiSet  Data set of class 'MultiSet'

Description

The expression data are real but anonymized. The data are from an experiment that used Affymetrix U95v2 chips. The data were processed by dChip and then exported to R for analysis. The phenoData, standard error estimates, and description data are fake.

Usage

data(sample.MultiSet)

Format

The data for 4 cases, labeled a to d and 500 genes. Each case has five covariates: SlideNumber: number; FileName: name; Cy3: genotype labeled Cy3; Cy5: genotype labeled Cy5; Date: date.

Examples

data(sample.MultiSet)

description

Retrieve and set overall experimental information eSet-like classes.

Description

These generic functions access experimental information associated with eSet-class.

Usage

description(object, ...)
description(object) <- value

Arguments

object  Object, possibly derived from class eSet-class.
value   Structured information describing the experiment, e.g., of MIAME-class.
...

Value

description returns an object of MIAME-class.

Author(s)

Biocore

See Also

eSet-class, MIAME-class
**dims**

Retrieve dimensions of all elements in a list or environment

**Description**

This function returns the dimensions of element members in lists or environments such as `AssayData-class`.

**Usage**

dims(object)

**Arguments**

- **object** List or environment object containing one or several matrices

**Value**

matrix of row and column dimensions, (in rows) for each element in object (columns).

**Author(s)**

Biocore

**See Also**

eSet-class

dumpPackTxt

**Dump Textual Description of a Package**

**Description**

Dump textual description of a package

**Usage**

dumpPackTxt(package)

**Arguments**

- **package** Character string naming an R package

**Details**

dumps DESCRIPTION and INDEX files from package sources

**Value**

stdout output
Note

Other approaches using formatDL are feasible

Author(s)

<stvjc@channing.harvard.edu>

Examples

dumpPackTxt("stats")

<table>
<thead>
<tr>
<th>esApply</th>
</tr>
</thead>
<tbody>
<tr>
<td>An apply-like function for ExpressionSet and related structures.</td>
</tr>
</tbody>
</table>

Description

esApply is a wrapper to apply for use with ExpressionSets. The application of a function to rows of an expression array usually involves variables in pData. esApply uses a special evaluation paradigm to make this easy. The function FUN may reference any data in pData by name.

Usage

esApply(X, MARGIN, FUN, ...)

Arguments

- **X**: An instance of class `ExpressionSet`.
- **MARGIN**: The margin to apply to, either 1 for rows (samples) or 2 for columns (features).
- **FUN**: Any function
- **...**: Additional parameters for FUN.

Details

The pData from X is installed in an environment. This environment is installed as the environment of FUN. This will then provide bindings for any symbols in FUN that are the same as the names of the pData of X. If FUN has an environment already it is retained but placed after the newly created environment. Some variable shadowing could occur under these circumstances.

Value

The result of `with(pData(x), apply(exprs(X), MARGIN, FUN, ...))`.

Author(s)

V.J. Carey <stvjc@channing.harvard.edu>, R. Gentleman

See Also

`apply`, `ExpressionSet`
Examples

data(sample.ExpressionSet)
## sum columns of exprs
res <- esApply(sample.ExpressionSet, 1, sum)

## t-test, splitting samples by 'sex'
f <- function(x) {
  xx <- split(x, sex)
  t.test(xx[[1]], xx[[2]])$p.value
}
res <- esApply(sample.ExpressionSet, 1, f)

## same, but using a variable passed in the function call
f <- function(x, s) {
  xx <- split(x, s)
  mean(xx[[1]]) - mean(xx[[2]])
}
sex <- sample.ExpressionSet["sex"]
res <- esApply(sample.ExpressionSet, 1, f, s = sex)

# obtain the p-value of the t-test for sex difference
mytt.demo <- function(y) {
  ys <- split(y, sex)
  t.test(ys[[1]], ys[[2]])$p.value
}
sexPValue <- esApply(sample.ExpressionSet, 1, mytt.demo)

# obtain the p-value of the slope associated with score, adjusting for sex
# (if we were concerned with sign we could save the z statistic instead at coef[3,3]
myreg.demo <- function(y) {
  summary(lm(y ~ sex + score))$coef[3,4]
}
scorePValue <- esApply(sample.ExpressionSet, 1, myreg.demo)

# a resampling method
resamp <- function(ESET) {
  ntiss <- ncol(exprs(ESET))
  newwind <- sample(1:ntiss, size = ntiss, replace = TRUE)
  ESET[newwind,]
}

# a filter
q3g100filt <- function(eset) {
  apply(exprs(eset), 1, function(x) quantile(x,.75) > 100)
}

# filter after resampling and then apply
set.seed(123)
rest <- esApply({
  bool <- q3g100filt(resamp(sample.ExpressionSet)); sample.ExpressionSet[bool,]
}, 1, mytt.demo)
Description
Container for high-throughput assays and experimental metadata. Classes derived from eSet contain one or more identical-sized matrices as assayData elements. Derived classes (e.g., ExpressionSet-class, SnpSet-class) specify which elements must be present in the assayData slot. eSet object cannot be instantiated directly; see the examples for usage.

Creating Objects
eSet is a virtual class, so instances cannot be created. Objects created under previous definitions of eSet-class can be coerced to the current classes derived from eSet using updateOldESet.

Slots
Introduced in eSet:
assayData: Contains matrices with equal dimensions, and with column number equal to nrow(phenoData). Class: AssayData-class
phenoData: Contains experimenter-supplied variables describing sample (i.e., columns in assayData) phenotypes. Class: AnnotatedDataFrame-class
featureData: Contains variables describing features (i.e., rows in assayData) unique to this experiment. Use the annotation slot to efficiently reference feature data common to the annotation package used in the experiment. Class: AnnotatedDataFrame-class
experimentData: Contains details of experimental methods. Class: MIAME-class
annotation: Label associated with the annotation package used in the experiment. Class: character
protocolData: Contains microarray equipment-generated variables describing sample (i.e., columns in assayData) phenotypes. Class: AnnotatedDataFrame-class
.__classVersion__: A Versions object describing the R and Biobase version numbers used to created the instance. Intended for developer use.

Methods
Methods defined in derived classes (e.g., ExpressionSet-class, SnpSet-class) may override the methods described here.
Class-specific methods:
sampleNames(object) and sampleNames(object)<-value: Coordinate accessing and setting sample names in assayData and phenoData
featureNames(object), featureNames(object) <- value: Coordinate accessing and setting of feature names (e.g, genes, probes) in assayData.
dimnames(object), dimnames(object) <- value: Also rownames and colnames; access and set feature and sample names.
dims(object): Access the common dimensions (dim) or column numbers (ncol), or dimensions of all members (dims) of assayData.
phenoData(object), phenoData(object) <- value: Access and set phenoData. Adding new columns to phenoData is often more easily done with eSetObject[["columnName"]]<- value.
pData(object), pData(object) <- value: Access and set sample data information. Adding new columns to pData is often more easily done with eSetObject[["columnName"]]<- value.
varMetadata(object), varMetadata(eSet, value) Access and set metadata describing variables reported in pData.

varLabels(object), varLabels(eSet, value)<- Access and set variable labels in phenoData.

featureData(object), featureData(object) <- value: Access and set featureData.

fData(object), fData(object) <- value: Access and set feature data information.

fvarMetadata(object), fvarMetadata(eSet, value) Access and set metadata describing features reported in fData.

fvarLabels(object), fvarLabels(eSet, value)<- Access and set variable labels in featureData.

assayData(object), assayData(object) <- value: signature(object = "eSet", value = "AssayData"): Access and replace the AssayData slot of an eSet instance. assayData returns a list or environment: elements in assayData not accessible in other ways (e.g., via exprs applied directly to the eSet) can most reliably be accessed with, e.g., assayData(obj)["se.exprs"].

experimentData(object), experimentData(object) <- value: Access and set details of experimental methods.

description(object), description(object) <- value: Synonymous with experimentData.

notes(object), notes(object) <- value: signature(object="eSet", value="list") Retrieve and set unstructured notes associated with eSet. signature(object="eSet", value="character") As with value="list", but append value to current list of notes.

pubMedIds(object), pubMedIds(eSet, value) Access and set PMIDs in experimentData.

abstract(object): Access abstract in experimentData.

annotation(object), annotation(object) <- value Access and set annotation label indicating package used in the experiment.

protocolData(object), protocolData(object) <- value Access and set the protocol data.

preproc(object), preproc(object) <- value: signature(object="eSet", value="list") Access and set preprocessing information in the MIAME-class object associated with this eSet.

combine(eSet, eSet): Combine two eSet objects. To be combined, eSets must have identical numbers of featureNames, distinct sampleNames, and identical annotation.

storageMode(object), storageMode(eSet, character)<-: Change storage mode of assayData. Can be used to 'unlock' environments, or to change between list and environment modes of storing assayData.

Standard generic methods:

initialize(object): Object instantiation, can be called by derived classes but not usually by the user.

validObject(object): Validity-checking method, ensuring (1) all assayData components have the same number of features and samples; (2) the number and names of phenoData rows match the number and names of assayData columns.

as(eSet, "ExpressionSet") Convert instance of class "eSet" to instance of ExpressionSet-class, if possible.

as(eSet, "MultiSet") Convert instance of class "eSet" to instance of MultiSet-class, if possible.

updateObject(object, ..., verbose=FALSE) Update instance to current version, if necessary. Usually called through class inheritance rather than directly by the user. See updateObject.

updateObjectTo(object, template, ..., verbose=FALSE) Update instance to current version by updating slots in template, if necessary. Usually call by class inheritance, rather than directly by the user. See updateObjectTo.
isCurrent(object)  Determine whether version of object is current. See isCurrent
isVersioned(object) Determine whether object contains a ‘version’ string describing its structure. See isVersioned
show(object)  Informatively display object contents.
dim(object), ncol  Access the common dimensions (dim) or column numbers (ncol), of all members (dims) of assayData.
object[(index):  Conducts subsetting of matrices and phenoData components
object$name, object$name<-value  Access and set name column in phenoData
object[[i, ...]], object[[i, ...]]<-value  Access and set column i (character or numeric index) in phenoData. The ... argument can include named variables (especially labelDescription) to be added to varMetadata.

Additional functions:
assayDataElement(object, element)  Return matrix element from assayData slot of object.
assayDataElement(object, element, validate=TRUE) <- value)  Set element element in assayData slot of object to matrix value. If validate=TRUE, check that value row and column names of conform to object.
assayDataElementReplace(object, element, value, validate=TRUE)  Set element element in assayData slot of object to matrix value. If validate=TRUE, check that row and column names of value conform to object.
assayDataElementNames(object)  Return element names in assayData slot of object

updateOldESet  Update versions of eSet constructed using listOrEnv as assayData slot (before May, 2006).

Author(s)
Biocore team

See Also
Method use in ExpressionSet-class. Related classes AssayData-class, AnnotatedDataFrame-class, MIAME-class. Derived classes ExpressionSet-class, SnpSet-class. To update objects from previous class versions, see updateOldESet.

Examples

# update previous eSet-like class oldESet to existing derived class
## Not run: updateOldESet(oldESet, "ExpressionSet")

# create a new, ad hoc, class, for personal use
# all methods outlined above are available automatically
.MySet <- setClass("MySet", contains="eSet")
.MySet()

# Create a more robust class, with constructor and validation methods
# to ensure assayData contains specific matrices
.TwoColorSet <- setClass("TwoColorSet", contains="eSet")
.TwoColorSet <-
    function(phenoData=AnnotatedDataFrame(), experimentData=MIAME(),
    {...}
ExpressionSet

Class to Contain and Describe High-Throughput Expression Level Assays.

Description

Container for high-throughput assays and experimental metadata. ExpressionSet class is derived from eSet, and requires a matrix named exprs as assayData member.

Usage

## Instance creation

ExpressionSet(assayData,  
  phenoData=annotatedDataFrameFrom(assayData, byrow=FALSE), featureData=annotatedDataFrameFrom(assayData, byrow=TRUE),  
  experimentData=MIAME(), annotation=character(), protocolData=annotatedDataFrameFrom(assayData, byrow=FALSE), ...)  

## Additional methods documented below

Arguments

assayData A matrix of expression values, or an environment.

When assayData is a matrix, the rows represent probe sets (‘features’ in ExpressionSet parlance). Columns represent samples. When present, row names identify features and column names identify samples. Row and column names must be unique, and consistent with row names of featureData and phenoData, respectively. The assay data can be retrieved with exprs().

When assayData is an environment, it contains identically dimensioned matrices like that described in the previous paragraph. One of the elements of the environment must be named ‘exprs’; this element is returned with exprs().
ExpressionSet

**PhenoData**
An optional AnnotatedDataFrame containing information about each sample. The number of rows in phenoData must match the number of columns in assayData. Row names of phenoData must match column names of the matrix / matrices in assayData.

**FeatureData**
An optional AnnotatedDataFrame containing information about each feature. The number of rows in featureData must match the number of rows in assayData. Row names of featureData must match row names of the matrix / matrices in assayData.

**ExperimentData**
An optional MIAME instance with meta-data (e.g., the lab and resulting publications from the analysis) about the experiment.

**Annotation**
A character describing the platform on which the samples were assayed. This is often the name of a Bioconductor chip annotation package, which facilitated down-stream analysis.

**ProtocolData**
An optional AnnotatedDataFrame containing equipment-generated information about protocols. The number of rows and row names of protocolData must agree with the dimension and column names of assayData.

Additional arguments, passed to `new("ExpressionSet", ...)` and available for classes that extend ExpressionSet.

**Extends**
Directly extends class `eSet`.

**Creating Objects**
ExpressionSet instances are usually created through `ExpressionSet()`.

**Slots**
Inherited from `eSet`:

- **assayData**: Contains matrices with equal dimensions, and with column number equal to `nrow(phenoData)`. assayData must contain a matrix `exprs` with rows representing features (e.g., probe sets) and columns representing samples. Additional matrices of identical size (e.g., representing measurement errors) may also be included in assayData. Class: `AssayData-class`

- **phenoData**: See `eSet`
- **featureData**: See `eSet`
- **experimentData**: See `eSet`
- **annotation**: See `eSet`
- **protocolData**: See `eSet`

**Methods**
Class-specific methods.

- `as(exprSet,"ExpressionSet")` Coerce objects of `exprSet-class` to `ExpressionSet`
- `as(object,"data.frame")` Coerce objects of `ExpressionSet-class` to `data.frame` by transposing the expression matrix and concatenating phenoData
- `exprs(ExpressionSet), exprs(ExpressionSet,matrix)<-` Access and set elements named `exprs` in the `AssayData-class` slot.
esApply(ExpressionSet, MARGIN, FUN, ...) 'apply'-like function to conveniently operate on ExpressionSet objects. See esApply.

write.exprs(ExpressionSet) Write expression values to a text file. It takes the same arguments as write.table

Derived from eSet:

updateObject(object, ..., verbose=FALSE) Update instance to current version, if necessary. See updateObject and eSet

isCurrent(object) Determine whether version of object is current. See isCurrent

isVersioned(object) Determine whether object contains a 'version' string describing its structure. See isVersioned

assayData(ExpressionSet): See eSet

sampleNames(ExpressionSet) and sampleNames(ExpressionSet)<-: See eSet

featureNames(ExpressionSet), featureNames(ExpressionSet, value)<-: See eSet
dims(ExpressionSet): See eSet

phenoData(ExpressionSet), phenoData(ExpressionSet, value)<-: See eSet

varLabels(ExpressionSet), varLabels(ExpressionSet, value)<-: See eSet

varMetadata(ExpressionSet), varMetadata(ExpressionSet, value)<-: See eSet

pData(ExpressionSet), pData(ExpressionSet, value)<-: See eSet

varMetadata(ExpressionSet), varMetadata(ExpressionSet, value) See eSet

experimentData(ExpressionSet), experimentData(ExpressionSet, value)<-: See eSet

pubMedIds(ExpressionSet), pubMedIds(ExpressionSet, value) See eSet

abstract(ExpressionSet): See eSet

annotation(ExpressionSet), annotation(ExpressionSet, value)<- See eSet

protocolData(ExpressionSet), protocolData(ExpressionSet, value)<- See eSet

combine(ExpressionSet, ExpressionSet): See eSet

storageMode(ExpressionSet), storageMode(ExpressionSet, character)<- See eSet

Standard generic methods:

initialize(ExpressionSet): Object instantiation, used by new; not to be called directly by the user.

updateObject(ExpressionSet): Update outdated versions of ExpressionSet to their current definition. See updateObject, Versions-class.

validObject(ExpressionSet): Validity-checking method, ensuring that exprs is a member of assayData. checkValidity(ExpressionSet) imposes this validity check, and the validity checks of eSet.

makeDataPackage(object, author, email, packageName, packageVersion, license, biocViews, filePath, description=paste(abstract(object), collapse="\n\n"), ...) Create a data package based on an ExpressionSet object. See makeDataPackage.

as(exprSet, ExpressionSet): Coerce exprSet to ExpressionSet.

as(eSet, ExpressionSet): Coerce the eSet portion of an object to ExpressionSet.

show(ExpressionSet) See eSet
dim(ExpressionSet), ncol See eSet

ExpressionSet[(index)]: See eSet

ExpressionSet$, ExpressionSet$<- See eSet

ExpressionSet[[i]], ExpressionSet[[i]]<- See eSet
exprs

Retrieve expression data from eSets.

Description
These generic functions access the expression and error measurements of assay data stored in an object derived from the eSet-class.

Usage
exprs(object)
exprs(object) <- value
se.exprs(object)
se.exprs(object) <- value
featureData

Arguments

object Object derived from class eSet.
value Matrix with rows representing features and columns samples.

Value

exprs returns a (usually large!) matrix of expression values; se.exprs returns the corresponding matrix of standard errors, when available.

Author(s)

Biocore

See Also

eSet-class, ExpressionSet-class, SnpSet-class

featureData Retrieve information on features recorded in eSet-derived classes.

Description

These generic functions access feature data (experiment specific information about features) and feature meta-data (e.g., descriptions of feature covariates).

Usage

featureData(object)
featureData(object) <- value
fData(object)
fData(object) <- value
fvarLabels(object)
fvarLabels(object) <- value
fvarMetadata(object)
fvarMetadata(object) <- value

Arguments

object Object, possibly derived from eSet-class or AnnotatedDataFrame-class.
value Value to be assigned to corresponding object.

Value

featureData returns an object containing information on both variable values and variable meta-data. fvarLabels returns a character vector of measured variable names. fData returns a data frame with features as rows, variables as columns. fvarMetadata returns a data frame with variable names as rows, description tags (e.g., unit of measurement) as columns.

Author(s)

Biocore
See Also
eSet, ExpressionSet

featureNames

Retrieve feature and sample names from eSets.

Description

These generic functions access the feature names (typically, gene or SNP identifiers) and sample
names stored in an object derived from the eSet-class.

Usage

featureNames(object)
featureNames(object) <- value
sampleNames(object)
sampleNames(object) <- value

Arguments

object Object, possibly derived from class eSet.
value Character vector containing feature or sample names.

Value

featureNames returns a (usually long!) character vector uniquely identifying each feature.
sampleNames returns a (usually shorter) character vector identifying samples.

Author(s)

Biocore

See Also

ExpressionSet-class, SnpSet-class

getPkgVigs

List Vignette Files for a Package

Description

This function will return a listing of all vignettes stored in a package’s doc directory.

Usage

getPkgVigs(package = NULL)

Arguments

package A character vector of packages to search or NULL. The latter is for all attached packages (in search()).
Value
A data.frame with columns package, filename, title.

Author(s)
Jeff Gentry, modifications by Wolfgang Huber.

See Also
openVignette

Examples
z <- getPkgVigs()
z # and look at them

Description
This generic function uses Versioned-class information to ask whether an instance of a class
(e.g., read from disk) has current version information.

By default, isCurrent has the following behaviors:

isCurrent(Versioned-instance) Returns a vector of logicals, indicating whether each version
matches the current version from the class prototype.

isCurrent(ANY) Return NA, indicating that the version cannot be determined

isCurrent(Versioned-instance, "class") Returns a logical vector indicating whether version
identifiers shared between Versioned-instance and "class" are current.

Starting with R-2.6 / Bioconductor 2.1 / Biobase 1.15.1, isCurrent(Versioned-instance, ...) returns an element S4 indicating whether the class has the ‘S4’ bit set; a value of FALSE indicates
that the object needs to be recreated.

Usage
isCurrent(object, value)

Arguments
object Object whose version is to be determined, as described above.
value (Optional) character string identifying a class with which to compare versions.

Value
isCurrent returns a logical vector.

Author(s)
Biocore team
See Also

Versions-class

Examples

```r
obj <- new("VersionedBiobase")
isCurrent(obj)

isCurrent(1:10) # NA

A <- setClass("A", contains="VersionedBiobase",
        prototype=prototype(new("VersionedBiobase", versions=c(A="1.0.0"))))

a <- A()
classVersion(a)
isCurrent(a, "VersionedBiobase") # is the 'VersionedBiobase' portion current?
classVersion(a)["A"] <- "1.0.1"
classVersion(a)
isCurrent(a, "VersionedBiobase")
isCurrent(a) # more recent, so does not match 'current' defined by prototype
removeClass("A")
```

---

**isUnique**

Determine Unique Elements

**Description**

Determines which elements of a vector occur exactly once.

**Usage**

```r
isUnique(x)
```

**Arguments**

- `x` a vector

**Value**

A logical vector of the same length as `x`, in which TRUE indicates uniqueness.

**Author(s)**

Wolfgang Huber

**See Also**

`unique`, `duplicated`.
isVersioned

Examples

```r
x <- c(9:20, 1:5, 3:7, 0:8)
isUnique(x)
```

<table>
<thead>
<tr>
<th>isVersioned</th>
<th>Determine whether object or class contains versioning information</th>
</tr>
</thead>
</table>

Description

This generic function checks to see whether `Versioned-class` information is present. When the argument to `isVersioned` is a character string, the prototype of the class corresponding to the string is consulted.

By default, `isVersioned` has the following behaviors:

- `isVersioned(Versioned-instance)` Returns TRUE when the instance have version information.
- `isCurrent("class-name")` Returns TRUE when the named class extends `Versioned-class`.
- `isVersioned(ANY)` Returns FALSE

Usage

```r
isVersioned(object)
```

Arguments

- `object` Object or class name to check for version information, as described above.

Value

`isVersioned` returns a logical indicating whether version information is present.

Author(s)

Biocore team

See Also

- `Versions-class`

Examples

```r
obj <- new("VersionedBiobase")
isVersioned(obj)

isVersioned(1:10) # FALSE

A <- setClass("A", contains="VersionedBiobase",
    prototype=prototype(new("VersionedBiobase", versions=c(A="1.0.0"))))
a <- A()
isVersioned(a)

removeClass("A")
```
`lcSuffix`  
*Compute the longest common prefix or suffix of a string*

**Description**

These functions find the longest common prefix or suffix among the strings in a character vector.

**Usage**

```r
lcPrefix(x, ignore.case=FALSE)
lcPrefixC(x, ignore.case=FALSE)
lcSuffix(x, ignore.case=FALSE)
```

**Arguments**

- `x`: a character vector.
- `ignore.case`: A logical value indicating whether or not to ignore the case in making comparisons.

**Details**

Computing the longest common suffix is helpful for truncating names of objects, like microarrays, that often have a common suffix, such as .CEL.

There are some potential problems with the approach used if multibyte character encodings are being used.

`lcPrefixC` is a faster implementation in C. It only handles ascii characters.

**Value**

The common prefix or suffix.

**Author(s)**

R. Gentleman

**See Also**

`nchar`, `nchar`

**Examples**

```r
s1 <- c("ABC.CEL", "DEF.CEL")
lcSuffix(s1)

s2 <- c("ABC.123", "ABC.456")
lcPrefix(s2)

CHK <- stopifnot

CHK(".CEL" == lcSuffix(s1))
CHK("bc" == lcSuffix(c("abc", "333abc", "bc")))
```
listLen

Description

This function returns an integer vector with the length of the elements of its argument, which is expected to be a list.

Usage

listLen(x)

Arguments

x A list

Details

This function returns a vector of the same length as the list x containing the lengths of each element. The current implementation is intended for lists containing vectors and the C-level length function is used to determine length. This means no dispatch is done for the elements of the list. If your list contains S4 objects, you should use sapply(x, length) instead.

Author(s)

Jeff Gentry and R. Gentleman

See Also

sapply

Examples

foo = lapply(1:8, rnorm)
listLen(foo)
makeDataPackage  

Make an R package from a data object

Description

This generic creates a valid R package from an R data object.

Usage

makeDataPackage(object, author, email,
    packageName=deparse(substitute(object)),
    packageVersion=package_version("1.0.0"),
    license="Artistic-2.0",
    biocViews="ExperimentData",
    filePath=tempdir(),
    ...
)

Arguments

object  An instance of an R data object.
author  The author, as a character string.
email   A valid email address for the maintainer, as a character string.
packageName  The name of the package, defaults to the name of the object instance.
packageVersion  The version number, as a character string.
license  The license, as a character string.
biocViews  A character vector of valid biocViews views.
filePath  The location to create the package.
...  Additional arguments to specific methods.

Details

The function makes use of various tools in R and Bioconductor to automatically generate the source files for a valid R package.

Value

The return value is that from a call to link{createPackage} which is invoked once the default arguments are set up. The data instance is stored in the data directory with a name the same as that of the resulting package.

Note

Developers implementing derived methods might force correct package name evaluation by including 'packageName' in any callNextMethod().

Author(s)

R. Gentleman
**matchpt**

**See Also**

createPackage

**Examples**

```r
data(sample.ExpressionSet)
## package created in tempdir()
s1 <- makeDataPackage(sample.ExpressionSet,
    author = "Foo Author",
    email = "foo@bar",
    packageName = "FooBarPkg",
    packageVersion = "1.0.0")
```

**Description**

Find the nearest neighbors of a set of query points in the same or another set of points in an n-dimensional real vector space, using the Euclidean distance.

**Usage**

```r
matchpt(x, y)
```

**Arguments**

- **x**: A matrix (or vector) of coordinates. Each row represents a point in an ncol(x)-dimensional real vector space.
- **y**: Optional, matrix (or vector) with the same number of columns as x.

**Details**

If y is provided, the function searches for each point in x its nearest neighbor in y. If y is missing, it searches for each point in x its nearest neighbor in x, excluding that point itself. In the case of ties, only the neighbor with the smaller index is given.

The implementation is simple and of complexity nrow(x) times nrow(y). For larger problems, please consider one of the many more efficient nearest neighbor search algorithms.

**Value**

A data.frame with two columns and nrow(x) rows. The first column is the index of the nearest neighbor, the second column the distance to the nearest neighbor. If y was given, the index is a row number in y, otherwise, in x. The row names of the result are those of x.

**Author(s)**

Oleg Sklyar <osklyar@ebi.ac.uk>
Examples

```r
a <- matrix(c(2,2,3,5,1,8,-1,4,5,6), ncol=2L, nrow=5L)
rownames(a) = LETTERS[seq_len(nrow(a))]
machpt(a)
b <- c(1,2,4,5,6)
d <- c(5.3, 3.2, 8.9, 1.3, 5.6, -6, 4.45, 3.32)
machpt(b, d)
machpt(d, b)
```

MIAME
---

Class for Storing Microarray Experiment Information

Description

Class `MIAME` covers MIAME entries that are not covered by other classes in Bioconductor. Namely, experimental design, samples, hybridizations, normalization controls, and pre-processing information. The MIAME class is derived from `MIaXE`.

Slots

- **name**: Object of class character containing the experimenter name
- **lab**: Object of class character containing the laboratory where the experiment was conducted
- **contact**: Object of class character containing contact information for lab and/or experimenter
- **title**: Object of class character containing a single-sentence experiment title
- **abstract**: Object of class character containing an abstract describing the experiment
- **url**: Object of class character containing a URL for the experiment
- **samples**: Object of class list containing information about the samples
- **hybridizations**: Object of class list containing information about the hybridizations
- **normControls**: Object of class list containing information about the controls such as housekeeping genes
- **preprocessing**: Object of class list containing information about the pre-processing steps used on the raw data from this experiment
- **pubMedIds**: Object of class character listing strings of PubMed identifiers of papers relevant to the dataset
- **other**: Object of class list containing other information for which none of the above slots does not apply

Methods

Constructor methods:

- `MIAME()`: MIAME(name = "", lab = "", contact = "", title = "", abstract = "", url = "", samples = "", hybridizations = "", normControls = "", preprocessing = "", pubMedIds = "", other = "")

  Creates a new MIAME object with slots as defined above.

Class-specific methods:

- `abstract(MIAME)`: An accessor function for abstract.
- `combine(MIAME, MIAME)`: Combine two objects of MIAME-class, issuing warnings when ambiguities encountered.
expinfo(MIAME): An accessor function for name, lab, contact, title, and url.

hybridizations(MIAME): An accessor function for hybridizations.

normControls(MIAME): An accessor function for normControls.

notes(MIAME), notes(MIAME) <- value: Accessor functions for other. notes(MIAME) <- character appends character to notes; use notes(MIAME) <- list to replace the notes entirely.

otherInfo(MIAME): An accessor function for other.

preproc(MIAME): An accessor function for preprocessing.

pubMedIds(MIAME), pubMedIds(MIAME) <- value: Accessor function for pubMedIds.

samples(MIAME): An accessor function for samples.

Standard generic methods:

updateObject(object, ..., verbose=FALSE) Update instance to current version, if necessary. See updateObject

isCurrent(object) Determine whether version of object is current. See isCurrent

isVersioned(object) Determine whether object contains a 'version' string describing its structure. See isVersioned

show(MIAME): Renders information about the MIAME information

Author(s)

Rafael A. Irizarry

References

http://www.mged.org/Workgroups/MIAME/miame_1.1.html

See Also

class:characterORMIAME, read.MIAME

MIAxE objects

Description

The MIAxE virtual class is a general container for storing experiment metadata. Information such as experimental design, samples, normalization methods and pre-processing information can be stored in these objects.

The MIAxE class is virtual and MIAxE objects cannot be instantiated directly. The following classes derive directly from the MIAxE class: MIAME.

Slots

Introduced in MIAxE:

__classVersion__: A Versions object describing the MIAxE version number. Intended for developer use.
multiassign

Methods
Standard generic methods:
show(object)  Informatively display object contents.

Author(s)
Biocore team

See Also
Related classes MIAME-class, ExpressionSet-class. Derived classes MIAME-class.

Examples

# Create a new class
MyData <- setClass("MyData", contains="MIAxE")
MyData()

# MIAxE objects cannot be instantiated directly
try(new("MIAxE"))

multiassign Assign Values to a Names

Description
Assign values to names in an environment.

Usage
multiassign(x, value, envir = parent.frame(), inherits=FALSE)

Arguments

x  A vector or list of names, represented by strings.
value a vector or list of values to be assigned.
envir the environment to use. See the details section.
iinherits should the enclosing frames of the environment be inspected?

Details
The pos argument can specify the environment in which to assign the object in any of several ways:
as an integer (the position in the search list); as the character string name of an element in the search
list; or as an environment (including using sys.frame to access the currently active function calls).
The envir argument is an alternative way to specify an environment, but is primarily there for back
compatibility.
If value is missing and x has names then the values in each element of x are assigned to the names
of x.
**MultiSet**

*Value*

This function is invoked for its side effect, which is assigning the values to the variables in `x`. If no `envir` is specified, then the assignment takes place in the currently active environment.

If `inherits` is `TRUE`, enclosing environments of the supplied environment are searched until the variable `x` is encountered. The value is then assigned in the environment in which the variable is encountered. If the symbol is not encountered then assignment takes place in the user’s workspace (the global environment).

If `inherits` is `FALSE`, assignment takes place in the initial frame of `envir`.

**Examples**

```r
#-- Create objects 'r1', 'r2', ... 'r6' --
nam <- paste("r",1:6, sep=".")

multiassign(nam, 11:16)
ls(pat="^r..$")

#assign the values in y to variables with the names from y
y<-list(a=4,d=mean,c="aaa")
multiassign(y)
```

---

**MultiSet**

*Class to Contain and Describe High-Throughput Expression Level Assays.*

**Description**

Container for high-throughput assays and experimental metadata. **MultiSet** is derived from **eSet-class**. **MultiSet** differs from **ExpressionSet-class** because **MultiSet** can contain any element(s) in `assayData` (ExpressionSet must have an element named `exprs`).

**Extends**

Directly extends class **eSet**.

**Creating Objects**

```r
new("MultiSet", phenoData = [AnnotatedDataFrame], experimentData = [MIAME], annotation = [

updateOldESet(oldESet,"MultiSet")
```

**MultiSet** instances are usually created through `new("MultiSet", ...)`. The ... arguments to `new` are matrices of expression data (with features corresponding to rows and samples to columns), `phenoData`, `experimentData`, `annotation`, and `protocolData`. `phenoData`, `experimentData`, `annotation`, and `protocolData` can be missing, in which case they are assigned default values.

**updateOldESet** will take a serialized instance (e.g., saved to a disk file with save object created with earlier definitions of the eSet-class, and update the object to **MultiSet**. Warnings are issued when direct translation is not possible; incorrectly created `oldESet` instances may not be updated.
## Slots

Inherited from eSet:

- **assayData**: Contains zero or more matrices with equal dimensions, and with column number equal to `nrow(phenoData)`. Each matrix in assayData has rows representing features (e.g., reporters) and columns representing samples. Class: `AssayData-class`

- **phenoData**: See `eSet-class`

- **experimentData**: See `eSet-class`

- **annotation**: See `eSet-class`

- **protocolData**: See `eSet-class`

## Methods

Class-specific methods: none

Derived from `eSet-class`:

- **updateObject(object, ..., verbose=FALSE)**: Update instance to current version, if necessary. See `updateObject` and `eSet`

- **isCurrent(object)**: Determine whether version of object is current. See `isCurrent`

- **isVersioned(object)**: Determine whether object contains a 'version' string describing its structure. See `isVersioned`

- **sampleNames(MultiSet)** and **sampleNames(MultiSet)<-**: See `eSet-class`

- **featureNames(MultiSet)**, **featureNames(MultiSet, value)<-**: See `eSet-class`

- **dims(MultiSet)**: See `eSet-class`

- **phenoData(MultiSet)**, **phenoData(MultiSet,value)<-**: See `eSet-class`

- **varLabels(MultiSet)**, **varLabels(MultiSet, value)<-**: See `eSet-class`

- **varMetadata(MultiSet)**, **varMetadata(MultiSet,value)<-**: See `eSet-class`

- **pData(MultiSet)**, **pData(MultiSet,value)<-**: See `eSet-class`

- **experimentData(MultiSet)**, **experimentData(MultiSet,value)<-**: See `eSet-class`

- **pubMedIds(MultiSet)**, **pubMedIds(MultiSet,value)**: See `eSet-class`

- **abstract(MultiSet)**: See `eSet-class`

- **annotation(MultiSet)**, **annotation(MultiSet,value)<-**: See `eSet-class`

- **protocolData(MultiSet)**, **protocolData(MultiSet,value)<-**: See `eSet-class`

- **combine(MultiSet,MultiSet)**: See `eSet-class`

- **storageMode(eSet)**, **storageMode(eSet,character)<-**: See `eSet-class`

Standard generic methods:

- **initialize(MultiSet)**: Object instantiation, used by `new`; not to be called directly by the user.

- **validObject(MultiSet)**: Validity-checking method, ensuring that all elements of assayData are matrices with equal dimensions.

- **as(eSet,MultiSet)**: Coerce the eSet portion of an object to MultiSet.

- **show(MultiSet)** See `eSet-class`

- **dim(MultiSet)**, **ncol**: See `eSet-class`

- **MultiSet[(index)]**: See `eSet-class`

- **MultiSet$, MultiSet$<**: See `eSet-class`
NChannelSet-class

Author(s)

Biocore team

See Also

eSet-class, ExpressionSet-class

Examples

# create an instance of ExpressionSet
new("MultiSet")

NChannelSet-class

Class to contain data from multiple channel array technologies

Description

Container for high-throughput assays and experimental meta-data. Data are from experiments where a single 'chip' contains several (more than 1) different 'channels'. All channels on a chip have the same set of 'features'. An experiment consists of a collection of several N-channel chips; each chip is a 'sample'.

An NChannelSet provides a way to coordinate assay data (expression values) with phenotype information and references to chip annotation data; it extends the eSet class.

An NChannelSet allows channels to be extracted (using the channels method, mentioned below), and subsets of features or samples to be selected (using \[features\], \[samples\]). Selection and subsetting occur so that relevant phenotypic data is maintained by the selection or subset.

Objects from the Class

Objects can be created by calls of the form NChannelSet( assayData, phenoData, ...). See the examples below.

Slots

assayData: Object of class AssayData, usually an environment containing matrices of identical size. Each matrix represents a single channel. Columns in each matrix correspond to samples, rows to features. Once created, NChannelSet manages coordination of samples and channels.

phenoData: Object of class AnnotatedDataFrame.

The data component of the AnnotatedDataFrame is data.frame with number of rows equal to the number of samples. Columns of the data component correspond to measured covariates.

The varMetadata component consists of mandatory columns labelDescription (providing a textual description of each column label in the data component) and channel. The channel of varMetadata is a factor, with levels equal to the names of the assayData channels, plus the special symbol _ALL_. The channel column is used to indicate which channel(s) the corresponding column in the data component of AnnotatedDataFrame correspond; the _ALL_ symbol indicates that the data column is applicable to all channels. varMetadata may contain additional columns with arbitrary information.

Once created, NChannelSet coordinates selection and subsetting of channels in phenoData.
featureData: Object of class AnnotatedDataFrame, used to contain feature data that is unique to this experiment; feature-level descriptions common to a particular chip are usually referenced through the annotation slot.

experimentData: Object of class MIAME containing descriptions of the experiment.

annotation: Object of class "character". Usually a length-1 character string identifying the chip technology used during the experiment. The annotation string is used to retrieve information about features, e.g., using the annotation package.

protocolData: Object of class "character". A character vector identifying the dates the samples were scanned during the experiment.

__classVersion__: Object of class Versions, containing automatically created information about the class definition Biobase package version, and other information about the user system at the time the instance was created. See classVersion and updateObject for examples of use.

Extends

Class "eSet", directly. Class "VersionedBiobase", by class "eSet", distance 2. Class "Versioned", by class "eSet", distance 3.

Methods

Methods with class-specific functionality:

channel(object, name, ...) signature(object="NChannelSet", name="character"). Return an ExpressionSet created from the channel and corresponding phenotype of argument name. name must have length 1. Arguments ... are rarely used, but are passed to the ExpressionSet constructor, for instance to influence storage.mode.

channelNames(object), channelNames(object) <- value signature(object = "NChannelSet"). Obtain, reorder, or rename channels contained in object. See channelNames.

selectChannels(object, names, ...) signature(object = "NChannelSet", names = "character"). Create a new NChannelSet from object, containing only channels in names. The ... is not used by this method.

object[features, samples] signature(object = "NChannelSet", features = "ANY", samples = "ANY"). Create a new NChannelSet from object, containing only elements matching features and samples; either index may be missing, or a character, numeric, or logical vector.

sampleNames(object) <- value signature(object = "NChannelSet", value = "list") assign each (named) element of value to the sampleNames of the correspondingly named elements of assayData in object.

Methods with functionality derived from eSet: annotation, annotation<-, assayData, assayData<-, classVersion, classVersion<-, dim, dims, experimentData, experimentData<-, featureData, featureData<-, phenoData, phenoData<-, protocolData, protocolData<-, pubMedIds, pubMedIds<-, sampleNames, sampleNames<-, storageMode, storageMode<-, varMetadata, varMetadata<-, isCurrent, isVersioned, updateObject.

Additional methods: coerce ("as", to convert between objects, if possible), initialize (used internally for creating objects), show (invoked automatically when the object is displayed to the screen)

Author(s)

Martin Morgan <mtmorgan@fhcrc.org>
See Also

`eSet`, `ExpressionSet`.

Examples

```r
## An empty NChannelSet
obj <- NChannelSet()

## An NChannelSet with two channels (R, G) and no phenotypic data
obj <- NChannelSet(R=matrix(0,10,5), G=matrix(0,10,5))

## An NChannelSet with two channels and channel-specific phenoData
R <- matrix(c(0, 10, 3), dimnames=list(NULL, LETTERS[1:3]))
G <- matrix(c(1, 10, 3), dimnames=list(NULL, LETTERS[1:3]))
assayData <- assayDataNew(R=R, G=G)
data <- data.frame(ChannelRData=numeric(ncol(R)),
                    ChannelGData=numeric(ncol(R)))
varMetadata <- data.frame(labelDescription=c("R-specific phenoData",
                                       "G-specific phenoData",
                                       "Both channel phenoData"),
                           channel=as.factor(c("R", "G", "_ALL_")))
phenoData <- AnnotatedDataFrame(data=data, varMetadata=varMetadata)
obj <- NChannelSet(assayData=assayData, phenoData=phenoData)

## G channel as NChannelSet
selectChannels(obj, "G")

## G channel as ExpressionSet
channel(obj, "G")

## Samples "A" and "C"
obj[,c("A", "C")]
```

---

### Informational Messages

**Description**

Generates an informational message that corresponds to its argument(s). Similar to warning() except prefaced by "Note:" instead of "Warning message:"

**Usage**

```r
note(...)
```

**Arguments**

... character vectors (which are pasted together) or NULL
Details

This function essentially cat()'s the created string to the screen. It is intended for messages to the user that are deemed to be 'informational', as opposed to warnings, etc.

Author(s)

Jeff Gentry

See Also

warning, stop

Examples

note("This is an example of a note")

notes

Retrieve and set eSet notes.

Description

These generic functions access notes (unstructured descriptive data) associated eSet-class. 

notes(<ExpressionSet>) <- <character> is unusual, in that the character vector is appended to the list of notes; use notes(<ExpressionSet>) <- <list> to entirely replace the list.

Usage

notes(object)
notes(object) <- value

Arguments

object Object, possibly derived from class eSet-class.
value Character vector containing unstructured information describing the experiment.

Value

notes returns a list.

Author(s)

Biocore

See Also

ExpressionSet-class, SnpSet-class
openPDF

Open PDF Files in a Standard Viewer

Description
Displays the specified PDF file.

Usage
openPDF(file, bg=TRUE)

Arguments
-file A character string, indicating the file to view
-bg Should the pdf viewer be opened in the background.

Details
Currently this function works on Windows and Unix platforms. Under Windows, whatever program is associated with the file extension will be used. Under Unix, the function will use the program named in the option "pdfviewer" (see help(options) for information on how this is set.) The bg argument is only interpreted on Unix.

Value
This function is executed for its side effects. The specified PDF file is opened in the PDF viewer and TRUE is returned.

Author(s)
Jeff Gentry

Examples
---
## Not run: openPDF("annotate.pdf")

openVignette

Open a Vignette or Show Vignette Selection Menu

Description
Using the data returned by vignette this function provides a simple easy to use interface for opening vignettes.

Usage
openVignette(package=NULL)
package.version

Arguments

package character string indicating the package to be used.

Details

If package is NULL then all packages are scanned for vignettes. The list of vignettes is presented to the user via the menu command. The user may select one of the vignettes to be opened in a PDF viewer.

Value

No value is returned; this function is run entirely for the side effect of opening the pdf document in the PDF viewer.

Author(s)

R. Gentleman

See Also

vignette, openPDF, menu, getPkgVigs

Examples

if(interactive())
  openVignette("Biobase")

package.version

Report Version of a Package

Description

Will report the version number of a requested installed package

Usage

package.version(pkg, lib.loc = NULL)

Arguments

pkg The name of the package
lib.loc a character vector describing the location of R library trees to search through, or ‘NULL’. The default value of ‘NULL’ corresponds to all libraries currently known.

Details

This function is a convenience wrapper around package.description, and will report simply the version number of the requested package. If the package does not exist or if the DESCRIPTION file can not be read, then an error will be thrown.
**phenoData**

**Value**

A character string reporting the version number.

**Author(s)**

Jeff Gentry

**See Also**

`package.description`

**Examples**

```r
package.version("Biobase")
```

---

**Description**

These generic functions access the phenotypic data (e.g., covariates) and meta-data (e.g., descriptions of covariates) associated with an experiment.

**Usage**

```r
phenoData(object)
phenoData(object) <- value
varLabels(object)
varLabels(object) <- value
varMetadata(object)
varMetadata(object) <- value
pData(object)
pData(object) <- value
```

**Arguments**

- `object`: Object, possibly derived from `eSet-class` or `AnnotatedDataFrame`.
- `value`: Value to be assigned to corresponding object.

**Value**

`phenoData` returns an object containing information on both variable values and variable meta-data. `varLabels` returns a character vector of measured variables. `pData` returns a data frame with samples as rows, variables as columns. `varMetadata` returns a data frame with variable names as rows, description tags (e.g., unit of measurement) as columns.

**Author(s)**

Biocore
**protocolData**  
*Protocol Metadata*

**Description**
This generic function handles methods for adding and retrieving protocol metadata for the samples in eSets.

**Usage**

```r
protocolData(object)  
protocolData(object) <- value
```

**Arguments**

- `object`: Object derived from class eSet  
- `value`: Object of class AnnotatedDataFrame

**Value**

`protocolData(object)` returns an AnnotatedDataFrame containing the protocol metadata for the samples.

**Author(s)**
Biocore

**See Also**

- `eSet-class`, `ExpressionSet-class`, `SnpSet-class`

---

**read.AnnotatedDataFrame**

*Read and write 'AnnotatedDataFrame'*

**Description**
Create an instance of class AnnotatedDataFrame by reading a file, or save an AnnotatedDataFrame to a file.
**Usage**

```r
read.AnnotatedDataFrame(filename, path, 
    sep = "\t", header = TRUE, quote = "", stringsAsFactors = FALSE, 
    row.names = 1L, 
    varMetadata.char="#", 
    widget = getOption("BioC")$Base$use.widgets, 
    sampleNames = character(0), ...) 
write.AnnotatedDataFrame(x, file="", varMetadata.char="#", ..., 
    append=FALSE, fileEncoding="")
```

**Arguments**

- `filename, file`: file or connection from which to read / write.
- `x`: An instance of class `AnnotatedDataFrame`.
- `path` (optional): directory in which to find `filename`.
- `row.names`: this argument gets passed on to `read.table` and will be used for the row names of the phenoData slot.
- `varMetadata.char`: lines beginning with this character are used for the varMetadata slot. See examples.
- `sep, header, quote, stringsAsFactors, ...`: further arguments that get passed on to `read.table` or `write.table`.
- `widget`: logical. Currently this is not implemented, and setting this option to TRUE will result in an error. In a precursor of this function, `read.phenoData`, this option could be used to open an interactive GUI widget for entering the data.
- `sampleNames`: optional argument that could be used in conjunction with `widget`; do not use.
- `append, fileEncoding`: Arguments as described in `write.table`.

**Details**

The function `read.table` is used to read pData. The argument `varMetadata.char` is passed on to that function as its argument `comment.char`. Lines beginning with `varMetadata.char` are expected to contain further information on the column headers of pData. The format is of the form: 

```
# variable: textual explanation of the variable, units, measurement method, etc. (assuming that # is the value of varMetadata.char). See also examples.
```

`write.AnnotatedDataFrame` outputs `varLabels` and `varMetadata(x)$labelDescription` as commented header lines, and `pData(x)` as a with `write.table`.

**Value**

- `read.AnnotatedDataFrame`: An instance of class `AnnotatedDataFrame`
- `write.AnnotatedDataFrame`: `NULL`, invisibly.

**Author(s)**

Martin Morgan <mtmorgan@fhcrc.org> and Wolfgang Huber, based on `read.phenoData` by Rafael A. Irizarry.
See Also

AnnotatedDataFrame for additional methods, read.table for details of reading in phenotypic data

Examples

```r
exampleFile = system.file("extdata", "pData.txt", package="Biobase")

adf <- read.AnnotatedDataFrame(exampleFile)
head(pData(adf))
head(noquote(readLines(exampleFile)), 11)
write.AnnotatedDataFrame(adf)  # write to console by default
```

Description

Reads MIAME information from a file or using a widget.

Usage

```r
read.MIAME(filename = NULL, widget =getOption("BioC")$Base$use.widgets, ...)
```

Arguments

- **filename**  
  Filename from which to read MIAME information.
- **widget**  
  Logical. If TRUE and a filename is not given, a widget is used to enter information.
- **...**  
  Further arguments to scan.

Details

Notice that the MIAME class tries to cover the MIAME entries that are not covered by other classes in Bioconductor. Namely, experimental design, samples, hybridizations, normalization controls, and pre-processing information.

The function `scan` is used to read. The file must be a flat file with the different entries for the instance of MIAME class separated by carriage returns. The order should be: name, lab, contact, title, abstract, and url.

Alternatively a widget can be used.

Value

An object of class MIAME.

Author(s)

Rafael Irizarry <rafa@jhu.edu>
## Description

Create an instance of class `ExpressionSet` by reading data from files. ‘widget’ functionality is not implemented for `readExpressionSet`.

## Usage

```r
readExpressionSet(exprsFile, phenoDataFile, experimentDataFile, notesFile, path, annotation, 
## arguments to read.* methods 
exprsArgs=list(sep=sep, header=header, row.names=row.names, 
quote=quote, ...), 
phenoDataArgs=list(sep=sep, header=header, row.names=row.names, 
quote=quote, stringsAsFactors=stringsAsFactors, ...), 
experimentDataArgs=list(sep=sep, header=header, 
row.names=row.names, quote=quote, 
stringsAsFactors=stringsAsFactors, ...), 
sep = "\t", header = TRUE, quote = "\", stringsAsFactors = FALSE, row.names = 1L, 
## widget
widget = getOption("BioC")$Base$use.widgets, 
...)
```

## Arguments

- `exprsFile` (character): File or connection from which to read expression values. The file should contain a matrix with rows as features and columns as samples. `read.table` is called with this as its `file` argument and further arguments given by `exprsArgs`.
- `phenoDataFile` (character): File or connection from which to read phenotypic data. `read.AnnotatedDataFrame` is called with this as its `file` argument and further arguments given by `phenoDataArgs`.
- `experimentDataFile` (character): File or connection from which to read experiment data. `read.MIAME` is called with this as its `file` argument and further arguments given by `experimentDataArgs`.
- `notesFile` (character): File or connection from which to read notes; `readLines` is used to input the file.

## Examples

```r
miame <- read.MIAME(widget=FALSE)  ##creates an empty instance
show(miame)
```

### path
(Optional) directory in which to find all the above files.

### annotation
(character) A single character string indicating the annotation associated with this ExpressionSet.

### exprsArgs
A list of arguments to be used with `read.table` when reading in the expression matrix.

### phenoDataArgs
A list of arguments to be used (with `read.AnnotatedDataFrame`) when reading the phenotypic data.

### experimentDataArgs
A list of arguments to be used (with `read.MIAME`) when reading the experiment data.

### sep, header, quote, stringsAsFactors, row.names
Arguments used by the `read.table`-like functions.

### widget
A boolean value indicating whether widgets can be used. Widgets are NOT yet implemented for `read.AnnotatedDataFrame`.

### ...
Further arguments that can be passed on to the `read.table`-like functions.

### Details
Expression values are read using the `read.table` function. Phenotypic data are read using the `read.AnnotatedDataFrame` function. Experiment data are read using the `read.MIAME` function. Notes are read using the `readLines` function. The return value must be a valid `ExpressionSet`. Only the `exprsFile` argument is required.

### Value
An instance of the `ExpressionSet` class.

### Author(s)
Martin Morgan <mtmorgan@fhcrc.org>

### See Also
`ExpressionSet` for additional methods.

### Examples
```r
exprsFile = system.file("extdata", "exprsData.txt", package="Biobase")
phenoFile = system.file("extdata", "pData.txt", package="Biobase")

## Read ExpressionSet with appropriate parameters
obj = readExpressionSet(exprsFile, phenoFile, sep = "\t", header=TRUE)
obj
```
Description

The `reporter` object is a 500 by 1 data frame. The rows represent the 500 probe IDs in the `geneData` data. The values in `reporter` are the predefined probe types for the probes. `reporter` is used in conjunction with the `geneData` object and its associates.

Usage

data(reporter)

Format

A 500 by 1 data frame

Details

There are 10 predefined probe types:

- `AFFX-` Quality Control (QC)
- `_f_` SequenceFamily
- `_g_` CommonGroups
- `_s_` SimilarityConstraint
- `_r_` RulesDropped
- `_i_` Incomplete
- `_b_` AmbiguousProbeSet
- `_l_` LongProbeSet
- `_at` AntiSenseTarget
- `_st` SenseTarget

Source


Examples

data(reporter)
```r
## maybe str(reporter) ; plot(reporter) ...
```
reverseSplit

A function to reverse the role of names and values in a list.

Description

Given a list with names \( x \) and values in a set \( y \) this function returns a list with names in \( y \) and values in \( x \).

Usage

reverseSplit(inList)

Arguments

inList  
A named list with values that are vectors.

Details

First the list is unrolled to provide a two long vectors, names are repeated, once for each of their values. Then the names are split by the values.

This turns out to be useful for inverting mappings between one set of identifiers and another.

Value

A list with length equal to the number of distinct values in the input list and values from the names of the input list.

Author(s)

R. Gentleman

See Also

split

Examples

```r
l1 = list(a=1:4, b=c(2,3), d=c(4,5))
reverseSplit(l1)
```
rowMedians

Calculates the median for each row in a matrix

Description
Calculates the median for each row in a matrix.

Usage
rowMedians(x, na.rm=FALSE, ...)

Arguments
x A numeric NxF matrix.
na.rm If TRUE, NAs are excluded first, otherwise not.
... Not use.

Details
The implementation of rowMedians() is optimized for both speed and memory. To avoid coercing to doubles (and hence memory allocation), there is a special implementation for integer matrices. That is, if x is an integer matrix, then rowMedians(as.double(x)) would require three times the memory of rowMedians(x), but all this is avoided.

Value
Returns a numeric vector of length N.

Missing values
Missing values are excluded before calculating the medians.

Author(s)
Henrik Bengtsson

See Also
See rowMeans() in colSums().

Examples
set.seed(1)
x <- rnorm(n=234*543)
x[sample(1:length(x), size=0.1*length(x))] <- NA
dim(x) <- c(234,543)
y1 <- rowMedians(x, na.rm=TRUE)
y2 <- apply(x, MARGIN=1, FUN=median, na.rm=TRUE)
stopifnot(all.equal(y1, y2))

x <- cbind(x1=3, x2=c(4:1, 2:5))
stopifnot(all.equal(rowMeans(x), rowMedians(x)))
A function to compute empirical row quantiles.

Description

This function computes the requested quantile for each row of a matrix, or of an ExpressionSet.

Usage

rowQ(imat, which)
rowMax(imat)
rowMin(imat)

Arguments

imat Either a matrix or an ExpressionSet.
which An integer indicating which order statistic should be returned.

Details

rowMax and rowMin simply call rowQ with the appropriate argument set.

The argument which takes values between 1, for the minimum per row, and ncol(imat), for the maximum per row.

Value

A vector of length equal to the number of rows of the input matrix containing the requested quantiles.

Author(s)

R. Gentleman

See Also

rowMedians, rowMeans() in colSums().

Examples

data(sample.ExpressionSet)
rowMin(sample.ExpressionSet)
rowQ(sample.ExpressionSet, 4)
**ScalarObject-class**

Utility classes for length one (scalar) objects

**Description**

These classes represent scalar quantities, such as a string or a number and are useful because they provide their own validity checking. The classes ScalarCharacter, ScalarLogical, ScalarInteger, and ScalarNumeric all extend their respective base vector types and can be used interchangeably (except they should always have length one).

The mkScalar factory function provides a convenient way of creating Scalar<type> objects (see the examples section below).

**Usage**

```r
mkScalar(obj)
```

**Arguments**

- `obj` An object of type character, logical, integer, or double

**Author(s)**

Seth Falcon

**Examples**

```r
v <- list(mkScalar("a single string"),
          mkScalar(1),
          mkScalar(1L),
          mkScalar(TRUE))
sapply(v, class)
sapply(v, length)
```

---

**selectChannels**

Create a new NChannelSet instance by selecting specific channels

**Description**

This generic function extracts specific elements from an object, returning a instance of that object.

**Usage**

```r
selectChannels(object, names, ...)
```

**Arguments**

- `object` An S4 object, typically derived from class eSet
- `names` Character vector of named channels.
- `...` Additional arguments.
Value

Instance of class object.

Author(s)

Biocore

Examples

```r
obj <- NChannelSet(R=matrix(runif(100), 20, 5), G=matrix(runif(100), 20, 5))

## G channel as NChannelSet
selectChannels(obj, "G")
```

---

**selectSome**

*Extract elements of a vector for concise rendering*

**Description**

Extract the first and last several elements of a vector for concise rendering; insert ellipses to indicate elided elements. This function is primarily meant for developer rather than end-user use.

**Usage**

```r
selectSome(obj, maxToShow=5)
```

**Arguments**

- `obj` A vector.
- `maxToShow` The number of elements (including "...") to render.

**Details**

This function can be used in 'show' methods to give users exemplars of the tokens used in a vector. For example, an `ExpressionSet` built from a yeast experiment might have features enumerated using systematic gene names (e.g., YPR181C) or standard gene names (e.g., SEC23). The `show` method for `ExpressionSet` uses `selectSome` to alert the user to the tokens used, and thereby to indicate what vocabulary must be understood to work with the feature names.

**Value**

A string vector with at most `maxToShow` plus 1 elements, where an ellipsis ("...") is included to indicate incompleteness of the excerpt.

**Author(s)**

Martin Morgan <mtmorgan@fhcrc.org>

**Examples**

```r
selectSome(1:20)
```
snpCall

Get and retrieve SNP call and call probability data.

Description

These generic functions access the calls and call probabilities stored in objects.

Usage

snpCall(object, ...)  
snpCall(object, ...) <- value  
snpCallProbability(object, ...)  
snpCallProbability(object, ...) <- value

Arguments

object Object, possibly derived from class SnpSet.
value Matrix with rows representing SNP calls or call probabilities and columns samples.
... Additional arguments available to methods.

Value

snpCall returns a matrix of SNP calls; snpCallProbability returns the corresponding matrix of standard errors, when available.

Author(s)

Biocore

See Also

SnpSet-class

SnpSet

Class to Contain Objects Describing High-Throughput SNP Assays.

Description

Container for high-throughput assays and experimental metadata. SnpSet class is derived from eSet, and requires matrices call, callProbability as assay data members.

Extends

Directly extends class eSet.
Creating Objects

```r
new('SnpSet', phenoData = [AnnotatedDataFrame], experimentData = [MIAME], annotation = [character], protocolData = [AnnotatedDataFrame], call = [matrix], callProbability = [matrix], ...)
```

SnpSet instances are usually created through `new("SnpSet", ...)`. Usually the arguments to `new` include `call` (a matrix of genotypic calls, with features (SNPs) corresponding to rows and samples to columns), `phenoData`, `experimentData`, `annotation`, and `protocolData`. `phenoData`, `experimentData`, `annotation` and `protocolData` can be missing, in which case they are assigned default values.

Slots

Inherited from `eSet`:

- `assayData`: Contains matrices with equal dimensions, and with column number equal to `nrow(phenoData)`. `assayData` must contain a matrix `call` with rows representing features (e.g., SNPs) and columns representing samples, and a matrix `callProbability` describing the certainty of the call. The content of `call` and `callProbability` are not enforced by the class. Additional matrices of identical size may also be included in `assayData`. Class: `AssayData-class`

- `phenoData`: See `eSet`
- `experimentData`: See `eSet`
- `annotation`: See `eSet`
- `protocolData`: See `eSet`

Methods

Class-specific methods:

- `snpCall(SnpSet), snpCall(SnpSet,matrix)<-`: Access and set elements named `call` in the `AssayData` slot.
- `exprs(SnpSet), exprs(SnpSet,matrix)<-`: Synonym for `snpCall`.
- `snpCallProbability(SnpSet), snpCallProbability<-(SnpSet,matrix)<-`: Access and set elements named `callProbability` in the `AssayData` slot.

Derived from `eSet`:

- `updateObject(object, ..., verbose=FALSE)`: Update instance to current version, if necessary. See `updateObject` and `eSet`
- `isCurrent(object)`: Determine whether version of object is current. See `isCurrent`
- `isVersioned(object)`: Determine whether object contains a 'version' string describing its structure. See `isVersioned`
- `sampleNames(SnpSet) and sampleNames(SnpSet)<-`: See `eSet`
- `featureNames(SnpSet), FeatureNames(SnpSet, value)<-`: See `eSet`
- `dims(SnpSet): See eSet`
- `phenoData(SnpSet), phenoData(SnpSet,value)<-`: See `eSet`
- `varLabels(SnpSet), varLabels(SnpSet, value)<-`: See `eSet`
- `varMetadata(SnpSet), varMetadata(SnpSet,value)<-`: See `eSet`
- `pData(SnpSet), pData(SnpSet,value)<-`: See `eSet`
- `varMetadata(SnpSet), varMetadata(SnpSet,value)`: See `eSet`
storageMode

experimentData(SnpSet), experimentData(SnpSet, value) <- See eSet
pubMedIds(SnpSet), pubMedIds(SnpSet, value) See eSet
abstract(SnpSet): See eSet
annotation(SnpSet), annotation(SnpSet, value) <- See eSet
protocolData(SnpSet), protocolData(SnpSet, value) <- See eSet
combine(SnpSet, SnpSet): See eSet
storageMode(eSet), storageMode(eSet, character) <- See eSet

Standard generic methods:
initialize(SnpSet): Object instantiation, used by new; not to be called directly by the user.
validObject(SnpSet): Validity-checking method, ensuring that call and call1Probability is a
member of assayData. checkValidity(SnpSet) imposes this validity check, and the validity
checks of eSet.
show(SnpSet) See eSet
dim(SnpSet), ncol See eSet
SnpSet[(index): See eSet
SnpSet$, SnpSet$ <- See eSet

Author(s)

Martin Morgan, V.J. Carey, after initial design by R. Gentleman

See Also
eSet, ExpressionSet

storageMode
Retrieve or set storage mode for eSets.

Description
These generic functions report or change the storage mode used for assayData.

Usage

storageMode(object)
storageMode(object) <- value

Arguments

object Object, derived from class eSet
value Character vector containing "lockedEnvironment", "environment", or "list".
See AssayData-class for details.

Value

storageMode returns a length-1 character vector
strbreak

Author(s)

Biocore

See Also

AssayData-class, eSet-class ExpressionSet-class, SnpSet-class

Description

Inserts line breaks (collapse) into input character strings. The main intention of this function is to prepare long strings for printing, so the output is not wider than width.

Usage

strbreak(x, width=getOption("width"), exdent=2, collapse="\n")

Arguments

x a character vector
width a positive integer giving the width of the output.
exdent a positive integer specifying the indentation of subsequent lines after the first line.
collapse a character. This is inserted to break lines.

Author(s)

Wolfgang Huber http://www.ebi.ac.uk/huber

See Also

strwrap, substring

Examples

longString = paste(rep(LETTERS, 10), collapse="", sep="")
cat(strbreak(longString))
subListExtract

Extract the same element from the sublists of a list

Description
Given a list of lists, this function can be used to extract a named element from each sublist.

Usage

subListExtract(L, name, simplify = FALSE, keep.names = TRUE)

Arguments

L A list of named lists
name The name of the element in the sublists that should be extracted. This should be a length one character vector.
simplify When TRUE, the return value will be an atomic vector. If any extracted sublist value has length not equal to one and simplify=TRUE, an error will be raised. When FALSE, a list is returned containing the extracted elements.
keep.names If TRUE (default), the names of L will be attached to the returned vector.

Details
This function is implemented in C and is intended to be faster than calling lapply or sapply.

Value
If simplify=FALSE, a list will be returned having the same length as L, but with each element containing the element named name from the corresponding inner list of L.

When simplify=TRUE, an atomic vector will be returned containing the extracted elements. If any of the inner list elements do not have length one or cannot be put inside an atomic vector, an error will be raised.

Author(s)
Seth Falcon

Examples

list_size = 500000
innerL = list(foo="foo", bar="bar")
L = rep(list(innerL), list_size)

system.time({j0 = sapply(L, function(x) x$foo)})
system.time({j1 = subListExtract(L, "foo", simplify=TRUE)})
stopifnot(all.equal(j0, j1))

LS = L[1:3]
names(LS) = LETTERS[1:3]
subListExtract(LS, "bar", simplify=TRUE)
subListExtract(LS, "bar", simplify=FALSE)
subListExtract(LS, "bar", simplify=TRUE, keep.names=FALSE)
**testBioCConnection**  
*A function to check internet connectivity to Bioconductor*

**Description**

This function will attempt to determine if the user has internet connectivity to the Bioconductor website. This is useful in many situations dealing with code that uses automated downloads and other such things.

**Usage**

```r
testBioCConnection()
```

**Value**

TRUE if a connection is possible, FALSE if not.

**Author(s)**

Jeff Gentry

**Examples**

```r
z <- testBioCConnection()
```

---

**updateObjectTo**  
*Update an object to the class definition of a template*

**Description**

The `updateObjectTo` generic function returns an instance of `object` updated to the class definition of `template`. It requires that the class of the returned object be the same as the class of the `template` argument, and that the object is valid. Usually, updating proceeds by modifying slots in `template` with information from `object`, and returning `template`. Use `as` to coerce an object from one type to another; `updateObjectTo` might be useful to update a virtual superclass. By default, `updateObjectTo` has the following behavior:

```r
updateObjectTo(ANY-object,ANY-template) Attempt as(ANY-object,class(ANY-template)).
```

**Usage**

```r
updateObjectTo(object, template, ..., verbose=FALSE)
```

**Arguments**

- `object`  
  Object to be updated.
- `template`  
  Instance representing a template for updating `object`.
- `...`  
  Additional arguments, for use in specific update methods.
- `verbose`  
  A logical, indicating whether information about the update should be reported. Use `message` to report this.
updateOldESet

Value
updateObjectTo returns a valid instance of template.

Author(s)
Biocore team

See Also
updateObject, Versions-class

updateOldESet Update previously created eSet object to current eSet structure

Description
This function updates eSet objects created in previous versions of Biobase to the current class structure. Warnings indicate when coercions change how data in the from object are altered. If the from object was not a valid object of the original eSet class, then updateOldESet may fail.

Usage
updateOldESet(from, toClass, ...)

Arguments

from Object created using a previous version of the eSet class.
toClass Character string identifying new class, e.g., "ExpressionSet"
... Additional arguments passed to the initialization method for class toClass

Value
Valid object of class toClass.

Author(s)
Biocore

See Also
eSet-class, ExpressionSet-class, SnpSet-class

Examples
## Not run:
updateOldESet(oldESet, "ExpressionSet")

## End(Not run)
userQuery  

A function to query the user for input

Description

This function will output a given message and seek a response from the user, repeating the message until the input is from a valid set provided by the code.

Usage

```r
userQuery(msg, allowed = c("y", "n"), default = "n", case.sensitive = FALSE)
```

Arguments

- `msg`: The output message
- `allowed`: Allowed input from the user
- `default`: Default response if called in batch mode
- `case.sensitive`: Is the response case sensitive? Defaults to FALSE

Value

The input from the user

Author(s)

Jeff Gentry

validMsg  

Conditionally append result to validity message

Description

This function facilitates constructing messages during S4 class validation, and is meant for developer rather than end-user use.

Usage

```r
validMsg(msg, result)
```

Arguments

- `msg`: A character vector or NULL.
- `result`: Any vector.

Details

This function appends `result` to `msg`, but only if `result` is a character vector.
Versioned

Author(s)

Martin Morgan <mtmorgan@fhcrc.org>

Examples

```r
msg <- NULL
validMsg(msg, FALSE) # still NULL
msg <- validMsg(msg, "one")
validMsg(msg, "two")
```

Class "Versioned"

Description

Use this class as a ‘superclass’ for classes requiring information about versions.

Methods

The following are defined; package developers may write additional methods.

- `new("Versioned", ..., versions=list())` Create a new Versioned-class instance, perhaps with additional named version elements (the contents of versions) added. Named elements of versions are character strings that can be coerced using package_version, or package_version instances.

- `classVersion(object)` Obtain version information about instance object. See `classVersion`.

- `classVersion(object) <- value` Set version information on instance object to value; useful when object is an instance of a class that contains VersionClass. See `classVersion`.

- `classVersion(object)["id"] <- value` Create or update version information "id" on instance object to value; useful when object is an instance of a class that contains VersionClass. See `classVersion`.

- `show(object)` Default method returns invisible, to avoid printing confusing information when your own class does not have a show method defined. Use `classVersion(object)` to get or set version information.

Author(s)

Biocore

See Also

- `Versions-class`

Examples

```r
obj <- new("Versioned", versions=list(A="1.0.0"))
obj
classVersion(obj)
A <- setClass("A", contains="Versioned")
```
classVersion("A")
a <- A()
a # 'show' nothing by default
classVersion(a)

B <- setClass("B", contains="Versioned",
    prototype=prototype(new("Versioned", versions=list(B="1.0.0"))))

classVersion("B")
b <- B()
classVersion(b)

classVersion(b)["B"] <- "1.0.1"
classVersion(b)
classVersion("B")

classVersion("B") < classVersion(b)
classVersion(b) == "1.0.1"

C <- setClass("C",
    representation(x="numeric"),
    contains=("VersionedBiobase"),
    prototype=prototype(new("VersionedBiobase", versions=c(C="1.0.1"))))

setMethod("show", signature(object="C"),
    function(object) print(object@x))

c <- C(x=1:10)
c

classVersion(c)

---

**VersionedBiobase**

**Class** "VersionedBiobase"

**Description**

Use this class as a ‘superclass’ for classes requiring information about versions. By default, the class contains versions for R and Biobase. See Versioned-class for additional details.

**Methods**

set Versioned-class for methods.

**Author(s)**

Biocore

**See Also**

Versioned-class
**Examples**

```r
obj <- new("VersionedBiobase")
classVersion(obj)

obj <- new("VersionedBiobase", versions=list(A="1.0.0"))
classVersion(obj)

A <- setClass("A", contains="VersionedBiobase")
classVersion("A")
a <- A()
classVersion(a)

obj <- new("VersionedBiobase", versions=c(MyVersion="1.0.0"))
classVersion(obj)

B <- setClass("B", contains="VersionedBiobase",
               prototype=prototype(new("VersionedBiobase", versions=list(B="1.0.0"))))
classVersion("B")
b <- B()
classVersion(b)

removeClass("A")
removeClass("B")
```

---

### Description

A class to record version number information. This class is used to report versions; to add version information to your own class, use `Versioned-class`.

### Methods

The following are defined; package developers may write additional methods.

- `new("Versions", ...)` Create a new `Versions-class` instance, perhaps with named version elements (the contents of `...`) added. Named elements of versions are character strings that can be coerced using `package_version`, or `package_version` instances, `Versions-class` objects.
- `object["id"]` Obtain version information "id" from object.
- `object["id"] <- value` Create or update version information "id" on instance object.
- `object[["id"][]` Obtain version information "id" from object. The result is a list of integers, corresponding to entries in the version string.
- `object[["id"][] <- value` Create or update version information "id" on instance object.
- `object$id` Obtain version information "id" from object. The result is a list of integers, corresponding to entries in the version string.
object$id <- value Create or update version information "id" on instance object.
show(object) Display version information.
updateObject(object) Update object to the current Versions-class representation. Note that
this does not update another class that uses Versions-class to track the class version.
as(object, "character" ) Convert object to character representation, e.g., 1.0.0
object1 < object2 Compare object1 and object2 using version class information. Symbols in
addition to < are admissible; see ?ops

Author(s)
Biocore

See Also
classVersion isCurrent isVersioned

Examples

obj <- new("Versions", A="1.0.0")
obj

obj["A"] <- "1.0.1"
obj
obj["B"] <- "2.0"
obj

obj1 <- obj
obj1["B"] <- "2.0.1"

obj1 == obj
obj1["B"] > "2.0.0"
obj["B"] == "2.0"  # TRUE!

Description
A class used to represent the ‘version’ of unversioned objects. Useful primarily for method dispatch.

Methods
The following are defined; package developers may write additional methods.
new("VersionsNull", ...) Create a new VersionsNull-class instance, ignoring any addi-
tional arguments.
show(object) Display “No version”.

Author(s)
Biocore
VersionsNull

See Also

classVersion

Examples

```r
obj <- new("VersionsNull")
obj

obj <- new("VersionsNull", A="1.0.0") # warning
obj
```
Index

*Topic array
  cache, 12
  matchpt, 43
*Topic character
  strbreak, 70
*Topic classes
  aggregator, 6
  AnnotatedDataFrame, 7
  AssayData-class, 11
  class:characterORMIAME, 15
  container, 16
  eSet, 27
  ExpressionSet, 31
  MIAME, 44
  MIAxE, 45
  MultiSet, 47
  NChannelSet-class, 49
  ScalarObject-class, 65
  SnpSet, 67
  Versioned, 75
  VersionedBiobase, 76
  Versions, 77
  VersionsNull, 78
*Topic connection
  copySubstitute, 18
*Topic datasets
  data:aaMap, 22
  data:geneData, 23
  data:sample.ExpressionSet, 23
  data:sample.MultiSet, 24
  reporter, 61
*Topic data
  multiassign, 46
*Topic file
  read.AnnotatedDataFrame, 56
  read.MIAME, 58
  readExpressionSet, 59
*Topic interface
  addVigs2WinMenu, 4
*Topic iteration
  anyMissing, 10
*Topic logic
  anyMissing, 10
  isUnique, 38
*Topic manip
  abstract, 4
  assayData, 10
  cache, 12
  channel, 13
  channelNames, 14
  classVersion, 15
  contents, 17
  description, 24
  dims, 25
  exprs, 34
  featureData, 35
  featureNames, 36
  isCurrent, 37
  isUnique, 38
  isVersioned, 39
  lcSuffix, 40
  makeDataPackage, 42
  matchpt, 43
  notes, 52
  phenoData, 55
  protocolData, 56
  read.AnnotatedDataFrame, 56
  readExpressionSet, 59
  reverseSplit, 62
  rowMedians, 63
  selectChannels, 65
  snpCall, 67
  storageMode, 69
  subListExtract, 71
  updateObjectTo, 72
  updateOldESet, 73
*Topic methods
  Aggregate, 5
  aggregator, 6
  annotatedDataFrameFrom-methods, 9
  container, 16
  esApply, 26
*Topic models
  dumpPackTxt, 25
  esApply, 26
*Topic package
Biobase (Biobase-package), 3
Biobase-package, 3

INDEX

AssayData-class, 11
Biobase (Biobase-package), 3
Biobase-package, 3
cache, 12
channel, 13
channel,NChannelSet,character-method (NChannelSet-class), 49
cache
channelNames, NChannelSet-method (NChannelSet-class), 49
channelNames<-(channelNames), 14, 50
channelNames<-,NChannelSet,character-method (NChannelSet-class), 49
channelNames<-,NChannelSet,list-method (NChannelSet-class), 49
characterORMIAME-class
(class:characterORMIAME), 15
class,NChannelSet (NChannelSet-class), 49
class:aggregator, 6
class:aggregator (aggregator), 6
class:AnnotatedDataFrame (AnnotatedDataFrame), 7
class:characterORMIAME, 15, 45
class:container (container), 16
class:eSet (eSet), 27
class:ExpressionSet (ExpressionSet), 31
class:MIAME (MIAME), 44
class:MIAXE (MIAXE), 45
class:MultiSet (MultiSet), 47
class:SnpSet (SnpSet), 67
classVersion, 15, 50, 75, 78, 79
classVersion,ANY-method (classVersion), 15
classVersion,character-method (classVersion), 15
classVersion,Versioned-method (Versioned), 75
classVersion<-(classVersion), 15
classVersion<-,Versioned,Versions-method (Versioned), 75
classVersion<-,Versioned,Versions-method (Versioned), 75
classVersion<-(classVersion), 15

coe:ExpressionSet, data.frame-method (ExpressionSet), 31
coe:ExpressionSet, data.frame-method (ExpressionSet), 31
coe:ExpressionSet, data.frame-method (ExpressionSet), 31
coe:ExpressionSet, data.frame-method (ExpressionSet), 31

coe:ExpressionSet, data.frame-method (ExpressionSet), 31

coe, eSet, MultiSet-method (MultiSet), 47
coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

coe, exprSet, ExpressionSet-method (ExpressionSet), 31
coe, exprSet, ExpressionSet-method (ExpressionSet), 31

(AsayData-class), 11

data:aaMap, 22
data:geneCov (data:geneData), 23
data:geneCovariate (data:geneData), 23
data:geneData, 23
data:reporter (reporter), 61
data:sample.ExpressionSet, 23
data:sample.MultiSet, 24
data:seD (data:geneData), 23
description, 24
description, eSet-method (eSet), 27
description<-(description), 24
description<-, eSet, MIAME-method (eSet), 27
dim, AnnotatedDataFrame-method (AnnotatedDataFrame), 7
dim, eSet-method (eSet), 27
dimLabels (AnnotatedDataFrame), 7
dimLabels, AnnotatedDataFrame-method (AnnotatedDataFrame), 7
dimLabels<-(AnnotatedDataFrame), 7
dimLabels<-, AnnotatedDataFrame, character-method (AnnotatedDataFrame), 7
dimnames (eSet), 27
dimnames, AnnotatedDataFrame-method (AnnotatedDataFrame), 7
initialize, Versions-method (Versions), 77
initialize, VersionsNull-method (VersionsNull), 78
integer, 63
isCurrent, 8, 30, 33, 37, 45, 48, 68, 78
isCurrent, ANY, ANY-method (isCurrent), 37
isCurrent, MIAME, missing-method (MIAME), 44
isCurrent, Versioned, character-method (Versioned), 75
isCurrent, Versioned, missing-method (Versioned), 75
isUnique, 38
isVersioned, 8, 30, 33, 39, 45, 48, 68, 78
isVersioned, ANY-method (isVersioned), 39
isVersioned, character-method (isVersioned), 39
isVersioned, Versioned-method (Versioned), 75
lcPrefix (lcSuffix), 40
lcPrefixC (lcSuffix), 40
lcSuffix, 40
length, container-method (container), 16
listLen, 41
listOrEnv (eSet), 27
locked, container-method (container), 16
makeDataPackage, 33, 42
makeDataPackage, ANY-method (makeDataPackage), 42
makeDataPackage, ExpressionSet-method (ExpressionSet), 31
matchpt, 43
matrix, 9, 63
menu, 54
MIAME, 3, 15, 44, 50, 58, 59
MIAME-class (MIAME), 44
MIAxE, 3, 44, 45
MIAxE-class (MIAxE), 45
mkScalar (ScalarObject-class), 65
multiassign, 46
MultiSet, 3, 47
MultiSet-class (MultiSet), 47
NA, 63
NChannelSet (NChannelSet-class), 49
NChannelSet-class, 49
nchar, 40
ncol, AnnotatedDataFrame-method (AnnotatedDataFrame), 7
ncol, eSet-method (eSet), 27
new.env, 6
normControls, MIAME-method (MIAME), 44
note, 51
notes, 52
notes, eSet-method (eSet), 27
notes, MIAME-method (MIAME), 44
notes <- (notes), 52
notes <-, eSet, ANY-method (eSet), 27
notes <-, MIAME, character-method (MIAME), 44
notes <-, MIAME, list-method (MIAME), 44
numeric, 63
openPDF, 3, 53, 54
openVignette, 3, 37, 53
otherInfo, MIAME-method (MIAME), 44
package.description, 55
package.version, 3, 54
package_version, 75, 77
pData, 7
pData (phenoData), 55
pData, AnnotatedDataFrame-method (AnnotatedDataFrame), 7
pData, eSet-method (eSet), 27
pData <- (phenoData), 55
pData <-, AnnotatedDataFrame, data.frame-method (AnnotatedDataFrame), 7
pData <-, eSet, data.frame-method (eSet), 27
phenoData, 55
phenoData, eSet-method (eSet), 27
phenoData <- (phenoData), 55
phenoData <-, eSet, AnnotatedDataFrame-method (eSet), 27
preproc (MIAME), 44
preproc, eSet-method (eSet), 27
preproc, MIAME-method (MIAME), 44
preproc <- (MIAME), 44
preproc <-, eSet-method (eSet), 27
preproc <-, MIAME-method (MIAME), 44
protocolData, 56
protocolData, eSet-method (eSet), 27
protocolData <- (protocolData), 56
protocolData <-, eSet, AnnotatedDataFrame-method (protocolData), 56
protocolData <-, eSet, character-method (eSet), 27
pubMedIds (abstract), 4
pubMedIds, eSet-method (eSet), 27
pubMedIds, MIAME-method (MIAME), 44
pubMedIds <- (abstract), 4
INDEX

(eSet), 27
strbreak, 70
strwrap, 70
subListExtract, 71
substring, 70
SW (eSet), 27
sys.frame, 46
tail.AnnotatedDataFrame
  (AnnotatedDataFrame), 7
testBioCConnection, 72
tkMIAME, 59
TRUE, 10, 63
unique, 38
updateObject, 8, 29, 33, 45, 48, 50, 68, 73
updateObject, AnnotatedDataFrame-method
  (AnnotatedDataFrame), 7
updateObject, eSet-method (eSet), 27
updateObject, ExpressionSet-method
  (ExpressionSet), 31
updateObject, MIAME-method (MIAME), 44
updateObject, Versions-method
  (Versions), 77
updateObjectTo, 29, 72
updateObjectTo, ANY, ANY-method
  (updateObjectTo), 72
updateObjectTo, eSet, eSet-method (eSet), 27
updateOldESet, 30, 47, 73
userQuery, 74
validMsg, 74
varLabels (phenoData), 55
varLabels, AnnotatedDataFrame-method
  (AnnotatedDataFrame), 7
varLabels, eSet-method (eSet), 27
varLabels<-(phenoData), 55
varLabels<-, AnnotatedDataFrame-method
  (AnnotatedDataFrame), 7
varLabels<-, eSet-method (eSet), 27
varMetadata, 7
varMetadata (phenoData), 55
varMetadata, AnnotatedDataFrame-method
  (AnnotatedDataFrame), 7
varMetadata, eSet-method (eSet), 27
varMetadata<-(phenoData), 55
varMetadata<-, AnnotatedDataFrame, data.frame-method
  (AnnotatedDataFrame), 7
varMetadata<-, eSet, data.frame-method
  (eSet), 27
vector, 10, 63
Versioned, 3, 50, 75
Versioned-class (Versioned), 75
VersionedBiobase, 3, 50, 76
VersionedBiobase-class
  (VersionedBiobase), 76
Versions, 50, 77
Versions-class (Versions), 77
VersionsNull, 78
VersionsNull-class (VersionsNull), 78
vignette, 54
warning, 52
write.AnnotatedDataFrame
  (read.AnnotatedDataFrame), 56
write.exprs (ExpressionSet), 31
write.exprs, ExpressionSet-method
  (ExpressionSet), 31
write.table, 57
writeLines, 19