

Package ‘SeuratObject’

May 7, 2024

Type Package

Title Data Structures for Single Cell Data

Version 5.0.2

Description Defines S4 classes for single-cell genomic data and associated information, such as dimensionality reduction embeddings, nearest-neighbor graphs, and spatially-resolved coordinates. Provides data access methods and R-native hooks to ensure the Seurat object is familiar to other R users. See Satija R, Farrell J, Gennert D, et al (2015) <[doi:10.1038/nbt.3192](https://doi.org/10.1038/nbt.3192)>, Macosko E, Basu A, Satija R, et al (2015) <[doi:10.1016/j.cell.2015.05.002](https://doi.org/10.1016/j.cell.2015.05.002)>, and Stuart T, Butler A, et al (2019) <[doi:10.1016/j.cell.2019.05.031](https://doi.org/10.1016/j.cell.2019.05.031)>, Hao Y, Hao S, et al (2021) <[doi:10.1016/j.cell.2021.04.048](https://doi.org/10.1016/j.cell.2021.04.048)> and Hao Y, et al (2023) <[doi:10.1101/2022.02.24.481684](https://doi.org/10.1101/2022.02.24.481684)> for more details.

URL <https://satijalab.github.io/seurat-object/>,
<https://github.com/satijalab/seurat-object>

BugReports <https://github.com/satijalab/seurat-object/issues>

License MIT + file LICENSE

Encoding UTF-8

LazyData true

RoxygenNote 7.3.1

Additional_repositories <https://bnprks.r-universe.dev>

Depends R (>= 4.1.0),
sp (>= 1.5.0)

Imports future,
future.apply,
grDevices,
grid,
Matrix (>= 1.6.4),
methods,
progressr,
Rcpp (>= 1.0.5),
rlang (>= 0.4.7),
stats,
tools,
utils,

spam,
lifecycle,
generics

Suggests DelayedArray,

fs (\geq 1.5.2),
ggplot2,
HDF5Array,
rmarkdown,
testthat,
BPCells,
sf (\geq 1.0.0)

Collate 'RcppExports.R'

'zzz.R'
'generics.R'
'keymixin.R'
'graph.R'
'default.R'
'assay.R'
'logmap.R'
'layers.R'
'assay5.R'
'centroids.R'
'command.R'
'compliance.R'
'data.R'
'jackstraw.R'
'dimreduc.R'
'segmentation.R'
'molecules.R'
'spatial.R'
'fov.R'
'neighbor.R'
'seurat.R'
'sparse.R'
'utils.R'

LinkingTo Rcpp, RcppEigen**Enhances** Seurat**Config/Needs/website** pkgdown**R topics documented:**

SeuratObject-package	5
.DollarNames.SeuratCommand	6
AddMetaData	7
as.Centroids	8
as.Graph	8
as.list.SeuratCommand	9
as.matrix.LogMap	10
as.Neighbor	11
as.Seurat	11

as.sparse	12
Assay-class	12
Assay-validity	13
Assay5-class	14
Assay5-validity	15
AssayData	15
Assays	17
AttachDeps	18
Boundaries	18
CastAssay	19
Cells	20
CellsByIdentities	21
CellsByImage	22
Centroids-class	22
Centroids-methods	23
CheckGC	25
CheckLayersName	25
Command	26
CreateAssay5Object	26
CreateAssayObject	27
CreateCentroids	28
CreateDimReducObject	29
CreateFOV	30
CreateMolecules	31
CreateSegmentation	32
CreateSeuratObject	33
Crop	35
DefaultAssay	35
DefaultDimReduc	37
DefaultFOV	37
DefaultLayer	38
dim.Assay	39
dim.Assay5	39
dim.DimReduc	40
dim.Seurat	41
dimnames.Assay	42
dimnames.Assay5	43
dimnames.Seurat	43
DimReduc-class	44
DimReduc-validity	45
Distances	46
droplevels.LogMap	46
Embeddings	47
EmptyMatrix	48
FetchData	49
FilterObjects	50
FOV-class	50
FOV-methods	51
FOV-validity	53
GetImage	54
GetTissueCoordinates	55
Graph-class	55

HVFInfo	56
Idents	59
Images	61
Index	62
Indices	62
intersect.LogMap	63
IsGlobal	64
IsMatrixEmpty	64
IsNamedList	65
JackStrawData-class	66
JackStrawData-methods	66
JoinLayers	67
JS	68
Key	68
labels.LogMap	70
LayerData	71
Loadings	73
LogMap	74
LogMap-validity	75
LogSeuratCommand	76
merge.Assay	77
merge.Assay5	78
merge.DimReduc	78
merge.Seurat	79
Misc	80
Molecules-class	82
Molecules-methods	82
names.Seurat	83
Neighbor-class	84
Neighbor-methods	84
Overlay	85
PackageCheck	86
pbmc_small	86
print.DimReduc	87
Project	88
Radius	89
RandomName	89
RenameAssays	90
RenameCells	90
RowMergeSparseMatrices	92
SaveSeuratRds	92
Segmentation-class	94
Segmentation-methods	95
set-if-null	97
Seurat-class	98
Seurat-validity	98
SeuratCommand-class	99
show,LogMap-method	99
Simplify	100
SpatialImage-class	100
SpatialImage-methods	101
split.Assay	104

split.Assay5	104
Stdev	106
StitchMatrix	106
subset.Assay	107
subset.Assay5	108
subset.DimReduc	108
subset.Seurat	109
Theta	110
Tool	110
UpdateSeuratObject	112
UpdateSlots	112
Version	113
WhichCells	113
[.Assay	114
[.Assay5	115
[.DimReduc	116
[.SeuratCommand	117
[[.Assay	118
[[.Assay5	119
[[.DimReduc	120
[[.Seurat	121
[[<-,Seurat	122
[[<-,Seurat,NULL	123
\$.Assay	124
\$.Assay5	125
\$.Seurat	125
\$.SeuratCommand	127

Index**128**

SeuratObject-package *SeuratObject: Data Structures for Single Cell Data*

Description

Defines S4 classes for single-cell genomic data and associated information, such as dimensionality reduction embeddings, nearest-neighbor graphs, and spatially-resolved coordinates. Provides data access methods and R-native hooks to ensure the Seurat object is familiar to other R users. See Satija R, Farrell J, Gennert D, et al (2015) [doi:10.1038/nbt.3192](https://doi.org/10.1038/nbt.3192), Macosko E, Basu A, Satija R, et al (2015) [doi:10.1016/j.cell.2015.05.002](https://doi.org/10.1016/j.cell.2015.05.002), and Stuart T, Butler A, et al (2019) [doi:10.1016/j.cell.2019.05.031](https://doi.org/10.1016/j.cell.2019.05.031), Hao Y, Hao S, et al (2021) [doi:10.1016/j.cell.2021.04.048](https://doi.org/10.1016/j.cell.2021.04.048) and Hao Y, et al (2023) [doi:10.1101/2022.02.24.481684](https://doi.org/10.1101/2022.02.24.481684) for more details.

Author(s)

Maintainer: Rahul Satija <seurat@nygenome.org> ([ORCID](#))

Authors:

- Paul Hoffman <hoff0792@alumni.umn.edu> ([ORCID](#))
- David Collins <dcollins@nygenome.org> ([ORCID](#))
- Yuhan Hao <yhao@nygenome.org> ([ORCID](#))

- Austin Hartman <ahartman@nygenome.org> ([ORCID](#))
- Gesmira Molla <gmolla@nygenome.org> ([ORCID](#))
- Andrew Butler <abutler@nygenome.org> ([ORCID](#))
- Tim Stuart <tstuart@nygenome.org> ([ORCID](#))

Other contributors:

- Madeline Kowalski <mkowalski@nygenome.org> ([ORCID](#)) [contributor]
- Saket Choudhary <schoudhary@nygenome.org> ([ORCID](#)) [contributor]
- Skylar Li <sli@nygenome.org> [contributor]
- Longda Jiang <ljiang@nygenome.org> ([ORCID](#)) [contributor]
- Jeff Farrell <jfarrell@g.harvard.edu> [contributor]
- Shiwei Zheng <szheng@nygenome.org> ([ORCID](#)) [contributor]
- Christoph Hafemeister <chafemeister@nygenome.org> ([ORCID](#)) [contributor]
- Patrick Roelli <proelli@nygenome.org> [contributor]

See Also

Useful links:

- <https://satijalab.github.io/seurat-object/>
- <https://github.com/satijalab/seurat-object>
- Report bugs at <https://github.com/satijalab/seurat-object/issues>

.DollarNames.SeuratCommand

Dollar-sign Autocompletion

Description

Autocompletion for \$ access on a [SeuratCommand](#) object

Usage

```
## S3 method for class 'SeuratCommand'
.DollarNames(x, pattern = "")
```

Arguments

x	A SeuratCommand object
pattern	A regular expression. Only matching names are returned.

Value

The parameter name matches for pattern

See Also

Command log object and interaction methods [\\$.SeuratCommand\(\)](#), [LogSeuratCommand\(\)](#), [SeuratCommand-class](#), [\[.SeuratCommand\(\)](#), [as.list.SeuratCommand\(\)](#)

AddMetaData	<i>Add in metadata associated with either cells or features.</i>
-------------	--

Description

Adds additional data to the object. Can be any piece of information associated with a cell (examples include read depth, alignment rate, experimental batch, or subpopulation identity) or feature (ENSG name, variance). To add cell level information, add to the Seurat object. If adding feature-level metadata, add to the Assay object (e.g. `object[["RNA"]]`)

Usage

```
AddMetaData(object, metadata, col.name = NULL)
```

```
## S3 method for class 'Assay'  
AddMetaData(object, metadata, col.name = NULL)
```

```
## S3 method for class 'Assay5'  
AddMetaData(object, metadata, col.name = NULL)
```

```
## S3 method for class 'Seurat'  
AddMetaData(object, metadata, col.name = NULL)
```

Arguments

<code>object</code>	An object
<code>metadata</code>	A vector, list, or data.frame with metadata to add
<code>col.name</code>	A name for meta data if not a named list or data.frame

Value

object with metadata added

Examples

```
cluster_letters <- LETTERS[Idents(object = pbmc_small)]  
names(cluster_letters) <- colnames(x = pbmc_small)  
pbmc_small <- AddMetaData(  
  object = pbmc_small,  
  metadata = cluster_letters,  
  col.name = 'letter.idents'  
)  
head(x = pbmc_small[[[]]])
```

as.Centroids *Convert Segmentation Layers*

Description

Convert Segmentation Layers

Usage

```
as.Centroids(x, nsides = NULL, radius = NULL, theta = NULL, ...)
```

```
as.Segmentation(x, ...)
```

```
## S3 method for class 'Segmentation'
```

```
as.Centroids(x, nsides = NULL, radius = NULL, theta = NULL, ...)
```

```
## S3 method for class 'Centroids'
```

```
as.Segmentation(x, ...)
```

Arguments

x	An object
nsides	The number of sides to represent cells/spots; pass Inf to plot as circles
radius	Radius of shapes when plotting
theta	Angle to adjust shapes when plotting
...	Arguments passed to other methods

Value

as.Centroids: A [Centroids](#) object

as.Segmentation: A [Segmentation](#) object

as.Graph *Coerce to a Graph Object*

Description

Convert a [matrix](#) (or [Matrix](#)) to a [Graph](#) object

Usage

```
as.Graph(x, ...)
```

```
## S3 method for class 'Matrix'
```

```
as.Graph(x, ...)
```

```
## S3 method for class 'matrix'
```

```
as.Graph(x, ...)
```

```
## S3 method for class 'Neighbor'
```

```
as.Graph(x, weighted = TRUE, ...)
```


Arguments

x	The matrix to convert
...	Ignored
weighted	If TRUE, fill entries in Graph matrix with value from the nn.dist slot of the Neighbor object

Value

A [Graph](#) object

See Also

Other graph: [Graph-class](#)

Examples

```
# converting sparse matrix
mat <- Matrix::rsparsematrix(nrow = 10, ncol = 10, density = 0.1)
rownames(x = mat) <- paste0("feature_", 1:10)
colnames(x = mat) <- paste0("cell_", 1:10)
g <- as.Graph(x = mat)

# converting dense matrix
mat <- matrix(data = 1:16, nrow = 4)
rownames(x = mat) <- paste0("feature_", 1:4)
colnames(x = mat) <- paste0("cell_", 1:4)
g <- as.Graph(x = mat)
```

as.list.SeuratCommand *Coerce a SeuratCommand to a list*

Description

Coerce a SeuratCommand to a list

Usage

```
## S3 method for class 'SeuratCommand'
as.list(x, complete = FALSE, ...)
```

Arguments

x	A SeuratCommand object
complete	Include slots besides just parameters (eg. call string, name, timestamp)
...	Ignored

Value

A list with the parameters and, if complete = TRUE, the call string, name, and timestamp

See Also

Command log object and interaction methods [\\$.SeuratCommand\(\)](#), [.DollarNames.SeuratCommand\(\)](#), [LogSeuratCommand\(\)](#), [SeuratCommand-class](#), [\[.SeuratCommand\(\)](#)

Examples

```
cmd <- pbmc_small[["NormalizeData.RNA"]]
as.list(cmd)
as.list(cmd, complete = TRUE)
```

as.matrix.LogMap

Coerce Logical Maps to Matrices

Description

Coerce a logical map to a matrix; this removes all [logical map](#) class capabilities from the object and returns a base-R matrix object

Usage

```
## S3 method for class 'LogMap'
as.matrix(x, ...)
```

Arguments

x	A LogMap object
...	Ignored

Value

A base-R matrix created from x

See Also

Logical map objects, validity, and interaction methods: [LogMap](#), [LogMap-validity](#), [droplevels.LogMap\(\)](#), [intersect.LogMap\(\)](#), [labels.LogMap\(\)](#)

Examples

```
map <- LogMap(letters[1:10])
map[["obs"]] <- c(1, 3, 7)
mat <- as.matrix(map)
mat
class(mat)
```

as.Neighbor	<i>Coerce to a Neighbor Object</i>
-------------	------------------------------------

Description

Convert objects to [Neighbor](#) objects

Usage

```
as.Neighbor(x, ...)
```

```
## S3 method for class 'Graph'  
as.Neighbor(x, ...)
```

Arguments

x	An object to convert to Neighbor
...	Arguments passed to other methods

Value

A [Neighbor](#) object

as.Seurat	<i>Coerce to a Seurat Object</i>
-----------	----------------------------------

Description

Convert objects to Seurat objects

Usage

```
as.Seurat(x, ...)
```

Arguments

x	An object to convert to class Seurat
...	Arguments passed to other methods

Value

A [Seurat](#) object generated from x

as.sparse	<i>Cast to Sparse</i>
-----------	-----------------------

Description

Convert dense objects to sparse representations

Usage

```
as.sparse(x, ...)

## S3 method for class 'data.frame'
as.sparse(x, row.names = NULL, ...)

## S3 method for class 'Matrix'
as.sparse(x, ...)

## S3 method for class 'matrix'
as.sparse(x, ...)

## S3 method for class 'ngCMatrix'
as.sparse(x, ...)
```

Arguments

x	An object
...	Arguments passed to other methods
row.names	NULL or a character vector giving the row names for the data; missing values are not allowed

Value

A sparse representation of the input data

Assay-class	<i>The Assay Class</i>
-------------	------------------------

Description

The Assay object is the basic unit of Seurat; each Assay stores raw, normalized, and scaled data as well as cluster information, variable features, and any other assay-specific metadata. Assays should contain single cell expression data such as RNA-seq, protein, or imputed expression data.

Slots

`counts` Unnormalized data such as raw counts or TPMs
`data` Normalized expression data
`scale.data` Scaled expression data
`assay.orig` Original assay that this assay is based off of. Used to track assay provenance
`var.features` Vector of features exhibiting high variance across single cells
`meta.features` Feature-level metadata
`misc` A named list of unstructured miscellaneous data
`key` A one-length character vector with the object's key; keys must be one or more alphanumeric characters followed by an underscore “_” (regex pattern “`^[a-zA-Z][a-zA-Z0-9]*_$`”)

See Also

v3 Assay object, validity, and interaction methods: `$.Assay()`, `Assay-validity`, `CreateAssayObject()`, `[.Assay()`, `[[.Assay()`, `dim.Assay()`, `dimnames.Assay()`, `merge.Assay()`, `split.Assay()`, `subset.Assay()`

 Assay-validity

V3 Assay Validity

Description

Validation of Assay objects is handled by `validObject`

data Validation

blah

counts Validation

blah

scale.data Validation

blah

Feature-Level Meta Data Validation

blah

Variable Feature Validation

blah

Key Validation

Keys must be a one-length character vector; a key must be composed of one of the following:

- An empty string (eg. “' ’”) where `nchar() == 0`
- An string composed of one or more alphanumeric values (both lower- and upper-case) that ends with an underscore (“_”); the first character must be a letter

Keys that are not empty strings are validated with the regex “`^[a-zA-Z][a-zA-Z0-9]*_$`”

See Also

[validObject](#)

v3 Assay object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [CreateAssayObject\(\)](#), [\[.Assay\(\)](#), [\[\[.Assay\(\)](#), [dim.Assay\(\)](#), [dimnames.Assay\(\)](#), [merge.Assay\(\)](#), [split.Assay\(\)](#), [subset.Assay\(\)](#)

Examples

```
rna <- pbmc_small[["RNA"]]
validObject(rna)
```

Assay5-class

The v5 Assay Object

Description

The v5 Assay is the typical Assay class used in **Seurat** v5; ...

Slots

layers A named list containing expression matrices; each matrix should be a two-dimensional object containing some subset of cells and features defined in the **cells** and **features** slots. Cell and feature membership is recorded in the **cells** and **features** slots, respectively

cells A [logical mapping](#) of cell names and layer membership; this map contains all the possible cells that this assay can contain. New layers must have some subset of cells present in this map

features A [logical mapping](#) of feature names and layer membership; this map contains all the possible features that this assay can contain. New layers must have some subset of features present in this map

default A one-length integer with the end index of the [default layer](#); the default layer be all layers up to and including the layer at index **default**

assay.orig Original assay that this assay is based off of; used to track assay provenance

meta.data A [data frame](#) with feature-level meta data; should have the same number of rows as **features**

misc A named list of unstructured miscellaneous data

key A one-length character vector with the object's key; keys must be one or more alphanumeric characters followed by an underscore "_" (regex pattern "`^[a-zA-Z][a-zA-Z0-9]*_`")

See Also

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-validity](#), [\[.Assay5\(\)](#), [\[\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [merge.Assay5\(\)](#), [split.Assay5\(\)](#), [subset.Assay5\(\)](#)

Assay5-validity	V5 Assay Validity
-----------------	-------------------

Description

Validation of Assay5 objects is handled by [validObject](#)

Layer Validation

blah

Key Validation

Keys must be a one-length character vector; a key must be composed of one of the following:

- An empty string (eg. “' ’”) where `nchar() == 0`
- An string composed of one or more alphanumeric values (both lower- and upper-case) that ends with an underscore (“_”); the first character must be a letter

Keys that are not empty strings are validated with the regex “`^[a-zA-Z][a-zA-Z0-9]*_$`”

See Also

[validObject](#)

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-class](#), [\[.Assay5\(\)](#), [\[\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [merge.Assay5\(\)](#), [split.Assay5\(\)](#), [subset.Assay5\(\)](#)

AssayData	<i>Get and Set Assay Data</i>
-----------	-------------------------------

Description

General accessor and setter functions for [Assay](#) objects. `GetAssayData` can be used to pull information from any of the expression matrices (eg. “counts”, “data”, or “scale.data”). `SetAssayData` can be used to replace one of these expression matrices

Usage

```
GetAssayData(object, ...)
```

```
SetAssayData(object, layer, new.data, slot = deprecated(), ...)
```

```
## S3 method for class 'Seurat'
```

```
GetAssayData(object, assay = NULL, layer = NULL, slot = deprecated(), ...)
```

```
## S3 method for class 'Seurat'
```

```
SetAssayData(
  object,
  layer = "data",
  new.data,
```

```

    slot = deprecated(),
    assay = NULL,
    ...
)

## S3 method for class 'Assay'
GetAssayData(
  object,
  layer = c("data", "scale.data", "counts"),
  slot = deprecated(),
  ...
)

## S3 method for class 'Assay'
SetAssayData(
  object,
  layer = c("data", "scale.data", "counts"),
  new.data,
  slot = deprecated(),
  ...
)

```

Arguments

object	An object
...	Arguments passed to other methods
layer	Name of layer to get or set
new.data	New assay data to add
slot	[Deprecated] Specific assay data to get or set
assay	Specific assay to get data from or set data for; defaults to the default assay

Value

GetAssayData: returns the specified assay data
 SetAssayData: object with the assay data set

Lifecycle

[Superseded]

GetAssayData and SetAssayData have been superseded. To fetch expression matrices, use [LayerData](#); to set expression data, use [LayerData<-](#)

Examples

```

# Get assay data from the default assay in a Seurat object
GetAssayData(object = pbmc_small, layer = "data")[1:5,1:5]

# Set an Assay layer through the Seurat object
count.data <- GetAssayData(object = pbmc_small[["RNA"]], layer = "counts")
count.data <- as.matrix(x = count.data + 1)
new.seurat.object <- SetAssayData(
  object = pbmc_small,

```



```

    layer = "counts",
    new.data = count.data,
    assay = "RNA"
  )

# Get the data directly from an Assay object
GetAssayData(pbmc_small[["RNA"]], layer = "data")[1:5,1:5]

# Set an Assay layer directly
count.data <- GetAssayData(pbmc_small[["RNA"]], layer = "counts")
count.data <- as.matrix(x = count.data + 1)
new.assay <- SetAssayData(pbmc_small[["RNA"]], layer = "counts", new.data = count.data)

```

Assays

Query Specific Object Types

Description

List the names of [Assay](#), [DimReduc](#), [Graph](#), [Neighbor](#) objects

Usage

```

Assays(object, ...)

Graphs(object, slot = NULL)

Neighbors(object, slot = NULL)

Reductions(object, slot = NULL)

## S3 method for class 'Seurat'
Assays(object, slot = deprecated(), ...)

```

Arguments

object	A Seurat object
...	Ignored
slot	Name of component object to return

Value

If `slot` is `NULL`, the names of all component objects in this `Seurat` object. Otherwise, the specific object specified

Examples

```

Assays(pbmc_small)

Graphs(pbmc_small)

Reductions(object = pbmc_small)

```

AttachDeps

Attach Required Packages

Description

Helper function to attach required packages. Detects if a package is already attached and if so, skips it. Should be called in `.onAttach`

Usage

```
AttachDeps(deps)
```

Arguments

deps A character vector of packages to attach

Value

Invisibly returns NULL

Lifecycle

[Superseded]

AttachDeps has been superseded as of **SeuratObject** v5.0.0; as an alternative, list dependencies in the Depends section of DESCRIPTION

Examples

```
# Use in your .onAttach hook
if (FALSE) {
  .onAttach <- function(libname, pkgname) {
    AttachDeps(c("SeuratObject", "rlang"))
  }
}
```

Boundaries

Get, Set, and Query Segmentation Boundaries

Description

Get, Set, and Query Segmentation Boundaries

Usage

```

Boundaries(object, ...)

DefaultBoundary(object)

DefaultBoundary(object, ...) <- value

Molecules(object, ...)

## S3 method for class 'FOV'
Boundaries(object, ...)

## S3 method for class 'FOV'
DefaultBoundary(object)

## S3 replacement method for class 'FOV'
DefaultBoundary(object, ...) <- value

## S3 method for class 'FOV'
Molecules(object, ...)

```

Arguments

object	An object
...	Arguments passed to other methods
value	The name of a segmentation boundary to set as default

Value

Boundaries: The names of all segmentation boundaries present within object

DefaultBoundary: The name of the default segmentation boundary

DefaultBoundary<-: object with the default segmentation boundary set to value

Molecules: The names of all molecule sets present within object

CastAssay

Cast Assay Layers

Description

Cast layers in v5 assays to other classes

Usage

```

CastAssay(object, to, ...)

## S3 method for class 'Assay5'
CastAssay(object, to, layers = NA, verbose = TRUE, ...)

```

Arguments

object	An object
to	Either a class name or a function that takes a layer and returns the same layer as a new class
...	If to is a function, arguments passed to to
layers	A vector of layers to cast; defaults to all layers
verbose	Show progress updates

Value

object with the layers cast to class specified by to

Cells

Cell and Feature Names

Description

Get the cell and feature names of an object

Usage

```
Cells(x, ...)
```

```
Features(x, ...)
```

```
## Default S3 method:
```

```
Cells(x, ...)
```

```
## S3 method for class 'Assay5'
```

```
Cells(x, layer = NULL, simplify = TRUE, ...)
```

```
## S3 method for class 'Assay5'
```

```
Features(x, layer = NULL, simplify = TRUE, ...)
```

```
## S3 method for class 'DimReduc'
```

```
Cells(x, ...)
```

```
## S3 method for class 'Neighbor'
```

```
Cells(x, ...)
```

Arguments

x	An object
...	Arguments passed to other methods
layer	Layer to pull cells/features for; defaults to default layer; if NA, returns all cells for the assay
simplify	Simplify the cell/feature names into a single vector; if FALSE, separates each cell/feature names by layer

Value

Cell: A vector of cell names

Features: A vector of feature names

See Also

[dimnames.Assay\(\)](#), [dimnames.Assay5\(\)](#), [dimnames.Seurat\(\)](#)

Examples

```
Cells(x = pbmc_small)
```

CellsByIdentities	<i>Get cell names grouped by identity class</i>
-------------------	---

Description

Get cell names grouped by identity class

Usage

```
CellsByIdentities(object, idents = NULL, cells = NULL, return.null = FALSE)
```

Arguments

object	A Seurat object
idents	A vector of identity class levels to limit resulting list to; defaults to all identity class levels
cells	A vector of cells to grouping to
return.null	If no cells are requested, return a NULL; by default, throws an error

Value

A named list where names are identity classes and values are vectors of cells belonging to that class

Examples

```
CellsByIdentities(object = pbmc_small)
```

CellsByImage	<i>Get a vector of cell names associated with an image (or set of images)</i>
--------------	---

Description

Get a vector of cell names associated with an image (or set of images)

Usage

```
CellsByImage(object, images = NULL, unlist = FALSE)
```

Arguments

object	Seurat object
images	Vector of image names
unlist	Return as a single vector of cell names as opposed to a list, named by image name.

Value

A vector of cell names

Examples

```
## Not run:
CellsByImage(object = object, images = "slice1")

## End(Not run)
```

Centroids-class	<i>The Centroids Class</i>
-----------------	----------------------------

Description

The Centroids Class

Slots

cells ([character \[n\]](#)) A vector of cell names; there should be as many cell names as there are points and no duplicate names

nsides ([integer \[1L\]](#)) The number of sides to draw when plotting centroids; must be either 0L for circles or greater than 3

radius ([numeric \[1L\]](#)) The radius of the shape when plotting the centroids

theta ([numeric \[1L\]](#)) The angle in degrees to adjust the shape when plotting the centroids

See Also

Centroids methods: [Centroids-methods](#)

Segmentation layer classes: [Centroids-methods](#), [Molecules-class](#), [Molecules-methods](#), [Segmentation-class](#), [Segmentation-methods](#)

Centroids-methods	Centroids <i>Methods</i>
-------------------	--------------------------

Description

Methods for [Centroids](#) objects

Usage

```
## S3 method for class 'Centroids'  
Cells(x, ...)  
  
## S3 method for class 'Centroids'  
GetTissueCoordinates(object, full = TRUE, ...)  
  
## S3 method for class 'Centroids'  
Radius(object, ...)  
  
## S3 method for class 'Centroids'  
RenameCells(object, new.names = NULL, ...)  
  
## S3 method for class 'Centroids'  
Theta(object)  
  
## S3 method for class 'Centroids'  
is.finite(x)  
  
## S3 method for class 'Centroids'  
is.infinite(...)  
  
## S3 method for class 'Centroids'  
length(x)  
  
## S3 method for class 'Centroids'  
lengths(x, use.names = TRUE)  
  
## S3 method for class 'Centroids'  
subset(x, cells = NULL, ...)  
  
## S4 method for signature 'Centroids,character,ANY,ANY'  
x[i, j, ..., drop = TRUE]  
  
## S4 method for signature 'Centroids,numeric,ANY,ANY'  
x[i, j, ..., drop = TRUE]  
  
## S4 method for signature 'Centroids'  
show(object)
```

Arguments

x, object A [Centroids](#) object

...	Arguments passed to other methods
full	Expand the coordinates to the full polygon
new.names	vector of new cell names
use.names	Ignored
i, cells	A vector of cells to keep; if NULL, defaults to all cells
j, drop	Ignored

Details

GetTissueCoordinates: Get cell spatial coordinates

Radius: Get the centroid radius

RenameCells: Update cell names

Theta: Get the offset angle

is.finite, is.infinite: Test to see if the centroids are circular or polygonal

length: Get the number of sides for the polygonal centroid

lengths: Generate a run-length encoding of the cells present

subset, [: Subset a Centroids object to certain cells

show: Display an object summary to stdout

Value

GetTissueCoordinates: A data frame with three columns:

- “x”: the x-coordinate
- “y”: the y-coordinate
- “cell”: the cell name

If full is TRUE, then each coordinate will indicate a vertex for the cell polygon; otherwise, each coordinate will indicate a centroid for the cell

Radius: The radius of the centroids

RenameCells: object with the cells renamed to new.names

Theta: The offset angle in degrees

is.finite: TRUE if the centroids are polygonal, FALSE if circular

is.infinite: The opposite of is.finite

length: 0 if the centroids are circular, otherwise the number of sides of the polygonal centroid

lengths: An [rle](#) object for the cells

subset, [: x subsetted to the cells specified by cells/i

show: Invisibly returns NULL

See Also

[Centroids-class](#)

Segmentation layer classes: [Centroids-class](#), [Molecules-class](#), [Molecules-methods](#), [Segmentation-class](#), [Segmentation-methods](#)

CheckGC	<i>Conditional Garbage Collection</i>
---------	---------------------------------------

Description

Call gc only when desired

Usage

```
CheckGC(option = "SeuratObject.memsafe")
```

Arguments

option ...

Value

Invisibly returns NULL

CheckLayersName	<i>Check layers names for the input list</i>
-----------------	--

Description

Check layers names for the input list

Usage

```
CheckLayersName(matrix.list, layers.type = c("counts", "data"))
```

Arguments

matrix.list A list of matrices
layers.type layers type, such as counts or data

Command	<i>Get SeuratCommands</i>
---------	---------------------------

Description

Pull information on previously run commands in the Seurat object.

Usage

```
Command(object, ...)
```

```
## S3 method for class 'Seurat'
```

```
Command(object, command = NULL, value = NULL, ...)
```

Arguments

object	An object
...	Arguments passed to other methods
command	Name of the command to pull, pass NULL to get the names of all commands run
value	Name of the parameter to pull the value for

Value

Either a SeuratCommand object or the requested parameter value

CreateAssay5Object	<i>Create a v5 Assay object</i>
--------------------	---------------------------------

Description

Create an [Assay5](#) object from a feature expression matrix; the expected format of the matrix is features x cells

Usage

```
CreateAssay5Object(
  counts = NULL,
  data = NULL,
  min.cells = 0,
  min.features = 0,
  csum = NULL,
  fsum = NULL,
  ...
)
```

Arguments

counts	A two-dimensional expression matrix
data	Optional prenormalized data matrix
min.cells	Include features detected in at least this many cells; will subset the counts matrix as well. To reintroduce excluded features, create a new object with a lower cutoff
min.features	Include cells where at least this many features are detected
csum	Function for calculating cell sums
fsum	Function for calculating feature sums
...	Arguments passed to other methods

Value

An [Assay5](#) object

CreateAssayObject	<i>Create an Assay object</i>
-------------------	-------------------------------

Description

Create an Assay object from a feature (e.g. gene) expression matrix. The expected format of the input matrix is features x cells.

Usage

```
CreateAssayObject(
  counts,
  data,
  min.cells = 0,
  min.features = 0,
  key = NULL,
  check.matrix = FALSE,
  ...
)
```

Arguments

counts	Unnormalized data such as raw counts or TPMs
data	Prenormalized data; if provided, do not pass counts
min.cells	Include features detected in at least this many cells. Will subset the counts matrix as well. To reintroduce excluded features, create a new object with a lower cutoff
min.features	Include cells where at least this many features are detected
key	Optional key to initialize assay with
check.matrix	Check counts matrix for NA, NaN, Inf, and non-integer values
...	Arguments passed to as.sparse

Details

Non-unique cell or feature names are not allowed. Please make unique before calling this function.

Value

A [Assay](#) object

See Also

v3 Assay object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [Assay-validity](#), [\[.Assay\(\)](#), [\[\[.Assay\(\)](#), [dim.Assay\(\)](#), [dimnames.Assay\(\)](#), [merge.Assay\(\)](#), [split.Assay\(\)](#), [subset.Assay\(\)](#)

Examples

```
## Not run:
pbmc_raw <- read.table(
  file = system.file('extdata', 'pbmc_raw.txt', package = 'Seurat'),
  as.is = TRUE
)
pbmc_rna <- CreateAssayObject(counts = pbmc_raw)
pbmc_rna

## End(Not run)
```

CreateCentroids

Create a [Centroids](#) Objects

Description

Create a [Centroids](#) Objects

Usage

```
CreateCentroids(coords, nsides, radius, theta)
```

Arguments

coords	The coordinates of cell/spot centroids
nsides	The number of sides to represent cells/spots; pass Inf to plot as circles
radius	Radius of shapes when plotting
theta	Angle to adjust shapes when plotting

Value

A [Centroids](#) object

CreateDimReducObject *Create a DimReduc object*

Description

Create a DimReduc object

Usage

```
CreateDimReducObject(  
  embeddings = new(Class = "matrix"),  
  loadings = new(Class = "matrix"),  
  projected = new(Class = "matrix"),  
  assay = NULL,  
  stdev = numeric(),  
  key = NULL,  
  global = FALSE,  
  jackstraw = NULL,  
  misc = list()  
)
```

Arguments

embeddings	A matrix with the cell embeddings
loadings	A matrix with the feature loadings
projected	A matrix with the projected feature loadings
assay	Assay used to calculate this dimensional reduction
stdev	Standard deviation (if applicable) for the dimensional reduction
key	A character string to facilitate looking up features from a specific DimReduc
global	Specify this as a global reduction (useful for visualizations)
jackstraw	Results from the JackStraw function
misc	list for the user to store any additional information associated with the dimensional reduction

Value

A [DimReduc](#) object

See Also

Dimensional reduction object, validity, and interaction methods [DimReduc-class](#), [DimReduc-validity](#), [\[.DimReduc\(\)](#), [\[\[.DimReduc\(\)](#), [dim.DimReduc\(\)](#), [merge.DimReduc\(\)](#), [print.DimReduc\(\)](#), [subset.DimReduc\(\)](#)

Examples

```

data <- GetAssayData(pbmc_small[["RNA"]], slot = "scale.data")
pcs <- prcomp(x = data)
pca.dr <- CreateDimReducObject(
  embeddings = pcs$rotation,
  loadings = pcs$x,
  stdev = pcs$sdev,
  key = "PC",
  assay = "RNA"
)

```

CreateFOV

Create Spatial Coordinates

Description

Create Spatial Coordinates

Usage

```
CreateFOV(coords, ...)
```

```
## S3 method for class 'Centroids'
```

```

CreateFOV(
  coords,
  molecules = NULL,
  assay = "Spatial",
  key = NULL,
  name = NULL,
  ...
)

```

```
## S3 method for class 'data.frame'
```

```

CreateFOV(
  coords,
  type = c("segmentation", "centroids"),
  nsides = Inf,
  radius = NULL,
  theta = 0L,
  molecules = NULL,
  assay = "Spatial",
  key = NULL,
  name = NULL,
  ...
)

```

```
## S3 method for class 'list'
```

```
CreateFOV(coords, molecules = NULL, assay = "Spatial", key = NULL, ...)
```

```
## S3 method for class 'Segmentation'
```

```

CreateFOV(
  coords,
  molecules = NULL,
  assay = "Spatial",
  key = NULL,
  name = NULL,
  ...
)

```

Arguments

coords	Spatial coordinates
...	Arguments passed to other methods
molecules	A data.frame with spatially-resolved molecule information or a Molecules object
assay	Name of associated assay
key	Key for these spatial coordinates
name	When coords is a data.frame , Centroids , or Segmentation , name to store coordinates as
type	When providing a data.frame , specify if the coordinates represent a cell segmentation or voxel centroids
nsides	The number of sides to represent cells/spots; pass Inf to plot as circles
radius	Radius of shapes when plotting
theta	Angle to adjust shapes when plotting

Value

A [FOV](#) object

See Also

[FOV-class](#)

CreateMolecules	<i>Create a Molecules Object</i>
-----------------	--

Description

Create a [Molecules](#) Object

Usage

```

CreateMolecules(coords, ...)

## S3 method for class 'data.frame'
CreateMolecules(coords, key = "", ...)

## S3 method for class 'Molecules'
CreateMolecules(coords, ...)

## S3 method for class '`NULL`'
CreateMolecules(coords, ...)

```

Arguments

coords	Spatial coordinates for molecules; should be a data frame with three columns: <ul style="list-style-type: none">• “x”: x-coordinates for each molecule• “y”: y-coordinates for each molecule• “gene”: gene name for each molecule
...	Arguments passed to other methods
key	A key to set for the molecules

Value

A [Molecules](#) object

CreateSegmentation *Create a [Segmentation](#) Objects*

Description

Create a [Segmentation](#) Objects

Usage

```
CreateSegmentation(coords)

## S3 method for class 'data.frame'
CreateSegmentation(coords)

## S3 method for class 'Segmentation'
CreateSegmentation(coords)
```

Arguments

coords	The coordinates of cell segmentations
--------	---------------------------------------

Value

A [Segmentation](#) object

CreateSeuratObject *Create a Seurat object*

Description

Create a Seurat object from raw data

Usage

```
CreateSeuratObject(  
  counts,  
  assay = "RNA",  
  names.field = 1,  
  names.delim = "_",  
  meta.data = NULL,  
  project = "CreateSeuratObject",  
  ...  
)  
  
## Default S3 method:  
CreateSeuratObject(  
  counts,  
  assay = "RNA",  
  names.field = 1L,  
  names.delim = "_",  
  meta.data = NULL,  
  project = "SeuratProject",  
  min.cells = 0,  
  min.features = 0,  
  ...  
)  
  
## S3 method for class 'Assay'  
CreateSeuratObject(  
  counts,  
  assay = "RNA",  
  names.field = 1L,  
  names.delim = "_",  
  meta.data = NULL,  
  project = "SeuratProject",  
  ...  
)  
  
## S3 method for class 'Assay5'  
CreateSeuratObject(  
  counts,  
  assay = "RNA",  
  names.field = 1L,  
  names.delim = "_",  
  meta.data = NULL,  
  project = "SeuratProject",
```

```
    ...
  )
```

Arguments

counts	Either a matrix -like object with unnormalized data with cells as columns and features as rows or an Assay -derived object
assay	Name of the initial assay
names.field	For the initial identity class for each cell, choose this field from the cell's name. E.g. If your cells are named as BARCODE_CLUSTER_CELLTYPE in the input matrix, set <code>names.field</code> to 3 to set the initial identities to CELLTYPE.
names.delim	For the initial identity class for each cell, choose this delimiter from the cell's column name. E.g. If your cells are named as BARCODE-CLUSTER-CELLTYPE, set this to "-" to separate the cell name into its component parts for picking the relevant field.
meta.data	Additional cell-level metadata to add to the Seurat object. Should be a data.frame where the rows are cell names and the columns are additional metadata fields. Row names in the metadata need to match the column names of the counts matrix.
project	Project name for the Seurat object
...	Arguments passed to other methods
min.cells	Include features detected in at least this many cells. Will subset the counts matrix as well. To reintroduce excluded features, create a new object with a lower cutoff
min.features	Include cells where at least this many features are detected

Value

A [Seurat](#) object

Note

In previous versions (<3.0), this function also accepted a parameter to set the expression threshold for a 'detected' feature (gene). This functionality has been removed to simplify the initialization process/assumptions. If you would still like to impose this threshold for your particular dataset, simply filter the input expression matrix before calling this function.

Examples

```
## Not run:
pbmc_raw <- read.table(
  file = system.file('extdata', 'pbmc_raw.txt', package = 'Seurat'),
  as.is = TRUE
)
pbmc_small <- CreateSeuratObject(counts = pbmc_raw)
pbmc_small

## End(Not run)
```

Crop	<i>Crop Coordinates</i>
------	-------------------------

Description

Crop Coordinates

Usage

```
Crop(object, x = NULL, y = NULL, coords = c("plot", "tissue"), ...)
```

```
## S3 method for class 'FOV'
```

```
Crop(object, x = NULL, y = NULL, coords = c("plot", "tissue"), ...)
```

Arguments

object	An object
x, y	Range to crop x/y limits to; if NULL, uses full range of x/y
coords	Coordinate system to execute crop; choose from: <ul style="list-style-type: none"> • “plot”: Coordinates as shown when plotting • “tissue”: Coordinates from GetTissueCoordinates
...	Arguments passed to other methods

Value

object cropped to the region specified by x and y

DefaultAssay	<i>Default Assay</i>
--------------	----------------------

Description

Get and set the default assay

Usage

```
DefaultAssay(object, ...)
```

```
DefaultAssay(object, ...) <- value
```

```
## S3 method for class 'Graph'
```

```
DefaultAssay(object, ...)
```

```
## S3 replacement method for class 'Graph'
```

```
DefaultAssay(object, ...) <- value
```

```
## S3 method for class 'Assay'
```

```
DefaultAssay(object, ...)
```

```

## S3 replacement method for class 'Assay'
DefaultAssay(object, ...) <- value

## S3 method for class 'Assay5'
DefaultAssay(object, ...)

## S3 replacement method for class 'Assay5'
DefaultAssay(object, ...) <- value

## S3 method for class 'SeuratCommand'
DefaultAssay(object, ...)

## S3 method for class 'DimReduc'
DefaultAssay(object, ...)

## S3 replacement method for class 'DimReduc'
DefaultAssay(object, ...) <- value

## S3 method for class 'Seurat'
DefaultAssay(object, ...)

## S3 replacement method for class 'Seurat'
DefaultAssay(object, ...) <- value

```

Arguments

object	An object
...	Arguments passed to other methods
value	Name of assay to set as default

Value

DefaultAssay: The name of the default assay

DefaultAssay<-: An object with the default assay updated

Examples

```

# Get current default assay
DefaultAssay(object = pbmc_small)

# Create dummy new assay to demo switching default assays
new.assay <- pbmc_small[["RNA"]]
Key(object = new.assay) <- "RNA2_"
pbmc_small[["RNA2"]] <- new.assay
# switch default assay to RNA2
DefaultAssay(object = pbmc_small) <- "RNA2"
DefaultAssay(object = pbmc_small)

```

DefaultDimReduc	<i>Find the default DimReduc</i>
-----------------	----------------------------------

Description

Searches for `DimReducs` matching “umap”, “tsne”, or “pca”, case-insensitive, and in that order. Priority given to `DimReducs` matching the `DefaultAssay` or assay specified (eg. “pca” for the default assay weights higher than “umap” for a non-default assay)

Usage

```
DefaultDimReduc(object, assay = NULL)
```

Arguments

object	A Seurat object
assay	Name of assay to use; defaults to the default assay of the object

Value

The default `DimReduc`, if possible

Examples

```
DefaultDimReduc(pbmc_small)
```

DefaultFOV	<i>Get and Set the Default FOV</i>
------------	------------------------------------

Description

Get and Set the Default FOV

Usage

```
DefaultFOV(object, ...)

DefaultFOV(object, ...) <- value

## S3 method for class 'Seurat'
DefaultFOV(object, assay = NULL, ...)

## S3 replacement method for class 'Seurat'
DefaultFOV(object, assay = NA, ...) <- value
```

Arguments

object	A Seurat Object
...	Arguments passed to other methods
value	The name of the FOV to set as the default
assay	Name of assay to get or set default FOV for; pass NA to get or set the global default FOV

Value

DefaultFOV: The name of the default [FOV](#)

DefaultFOV<-: object with the default [FOV](#) set to value

DefaultLayer	<i>Default Layer</i>
--------------	----------------------

Description

Get and set the default layer

Usage

```
DefaultLayer(object, ...)

DefaultLayer(object, ...) <- value

## S3 method for class 'Assay'
DefaultLayer(object, ...)

## S3 method for class 'Assay5'
DefaultLayer(object, ...)

## S3 replacement method for class 'Assay5'
DefaultLayer(object, ...) <- value
```

Arguments

object	An object
...	Arguments passed to other methods
value	Name of layer to set as default

Value

DefaultLayer: The name of the default layer

DefaultLayer<-: An object with the default layer updated

dim.Assay	<i>Feature and Cell Numbers</i>
-----------	---------------------------------

Description

Feature and Cell Numbers

Usage

```
## S3 method for class 'Assay'
dim(x)
```

Arguments

x An *Assay* object

Value

A two-length numeric vector with the total number of features and cells in x

See Also

v3 *Assay* object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [Assay-validity](#), [CreateAssayObject\(\)](#), [\[.Assay\(\)](#), [\[\[.Assay\(\)](#), [dimnames.Assay\(\)](#), [merge.Assay\(\)](#), [split.Assay\(\)](#), [subset.Assay\(\)](#)

Examples

```
rna <- pbmc_small[["RNA"]]
dim(rna)
```

dim.Assay5	<i>Feature and Cell Numbers</i>
------------	---------------------------------

Description

Feature and Cell Numbers

Usage

```
## S3 method for class 'Assay5'
dim(x)
```

Arguments

x An *Assay5* object

Value

A two-length numeric vector with the total number of features and cells in x

See Also

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-class](#), [Assay5-validity](#), [\[.Assay5\(\)](#), [\[\[.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [merge.Assay5\(\)](#), [split.Assay5\(\)](#), [subset.Assay5\(\)](#)

 dim.DimReduc

Dimensional Reduction Meta-Information

Description

Pull meta-information about cells and dimensions for a given [dimensional reduction](#); cell meta-information is stored as row meta-information (eg. nrow, rownames) and dimension meta-information is stored as column meta-information (eg. ncol, colnames)

Usage

```
## S3 method for class 'DimReduc'
dim(x)

## S3 method for class 'DimReduc'
dimnames(x)

## S3 method for class 'DimReduc'
length(x)

## S3 method for class 'DimReduc'
names(x)
```

Arguments

x A [DimReduc](#) object

Value

dim: The number of cells (nrow) and dimensions (ncol)
 dimnames: The cell (row) and dimension (column) names
 length: The number of dimensions
 names: The dimension identifiers

See Also

Cells

Dimensional reduction object, validity, and interaction methods [CreateDimReducObject\(\)](#), [DimReduc-class](#), [DimReduc-validity](#), [\[.DimReduc\(\)](#), [\[\[.DimReduc\(\)](#), [merge.DimReduc\(\)](#), [print.DimReduc\(\)](#), [subset.DimReduc\(\)](#)

Examples

```
pca <- pbmc_small[["pca"]]
pca
dim(pca)

# nrow is number of cells
nrow(pca)

# rownames pulls cell names
head(rownames(pca))

# ncol and length are number of dimensions
ncol(pca)
length(pca)

# colnames and names pull dimension identifiers
head(colnames(pca))
head(names(pca))
```

dim.Seurat

Feature and Cell Numbers

Description

Feature and Cell Numbers

Usage

```
## S3 method for class 'Seurat'
dim(x)
```

Arguments

x A [Seurat](#) object

Value

A two-length numeric vector with the total number of features and cells in x

See Also

[Seurat](#) object, [validity](#), and [interaction methods](#) [\\$.Seurat\(\)](#), [Seurat-class](#), [Seurat-validity](#), [\[\[.Seurat\(\)](#)], [\[\[<- , Seurat](#), [\[\[<- , Seurat, NULL](#), [dimnames.Seurat\(\)](#)], [merge.Seurat\(\)](#)], [names.Seurat\(\)](#), [subset.Seurat\(\)](#)

Examples

```
# Get the number of features in an object
nrow(pbmc_small)

# Get the number of cells in an object
ncol(pbmc_small)
```

dimnames.Assay *Assay-Level Feature and Cell Names*

Description

Get and set feature and cell names in v5 Assays

Usage

```
## S3 method for class 'Assay'
dimnames(x)

## S3 replacement method for class 'Assay'
dimnames(x) <- value
```

Arguments

x An *Assay* object

value A two-length list where the first entry is the existing feature names for *x* and the second entry is the *updated* cell names for *x*

Value

dimnames: A two-length list with the following values:

- A character vector with all features in *x*
- A character vector with all cells in *x*

dimnames<=: *x* with the cell names updated to those in value[[2L]]

See Also

v3 Assay object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [Assay-validity](#), [CreateAssayObject\(\)](#), [\[.Assay\(\)](#), [\[\[.Assay\(\)](#), [dim.Assay\(\)](#), [merge.Assay\(\)](#), [split.Assay\(\)](#), [subset.Assay\(\)](#)

[Cells\(\)](#), [dimnames.Assay5\(\)](#), [dimnames.Seurat\(\)](#)

Examples

```
rna <- pbmc_small[["RNA"]]

# Feature and cell names can be acquired with `rownames` and `colnames`
head(rownames(rna))
head(colnames(rna))

# Cell names can be updated with `colnames<-`
colnames(rna)[1] <- "newcell"
head(colnames(rna))
```

dimnames.Assay5 *Assay-Level Feature and Cell Names*

Description

Get and set feature and cell names in v5 Assays

Usage

```
## S3 method for class 'Assay5'
dimnames(x)

## S3 replacement method for class 'Assay5'
dimnames(x) <- value
```

Arguments

x An [Assay5](#) object
value A two-length list with updated feature and/or cells names

Value

dimnames: A two-length list with the following values:

- A character vector with all features in x
- A character vector with all cells in x

dimnames<=: x with the feature and/or cell names updated to value

See Also

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-class](#), [Assay5-validity](#), [\[.Assay5\(\)](#), [\[\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [merge.Assay5\(\)](#), [split.Assay5\(\)](#), [subset.Assay5\(\)](#), [Cells\(\)](#), [dimnames.Assay\(\)](#), [dimnames.Seurat\(\)](#)

dimnames.Seurat *Feature and Cell Names*

Description

Get and set feature and cell inames in [Seurat](#) objects

Usage

```
## S3 method for class 'Seurat'
dimnames(x)

## S3 replacement method for class 'Seurat'
dimnames(x) <- value
```

Arguments

x A [Seurat](#) object
 value A two-length list with updated feature and/or cells names

Value

dimnames: A two-length list with the following values:

- A character vector with all features in the [default assay](#)
- A character vector with all cells in x

dimnames<-: x with the feature and/or cell names updated to value

See Also

[Seurat](#) object, [validity](#), and [interaction methods](#) `$.Seurat()`, [Seurat-class](#), [Seurat-validity](#), `[[.Seurat()`, `[[<- ,Seurat`, `[[<- ,Seurat, NULL`, `dim.Seurat()`, `merge.Seurat()`, `names.Seurat()`, `subset.Seurat()`

`Cells()`, `dimnames.Assay()`, `dimnames.Assay5()`

Examples

```
# Get the feature names of an object
head(rownames(pbmc_small))

# Get the cell names of an object
head(colnames(pbmc_small))

colnames(pbmc_small)[1] <- "newcell"
head(colnames(pbmc_small))
```

 DimReduc-class

The Dimensional Reduction Class

Description

The DimReduc object stores a dimensionality reduction taken out in Seurat; each DimReduc consists of a cell embeddings matrix, a feature loadings matrix, and a projected feature loadings matrix.

Slots

`cell.embeddings` Cell embeddings matrix (required)
`feature.loadings` Feature loadings matrix (optional)
`feature.loadings.projected` Projected feature loadings matrix (optional)
`assay.used` Name of assay used to generate DimReduc object
`global` Is this DimReduc global/persistent? If so, it will not be removed when removing its associated assay
`stdev` A vector of standard deviations
`jackstraw` A [JackStrawData-class](#) object associated with this DimReduc

`misc` A named list of unstructured miscellaneous data

`key` A one-length character vector with the object's key; keys must be one or more alphanumeric characters followed by an underscore “_” (regex pattern “`^[a-zA-Z][a-zA-Z0-9]*_$`”)

See Also

Dimensional reduction object, validity, and interaction methods [CreateDimReducObject\(\)](#), [DimReduc-validity](#), [\[.DimReduc\(\)](#), [\[\[.DimReduc\(\)](#), [dim.DimReduc\(\)](#), [merge.DimReduc\(\)](#), [print.DimReduc\(\)](#), [subset.DimReduc\(\)](#)

DimReduc-validity *Dimensional Reduction Validity*

Description

Validation of DimReduc objects is handled by [validObject](#)

Cell Embeddings Validation

The cell embeddings matrix must be a numeric matrix of dimensions n_{cells} by $d_{dimensions}$; row names must be the cell names and column names must be the dimension identifier. The dimension identifier must be “key_dimension” (eg. “PC_1”). Dimension identifiers must be in order and cannot be skipped

Feature and Projected Feature Loadings Validation

blah

Standard Deviations Validation

blah

Key Validation

Keys must be a one-length character vector; a key must be composed of one of the following:

- An empty string (eg. “”) where `nchar() == 0`
- An string composed of one or more alphanumeric values (both lower- and upper-case) that ends with an underscore (“_”); the first character must be a letter

Keys that are not empty strings are validated with the regex “`^[a-zA-Z][a-zA-Z0-9]*_$`”

See Also

Dimensional reduction object, validity, and interaction methods [CreateDimReducObject\(\)](#), [DimReduc-class](#), [\[.DimReduc\(\)](#), [\[\[.DimReduc\(\)](#), [dim.DimReduc\(\)](#), [merge.DimReduc\(\)](#), [print.DimReduc\(\)](#), [subset.DimReduc\(\)](#)

Distances

Get the Neighbor nearest neighbors distance matrix

Description

Get the Neighbor nearest neighbors distance matrix

Usage

```
Distances(object, ...)
```

```
## S3 method for class 'Neighbor'
Distances(object, ...)
```

Arguments

object	An object
...	Arguments passed to other methods

Value

The distance matrix

droplevels.LogMap

Drop Unused Logical Map Values

Description

Remove any unused values from a [logical map](#)

Usage

```
## S3 method for class 'LogMap'
droplevels(x, ...)
```

Arguments

x	A LogMap object
...	Ignored

Value

x with values not present in any observation removed

See Also

Logical map objects, validity, and interaction methods: [LogMap](#), [LogMap-validity](#), [as.matrix.LogMap\(\)](#), [intersect.LogMap\(\)](#), [labels.LogMap\(\)](#)

Examples

```
map <- LogMap(letters[1:10])
map[['obs']] <- c(1, 3, 7)
map[['entry']] <- c(2, 7, 10)

# Remove unused values
map <- droplevels(map)
map
map[[]]
```

Embeddings

Get Cell Embeddings

Description

Get Cell Embeddings

Usage

```
Embeddings(object, ...)
```

S3 method for class 'DimReduc'

```
Embeddings(object, ...)
```

S3 method for class 'Seurat'

```
Embeddings(object, reduction = "pca", ...)
```

Arguments

object	An object
...	Arguments passed to other methods
reduction	Name of reduction to pull cell embeddings for

Value

The embeddings matrix

Examples

```
# Get the embeddings directly from a DimReduc object
Embeddings(object = pbmc_small[["pca"]])[1:5, 1:5]
```

Get the embeddings from a specific DimReduc in a Seurat object

```
Embeddings(object = pbmc_small, reduction = "pca")[1:5, 1:5]
```

EmptyMatrix

Empty Matrices

Description

Create empty 0x0 matrices of varying types

Usage

```
EmptyMatrix(repr = "C", type = "d")
```

Arguments

repr Representation of empty matrix; choose from:

- “C” for a [CsparseMatrix](#)
- “T” for a [TsparseMatrix](#)
- “R” for an [RsparseMatrix](#)
- “e” for an [unpackedMatrix](#)
- “d” for a dense [S3 matrix](#)
- “spam” for a [spam matrix](#)

type Type of resulting matrix to return, choose from:

- “d” for numeric matrices
- “l” for logical matrices
- “n” for pattern matrices

Note, when repr is “spam”, type must be “d”; when repr is “d”, setting type to “n” returns a logical matrix

Value

A 0x0 matrix of the specified representation and type

See Also

[IsMatrixEmpty\(\)](#)

Examples

```
EmptyMatrix()  
EmptyMatrix("spam")
```

FetchData	<i>Access cellular data</i>
-----------	-----------------------------

Description

Retrieves data (feature expression, PCA scores, metrics, etc.) for a set of cells in a Seurat object

Usage

```
FetchData(object, ...)

## S3 method for class 'DimReduc'
FetchData(object, vars, cells = NULL, ...)

## S3 method for class 'Seurat'
FetchData(
  object,
  vars,
  cells = NULL,
  layer = NULL,
  clean = TRUE,
  slot = deprecated(),
  ...
)
```

Arguments

object	An object
...	Arguments passed to other methods
vars	List of all variables to fetch, use keyword “ident” to pull identity classes
cells	Cells to collect data for (default is all cells)
layer	Layer to pull feature data for
clean	Remove cells that are missing data; choose from: <ul style="list-style-type: none"> • “all”: consider all columns for cleaning • “ident”: consider all columns except the identity class for cleaning • “project”: consider all columns except the identity class for cleaning; fill missing identity values with the object’s project • “none”: do not clean Passing TRUE is a shortcut for “ident”; passing FALSE is a shortcut for “none”
slot	Deprecated in favor of layer

Value

A data frame with cells as rows and cellular data as columns

Examples

```
pc1 <- FetchData(object = pbmc_small, vars = 'PC_1')
head(x = pc1)
head(x = FetchData(object = pbmc_small, vars = c('groups', 'ident')))
```

FilterObjects	<i>Find Sub-objects of a Certain Class</i>
---------------	--

Description

Get the names of objects within a Seurat object that are of a certain class

Usage

```
FilterObjects(object, classes.keep = c("Assay", "StdAssay", "DimReduc"))
```

Arguments

object A [Seurat](#) object
 classes.keep A vector of names of classes to get

Value

A vector with the names of objects within the Seurat object that are of class `classes.keep`

Lifecycle**[Deprecated]**

FilterObjects was deprecated in version 5.0.0; use [.FilterObjects](#) instead

Examples

```
FilterObjects(pbmc_small)
```

FOV-class	<i>The Field of View Object</i>
-----------	---------------------------------

Description

A modern container for storing coordinates of spatially-resolved single cells. Capable of storing multiple cell segmentation boundary masks. Supports coordinates for spatially-resolved molecule (FISH) data. Compatible with [SpatialImage](#)

Slots

molecules A named list of [Molecules](#) objects defining spatially-resolved molecular coordinates
 boundaries A named list of [Segmentation](#) and [Centroids](#) objects defining spatially-resolved boundaries
 assay A character naming the associated assay of the spatial coordinates
 key A one-length character vector with the object's key; keys must be one or more alphanumeric characters followed by an underscore "_" (regex pattern "`^[a-zA-Z][a-zA-Z0-9]*_`")

See Also

[FOV-methods](#)

FOV-methods

FOV *Methods*

Description

Methods for [FOV](#) objects

Usage

```
## S3 method for class 'FOV'  
Cells(x, boundary = NULL, ...)  
  
## S3 method for class 'FOV'  
Features(x, set = NULL, ...)  
  
## S3 method for class 'FOV'  
FetchData(object, vars, cells = NULL, simplify = TRUE, ...)  
  
## S3 method for class 'FOV'  
GetTissueCoordinates(object, which = NULL, ...)  
  
## S3 method for class 'FOV'  
Keys(object, ...)  
  
## S3 method for class 'FOV'  
RenameCells(object, new.names = NULL, ...)  
  
## S3 method for class 'FOV'  
x$i, ...  
  
## S3 method for class 'FOV'  
x[i, j, ...]  
  
## S3 method for class 'FOV'  
x[[i, ...]]  
  
## S3 method for class 'FOV'  
length(x)  
  
## S3 method for class 'FOV'  
names(x)  
  
## S3 method for class 'FOV'  
subset(x, cells = NULL, features = NULL, ...)  
  
## S4 replacement method for signature 'FOV,character,missing,Centroids'  
x[[i, j, ...]] <- value  
  
## S4 replacement method for signature 'FOV,character,missing,Molecules'  
x[[i, j, ...]] <- value
```

```
## S4 replacement method for signature 'FOV,character,missing,NULL'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'FOV,character,missing,Segmentation'
x[[i, j, ...]] <- value

## S4 method for signature 'FOV'
show(object)
```

Arguments

x, object	A FOV object
boundary, set	Name of segmentation boundary or molecule set to extract cell or feature names for; pass NA to return all cells or feature names
...	Arguments passed to other methods
vars	A vector of variables to fetch; can be the name of a segmentation boundary, to get tissue coordinates, or molecule names, to get molecule coordinates
simplify	If only returning either boundary or molecule coordinates, return a single data frame instead of a list
which	Name of segmentation boundary or molecule set
new.names	vector of new cell names
i, cells	For <code>[[</code> and <code>[[<-</code> , the name of a segmentation or “molecules”; for <code>FetchData</code> , <code>subset</code> . and <code>[</code> , a vector of cells to keep
j, features	For <code>subset</code> and <code>[</code> , a vector of features to keep; for <code>[[<-</code> , not used
value	For <code>[[<-</code> , a replacement Molecules , Centroids , or Segmentation object; otherwise NULL to remove the boundary stored at i

Details

The following methods are defined for interacting with a FOV object:

Cells: Get cell names

Features: Get spatially-resolved molecule names

FetchData: Fetch boundary and/or molecule coordinates from a FOV object

GetTissueCoordinates: Get boundary or molecule coordinates from a FOV object

Keys: Get the keys of molecule sets contained within a FOV object

RenameCells: Update cell names

\$, `[[`: Extract a segmentation boundary

length: Get the number of segmentation layers in a FOV object

names: Get the names of segmentation layers and molecule sets

subset, `[`: Subset a FOV object

`[[<-`: Add or remove segmentation layers and molecule information to/from a FOV object

show: Display an object summary to stdout

Value

Cells: A vector of cell names

Features: A vector of spatially-resolved molecule names; if no molecular information present, returns NULL

FetchData: If both molecule and boundary coordinates are requested, then a two-length list:

- “molecules”: A data frame with the molecule coordinates requested. If molecules requested are keyed, the keys are preserved in the data frame
- “coordinates”: A data frame with coordinates from the segmentation boundaries requested

If `simplify` is TRUE and only one data frame is generated, then only the data frame is returned. Otherwise, a one-length list is returned with the single data frame generated

GetTissueCoordinates: ...

Keys: A named vector of molecule set keys; names are the names of the molecule sets and values are the keys for the respective molecule set

RenameCells: object with the cells renamed to `new.names`

`$`, `[[`: The segmentation boundary or spatially-resolved molecule information stored at `i`

`length`: The number of segmentation layers ([Segmentation](#) or [Centroids](#) objects)

`names`: A vector of segmentation boundary and molecule set names

`subset`: `x` with just the cells and features specified

`[[<-`: Varies depending on the class of value:

- If value is NULL, returns `x` with the boundary `i` removed; also allows removing molecules; does not allow removing the default segmentation
- If value is a `Molecules`, returns `x` with value stored in `molecules`; requires that `i` is “molecules”
- Otherwise, stores value as a segmentation boundary named `i`

`show`: Invisibly returns NULL

See Also

[FOV-class](#)

FOV-validity

FOV Validity

Description

Validation of FOV objects is handled by [validObject](#)

Boundary Validation

blah

Molecule Validation

blah

See Also

[validObject](#)

GetImage	<i>Get image data</i>
----------	-----------------------

Description

Get image data

Usage

```
GetImage(object, mode = c("grob", "raster", "plotly", "raw"), ...)

## S3 method for class 'Seurat'
GetImage(
  object,
  mode = c("grob", "raster", "plotly", "raw"),
  image = NULL,
  ...
)
```

Arguments

object	An object
mode	How to return the image; should accept one of “grob”, “raster”, “plotly”, or “raw”
...	Arguments passed to other methods
image	Name of SpatialImage object to pull image data for; if NULL, will attempt to select an image automatically

Value

Image data, varying depending on the value of mode:

“**grob**” An object representing image data inheriting from grob objects (eg. rastergrob)

“**raster**” An object of class raster

“**plotly**” A list with image data suitable for Plotly rendering, see [plotly::layout](#) for more details

“**raw**” The raw image data as stored in the object

See Also

[layout](#)

GetTissueCoordinates *Get tissue coordinates*

Description

Get tissue coordinates

Usage

```
GetTissueCoordinates(object, ...)

## S3 method for class 'Seurat'
GetTissueCoordinates(object, image = NULL, ...)
```

Arguments

object	An object
...	Arguments passed to other methods
image	Name of SpatialImage object to get coordinates for; if NULL, will attempt to select an image automatically

Value

A data frame with tissue coordinates

Graph-class *The Graph Class*

Description

The Graph class inherits from [dgCMatrx](#). We do this to enable future expandability of graphs.

Slots

assay.used Optional name of assay used to generate Graph object

See Also

[dgCMatrx-class](#)

Other graph: [as.Graph\(\)](#)

 HVInfo

Highly Variable Features

Description

Get and set variable feature information for an [Assay](#) object. HVInfo and VariableFeatures utilize generally variable features, while SVFInfo and SpatiallyVariableFeatures are restricted to spatially variable features

Usage

```
HVInfo(object, method, status = FALSE, ...)
```

```
VariableFeatures(object, method = NULL, ...)
```

```
VariableFeatures(object, ...) <- value
```

```
SVFInfo(object, method, status, ...)
```

```
SpatiallyVariableFeatures(object, method, ...)
```

```
## S3 method for class 'Seurat'
```

```
HVInfo(
  object,
  method = NULL,
  status = FALSE,
  assay = NULL,
  selection.method = deprecated(),
  ...
)
```

```
## S3 method for class 'Seurat'
```

```
VariableFeatures(
  object,
  method = NULL,
  assay = NULL,
  nfeatures = NULL,
  layer = NA,
  simplify = TRUE,
  selection.method = deprecated(),
  ...
)
```

```
## S3 replacement method for class 'Seurat'
```

```
VariableFeatures(object, assay = NULL, ...) <- value
```

```
## S3 method for class 'Seurat'
```

```
SVFInfo(
  object,
  method = c("markvariogram", "moransi"),
  status = FALSE,
  ...
)
```



```
    assay = NULL,
    selection.method = deprecated(),
    ...
)

## S3 method for class 'Seurat'
SpatiallyVariableFeatures(
  object,
  method = "moransi",
  assay = NULL,
  decreasing = TRUE,
  selection.method = deprecated(),
  ...
)

## S3 method for class 'Assay'
HVFInfo(object, method, status = FALSE, selection.method = deprecated(), ...)

## S3 method for class 'Assay'
SpatiallyVariableFeatures(
  object,
  method = "moransi",
  decreasing = TRUE,
  selection.method = deprecated(),
  ...
)

## S3 method for class 'Assay'
SVFInfo(
  object,
  method = c("markvariogram", "moransi"),
  status = FALSE,
  selection.method = deprecated(),
  ...
)

## S3 method for class 'Assay'
VariableFeatures(object, method = NULL, selection.method = deprecated(), ...)

## S3 replacement method for class 'Assay'
VariableFeatures(object, ...) <- value

## S3 method for class 'Assay5'
HVFInfo(object, method = NULL, status = FALSE, layer = NULL, strip = TRUE, ...)

## S3 method for class 'Assay5'
VariableFeatures(
  object,
  method = NULL,
  layer = NA,
  simplify = TRUE,
  nfeatures = Inf,
```

```

    selection.method = deprecated(),
    ...
)

## S3 replacement method for class 'Assay5'
VariableFeatures(object, method = "custom", layer = NULL, ...) <- value

```

Arguments

object	An object
method	Which method to pull. For HVFInfo and VariableFeatures, choose one from one of the following: <ul style="list-style-type: none"> • “vst” • “sctransform” or “sct” • “mean.var.plot”, “dispersion”, “mvp”, or “disp” For SVFInfo and SpatiallyVariableFeatures, choose from: <ul style="list-style-type: none"> • “markvariogram” • “moransi”
status	Add variable status to the resulting data frame
...	Arguments passed to other methods
value	A character vector of variable features
assay	Name of assay to pull highly variable feature information for
selection.method	[Deprecated]
nfeatures	Maximum number of features to select when simplifying
layer	Layer to pull variable features for
simplify	When pulling for multiple layers, combine into a single vector and select a common set of variable features for all layers
decreasing	Return features in decreasing order (most spatially variable first).
strip	Remove method/layer identifiers from highly variable data frame

Value

HVFInfo: A data frame with feature means, dispersion, and scaled dispersion

VariableFeatures: a vector of the variable features

SVFInfo: a data frame with the spatially variable features

SpatiallyVariableFeatures: a character vector of the spatially variable features

Examples

```

# Get the HVF info from a specific Assay in a Seurat object
HVFInfo(object = pbmc_small, assay = "RNA")[1:5, ]

# Get the HVF info directly from an Assay object
HVFInfo(pbmc_small[["RNA"]], method = 'vst')[1:5, ]

```

Idents

Get, set, and manipulate an object's identity classes

Description

Get, set, and manipulate an object's identity classes

Usage

```
Idents(object, ...)
```

```
Idents(object, ...) <- value
```

```
RenameIdents(object, ...)
```

```
ReorderIdent(object, var, ...)
```

```
SetIdent(object, ...)
```

```
StashIdent(object, save.name, ...)
```

```
## S3 method for class 'Seurat'
```

```
Idents(object, ...)
```

```
## S3 replacement method for class 'Seurat'
```

```
Idents(object, cells = NULL, drop = FALSE, replace = FALSE, ...) <- value
```

```
## S3 method for class 'Seurat'
```

```
ReorderIdent(  
  object,  
  var,  
  reverse = FALSE,  
  afxn = mean,  
  reorder.numeric = FALSE,  
  ...  
)
```

```
## S3 method for class 'Seurat'
```

```
RenameIdents(object, ...)
```

```
## S3 method for class 'Seurat'
```

```
SetIdent(object, cells = NULL, value, ...)
```

```
## S3 method for class 'Seurat'
```

```
StashIdent(object, save.name = "orig.ident", ...)
```

```
## S3 method for class 'Seurat'
```

```
droplevels(x, ...)
```

```
## S3 method for class 'Seurat'
```

```
levels(x)
```

```
## S3 replacement method for class 'Seurat'
levels(x) <- value
```

Arguments

...	Arguments passed to other methods; for <code>RenameIdents</code> : named arguments as <code>old.ident = new.ident</code> ; for <code>ReorderIdent</code> : arguments passed on to FetchData
value	The name of the identities to pull from object metadata or the identities themselves
var	Feature or variable to order on
save.name	Store current identity information under this name
cells	Set cell identities for specific cells
drop	Drop unused levels
replace	Replace identities for unset cells with NA
reverse	Reverse ordering
afxn	Function to evaluate each identity class based on; default is mean
reorder.numeric	Rename all identity classes to be increasing numbers starting from 1 (default is FALSE)
x, object	An object

Value

Idents: The cell identities
 Idents<-: object with the cell identities changed
 RenameIdents: An object with selected identity classes renamed
 ReorderIdent: An object with
 SetIdent: An object with new identity classes set
 StashIdent: An object with the identities stashed

Examples

```
# Get cell identity classes
Idents(pbmc_small)

# Set cell identity classes
# Can be used to set identities for specific cells to a new level
Idents(pbmc_small, cells = 1:4) <- 'a'
head(Idents(pbmc_small))

# Can also set idents from a value in object metadata
colnames(pbmc_small[[[]]])
Idents(pbmc_small) <- 'RNA_snn_res.1'
levels(pbmc_small)

# Rename cell identity classes
# Can provide an arbitrary amount of idents to rename
levels(pbmc_small)
pbmc_small <- RenameIdents(pbmc_small, '0' = 'A', '2' = 'C')
```

```
levels(pbmc_small)

## Not run:
head(Idents(pbmc_small))
pbmc_small <- ReorderIdent(pbmc_small, var = 'PC_1')
head(Idents(pbmc_small))

## End(Not run)

# Set cell identity classes using SetIdent
cells.use <- WhichCells(pbmc_small, idents = '1')
pbmc_small <- SetIdent(pbmc_small, cells = cells.use, value = 'B')

head(pbmc_small[[[]]])
pbmc_small <- StashIdent(pbmc_small, save.name = 'idents')
head(pbmc_small[[[]]])

# Get the levels of identity classes of a Seurat object
levels(x = pbmc_small)

# Reorder identity classes
levels(x = pbmc_small)
levels(x = pbmc_small) <- c('C', 'A', 'B')
levels(x = pbmc_small)
```

Images

Pull spatial image names

Description

List the names of SpatialImage objects present in a Seurat object. If assay is provided, limits search to images associated with that assay

Usage

```
Images(object, assay = NULL)
```

Arguments

object	A Seurat object
assay	Name of assay to limit search to

Value

A list of image names

Examples

```
## Not run:
Images(object)

## End(Not run)
```

Index	<i>Get Neighbor algorithm index</i>
-------	-------------------------------------

Description

Get Neighbor algorithm index

Usage

```
Index(object, ...)
```

```
Index(object, ...) <- value
```

```
## S3 method for class 'Neighbor'
Index(object, ...)
```

```
## S3 replacement method for class 'Neighbor'
Index(object, ...) <- value
```

Arguments

object	An object
...	Arguments passed to other methods
value	The index to store

Value

Returns the value in the alg.idx slot of the Neighbor object
 Idents<-: A Neighbor object with the index stored

Indices	<i>Get Neighbor nearest neighbor index matrices</i>
---------	---

Description

Get Neighbor nearest neighbor index matrices

Usage

```
Indices(object, ...)
```

```
## S3 method for class 'Neighbor'
Indices(object, ...)
```

Arguments

object	An object
...	Arguments passed to other methods

Value

A matrix with the nearest neighbor indices

intersect.LogMap *Find Common Logical Map Values*

Description

Identify values in a [logical map](#) that are common to every observation

Usage

```
## S3 method for class 'LogMap'  
intersect(x, y = missing_arg(), ...)
```

Arguments

x	A LogMap object
y	Ignored
...	Ignored

Value

The values of x that are present in **every** observation

See Also

Logical map objects, validity, and interaction methods: [LogMap](#), [LogMap-validity](#), [as.matrix.LogMap\(\)](#), [droplevels.LogMap\(\)](#), [labels.LogMap\(\)](#)

Examples

```
map <- LogMap(letters[1:10])  
map[['obs']] <- c(1, 3, 7)  
map[['entry']] <- c(2, 7, 10)  
  
# Identify values that are present in every observation  
intersect(map)
```

IsGlobal	<i>Is an object global/persistent?</i>
----------	--

Description

Typically, when removing Assay objects from an Seurat object, all associated objects (eg. DimReduc, Graph, and SeuratCommand objects) are removed as well. If an associated object is marked as global/persistent, the associated object will remain even if its original assay was deleted

Usage

```
IsGlobal(object, ...)

## Default S3 method:
IsGlobal(object, ...)

## S3 method for class 'DimReduc'
IsGlobal(object, ...)
```

Arguments

object	An object
...	Arguments passed to other methods

Value

TRUE if the object is global/persistent otherwise FALSE

Examples

```
IsGlobal(pbmc_small[['pca']])
```

IsMatrixEmpty	<i>Check if a matrix is empty</i>
---------------	-----------------------------------

Description

Takes a matrix and asks if it's empty (either 0x0 or 1x1 with a value of NA)

Usage

```
IsMatrixEmpty(x)

## Default S3 method:
IsMatrixEmpty(x)
```

Arguments

x	A matrix
---	----------

Value

Whether or not `x` is empty

See Also

[EmptyMatrix\(\)](#)

Examples

```
IsMatrixEmpty(new("matrix"))
IsMatrixEmpty(matrix())
IsMatrixEmpty(matrix(1:3))
```

IsNamedList

Check List Names

Description

Check to see if a list has names; also check to enforce that all names are present and unique

Usage

```
IsNamedList(x, all.unique = TRUE, allow.empty = FALSE, pass.zero = FALSE)
```

Arguments

<code>x</code>	A list
<code>all.unique</code>	Require that all names are unique from one another
<code>allow.empty</code>	Allow empty (<code>nchar = 0</code>) names
<code>pass.zero</code>	Pass on zero-length lists

Value

TRUE if ..., otherwise FALSE

Examples

```
IsNamedList(list())
IsNamedList(list(), pass.zero = TRUE)
IsNamedList(list(1, 2, 3))
IsNamedList(list(a = 1, b = 2, c = 3))
IsNamedList(list(a = 1, 2, c = 3))
IsNamedList(list(a = 1, 2, c = 3), allow.empty = TRUE)
IsNamedList(list(a = 1, a = 2, a = 3))
IsNamedList(list(a = 1, a = 2, a = 3), all.unique = FALSE)
```

JackStrawData-class *The JackStrawData Class*

Description

The JackStrawData is used to store the results of a JackStraw computation.

Slots

empirical.p.values Empirical p-values
 fake.reduction.scores Fake reduction scores
 empirical.p.values.full Empirical p-values on full
 overall.p.values Overall p-values from ScoreJackStraw

JackStrawData-methods JackStrawData *Methods*

Description

Methods for [JackStrawData](#) objects for generics defined in other packages

Usage

```
## S3 method for class 'JackStrawData'
.DollarNames(x, pattern = "")

## S3 method for class 'JackStrawData'
x$i, ...

## S3 method for class 'JackStrawData'
as.logical(x, ...)

## S4 method for signature 'JackStrawData'
show(object)
```

Arguments

x, object	A JackStrawData object
pattern	A regular expression. Only matching names are returned.
i	A JackStrawData slot name
...	Ignored

Value

\$: Slot i from x
 as.logical: TRUE if empirical p-values have been calculated otherwise FALSE
 show: Prints summary to [stdout](#) and invisibly returns NULL

Functions

- `.DollarNames(JackStrawData)`: Autocompletion for \$ access on a JackStrawData object
- `$`: Access data from a JackStrawData object
- `as.logical(JackStrawData)`: Have empirical p-values for a JackStrawData object been calculated
- `show(JackStrawData)`: Overview of a JackStrawData object

 JoinLayers

Split and Join Layers Together

Description

Split and Join Layers Together

Usage

```
JoinLayers(object, ...)

## S3 method for class 'Assay5'
JoinLayers(object, layers = NULL, new = NULL, ...)

## S3 method for class 'Seurat'
JoinLayers(object, assay = NULL, layers = NULL, new = NULL, ...)
```

Arguments

<code>object</code>	An object
<code>...</code>	Arguments passed to other methods
<code>layers</code>	Names of layers to split or join
<code>new</code>	Name of new layers
<code>assay</code>	Name of assay to split layers

Value

object with the layers specified joined

 JS

Get and set JackStraw information

Description

Get and set JackStraw information

Usage

```

JS(object, ...)

JS(object, ...) <- value

## S3 method for class 'JackStrawData'
JS(object, slot, ...)

## S3 replacement method for class 'JackStrawData'
JS(object, slot, ...) <- value

## S3 method for class 'DimReduc'
JS(object, slot = NULL, ...)

## S3 replacement method for class 'DimReduc'
JS(object, slot = NULL, ...) <- value

```

Arguments

object	An object
...	Arguments passed to other methods
value	JackStraw information
slot	Name of slot to store JackStraw scores to Can shorten to 'empirical', 'fake', 'full', or 'overall'

Value

JS: either a [JackStrawData](#) object or the specified jackstraw data
 JS<-: object with the update jackstraw information

 Key

Get and set object keys

Description

Get and set object keys

Usage

```

Key(object, ...)

Keys(object, ...)

Key(object, ...) <- value

## S3 method for class 'Assay'
Key(object, ...)

## S3 replacement method for class 'Assay'
Key(object, ...) <- value

## S3 method for class 'Assay5'
Key(object, ...)

## S3 replacement method for class 'Assay5'
Key(object, ...) <- value

## S3 method for class 'DimReduc'
Key(object, ...)

## S3 replacement method for class 'DimReduc'
Key(object, ...) <- value

## S3 method for class 'Seurat'
Key(object, ...)

## S3 method for class 'Seurat'
Keys(object, ...)

```

Arguments

object	An object
...	Arguments passed to other methods
value	Key value

Value

Key: the object key
 Keys: a named vector of keys of sub-objects
 Key<-: object with an updated key

Examples

```

# Get an Assay key
Key(pbmc_small[["RNA"]])

# Set the key for an Assay
Key(pbmc_small[["RNA"]]) <- "newkey_"
Key(pbmc_small[["RNA"]])

```

```
# Get a DimReduc key
Key(object = pbmc_small[["pca"]])

# Set the key for DimReduc
Key(object = pbmc_small[["pca"]]) <- "newkey2_"
Key(object = pbmc_small[["pca"]])

# Show all keys associated with a Seurat object
Key(object = pbmc_small)
Keys(object = pbmc_small)
```

labels.LogMap

Find Observations by Value

Description

Identify the observations that contain a specific value in a [logical map](#)

Usage

```
## S3 method for class 'LogMap'
labels(
  object,
  values,
  select = c("first", "last", "common", "all"),
  simplify = TRUE,
  ...
)
```

Arguments

object	A LogMap object
values	A vector of values to find observations for
select	Observation selection method; choose from: <ul style="list-style-type: none"> “first”: the first observation the value is found in “last”: the last observation the value is found in “common”: the first most-common observation the value is found in; most-common is determined by the observation that contains the most of the values requested “all”: all observations the value is found in
simplify	Simplify the resulting list to a vector
...	Ignored

Value

labels: A list, or vector if simplify is TRUE, of all values and the observations they're found in, according to the value of select

See Also

Logical map objects, validity, and interaction methods: [LogMap](#), [LogMap-validity](#), [as.matrix.LogMap\(\)](#), [droplevels.LogMap\(\)](#), [intersect.LogMap\(\)](#)

Examples

```
map <- LogMap(letters[1:10])
map[['obs']] <- c(1, 3, 7)
map[['entry']] <- c(2, 7, 10)

# Find observations for a set of values
labels(map, c('a', 'b', 'g'))
```

 LayerData

Query and Manipulate Assay Layers

Description

Query and Manipulate Assay Layers

Usage

```
LayerData(object, layer, ...)

LayerData(object, layer, ...) <- value

Layers(object, ...)

## S3 method for class 'Assay'
LayerData(
  object,
  layer = NULL,
  cells = NULL,
  features = NULL,
  slot = deprecated(),
  ...
)

## S3 replacement method for class 'Assay'
LayerData(object, layer, ...) <- value

## S3 method for class 'Assay'
Layers(object, search = NA, ...)

## S3 method for class 'Assay5'
LayerData(
  object,
  layer = NULL,
  cells = NULL,
  features = NULL,
```

```

    fast = FALSE,
    slot = deprecated(),
    ...
)

## S3 replacement method for class 'Assay5'
LayerData(object, layer, features = NULL, cells = NULL, ...) <- value

## S3 method for class 'Assay5'
Layers(object, search = NA, ...)

## S3 method for class 'Seurat'
LayerData(object, layer = NULL, assay = NULL, slot = deprecated(), ...)

## S3 replacement method for class 'Seurat'
LayerData(object, layer, assay = NULL, ...) <- value

## S3 method for class 'Seurat'
Layers(object, search = NA, assay = NULL, ...)

```

Arguments

object	An object
layer	Name of layer to fetch or set
...	Arguments passed to other methods
value	New two-dimensional data to be added as a layer
features, cells	Vectors of features/cells to include
slot	[Deprecated]
search	A pattern to search layer names for; pass one of: <ul style="list-style-type: none"> • “NA” to pull all layers • “NULL” to pull the default layer(s) • a regular expression that matches layer names
fast	Determine how to return the layer data; choose from: <p>FALSE Apply any transpositions and attempt to add feature/cell names (if supported) back to the layer data</p> <p>NA Attempt to add feature/cell names back to the layer data, skip any transpositions</p> <p>TRUE Do not apply any transpositions or add feature/cell names to the layer data</p>
assay	Name of assay to fetch layer data from or assign layer data to

Value

LayerData: the layer data for layer from object

Layer<-: object with value added as a layer named layer

Layers: the names of the layers present in object

Loadings

Get and set feature loadings

Description

Get and set feature loadings

Usage

```
Loadings(object, ...)
```

```
Loadings(object, ...) <- value
```

```
## S3 method for class 'DimReduc'  
Loadings(object, projected = FALSE, ...)
```

```
## S3 replacement method for class 'DimReduc'  
Loadings(object, projected = TRUE, ...) <- value
```

```
## S3 method for class 'Seurat'  
Loadings(object, reduction = "pca", projected = FALSE, ...)
```

Arguments

object	An object
...	Arguments passed to other methods
value	Feature loadings to add
projected	Pull the projected feature loadings?
reduction	Name of reduction to pull feature loadings for

Value

Loadings: the feature loadings for object

Loadings<-: object with the updated loadings

Examples

```
# Get the feature loadings for a given DimReduc  
Loadings(object = pbmc_small[["pca"]])[1:5,1:5]
```

```
# Set the feature loadings for a given DimReduc  
new.loadings <- Loadings(object = pbmc_small[["pca"]])  
new.loadings <- new.loadings + 0.01  
Loadings(object = pbmc_small[["pca"]]) <- new.loadings
```

```
# Get the feature loadings for a specified DimReduc in a Seurat object  
Loadings(object = pbmc_small, reduction = "pca")[1:5,1:5]
```

LogMap

*A Logical Map***Description**

A simple container for storing mappings of values using logical matrices. Keeps track of which values (rows) are present in which observations (columns). LogMap objects can be created with LogMap(); queries can be performed with [] and observations can be added or removed with []<-

Usage

```
LogMap(y)

## S4 method for signature 'LogMap,character,missing'
x[[i, j, ...]]

## S4 method for signature 'LogMap,missing,missing'
x[[i, j, ...]]

## S4 method for signature 'LogMap,NULL,missing'
x[[i, j, ...]]

## S4 replacement method for signature 'LogMap,character,missing,character'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'LogMap,character,missing,integer'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'LogMap,character,missing,NULL'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'LogMap,character,missing,numeric'
x[[i, j, ...]] <- value
```

Arguments

y	A character vector
x	A LogMap object
i	A character vector of length 1, or NULL
j	Not used
...	Ignored
value	A character or integer vector of values to record in the map for i, or NULL to remove the record for i

Value

LogMap: A new LogMap object with zero columns and length(x = x) rows; rownames are set to x []: if i is a character vector, the rownames that are mapped to i; otherwise the rownames of x []<-: If value is NULL, then x without the observations for i; otherwise, x with a new column for i recording a TRUE for all values present in value

Slots

.Data A logical matrix with at least one row

See Also

Logical map objects, validity, and interaction methods: [LogMap-validity](#), [as.matrix.LogMap\(\)](#), [droplevels.LogMap\(\)](#), [intersect.LogMap\(\)](#), [labels.LogMap\(\)](#)

Examples

```
# Create a LogMap
map <- LogMap(letters[1:10])
map

# Get the names of values in the LogMap
map[[NULL]]
rownames(map)

# Add an observation to the LogMap
map[['obs']] <- c(1, 3, 7)
map[['entry']] <- c(2, 7, 10)
map

# Get the names of observations in the LogMap
colnames(map)

# Fetch an observation from the LogMap
map[['obs']]

# Get the full logical matrix
map[[]]

# Remove an observation from the LogMap
map[['obs']] <- NULL
map[['entry']] <- NULL
map
```

LogMap-validity

Logical Map Validity

Description

Validation of LogMap objects is handled by [validObject](#)

Data Validation

Logical maps must be a logical matrix containing only TRUE or FALSE values

Value Validation

All values must be named within the rownames of the object. Duplicate or empty ("") values are not allowed

Observation Validation

All observations must be named within the column names of the object. Duplicate or empty (") observations are not allowed

See Also

[validObject](#)

Logical map objects, validity, and interaction methods: [LogMap](#), [as.matrix.LogMap\(\)](#), [droplevels.LogMap\(\)](#), [intersect.LogMap\(\)](#), [labels.LogMap\(\)](#)

Examples

```
map <- LogMap(letters[1:10])
map[['obs']] <- c(1, 3, 7)
map[['entry']] <- c(2, 7, 10)
validObject(map)
```

LogSeuratCommand

Log a command

Description

Logs command run, storing the name, timestamp, and argument list. Stores in the Seurat object

Usage

```
LogSeuratCommand(object, return.command = FALSE)
```

Arguments

`object` Name of Seurat object
`return.command` Return a [SeuratCommand](#) object instead

Value

If `return.command`, returns a [SeuratCommand](#) object; otherwise, returns the Seurat object with command stored

See Also

[Command](#)

Command log object and interaction methods [\\$.SeuratCommand\(\)](#), [.DollarNames.SeuratCommand\(\)](#), [SeuratCommand-class](#), [\[.SeuratCommand\(\)](#), [as.list.SeuratCommand\(\)](#)

merge.Assay	<i>Merge Assays</i>
-------------	---------------------

Description

Merge one or more v3 assays together

Usage

```
## S3 method for class 'Assay'  
merge(  
  x = NULL,  
  y = NULL,  
  add.cell.ids = NULL,  
  merge.data = TRUE,  
  labels = NULL,  
  collapse = TRUE,  
  ...  
)
```

Arguments

x	An Assay object
y	One or more Assay objects
add.cell.ids	A character vector of length(x = c(x, y)); appends the corresponding values to the start of each objects' cell names
merge.data	Merge the data slots instead of just merging the counts (which requires renormalization); this is recommended if the same normalization approach was applied to all objects
labels, collapse	Currently unused
...	Ignored

Value

A new assay with data merged from c(x, y)

See Also

v3 Assay object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [Assay-validity](#), [CreateAssayObject\(\)](#), [\[.Assay\(\)](#), [\[\[.Assay\(\)](#), [dim.Assay\(\)](#), [dimnames.Assay\(\)](#), [split.Assay\(\)](#), [subset.Assay\(\)](#)

merge.Assay5	<i>Merge Assays</i>
--------------	---------------------

Description

Merge one or more v5 assays together

Usage

```
## S3 method for class 'Assay5'
merge(x, y, labels = NULL, add.cell.ids = NULL, collapse = FALSE, ...)
```

Arguments

x	An Assay5 object
y	One or more Assay5 objects
labels	A character vector equal to the number of objects; defaults to <code>as.character(seq_along(c(x, y)))</code>
add.cell.ids	A character vector equal to the number of objects provided to append to all cell names; if TRUE, uses labels as add.cell.ids
collapse	If TRUE, merge layers of the same name together; if FALSE, appends labels to the layer name
...	Ignored

Details

Note: collapsing layers is currently not supported

Value

A new v5 assay with data merged from `c(x, y)`

See Also

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-class](#), [Assay5-validity](#), [\[.Assay5\(\)](#), [\[\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [split.Assay5\(\)](#), [subset.Assay5\(\)](#)

merge.DimReduc	<i>Merge Dimensional Reductions</i>
----------------	-------------------------------------

Description

Merge two or more [dimensional reduction](#) together

Usage

```
## S3 method for class 'DimReduc'
merge(x = NULL, y = NULL, add.cell.ids = NULL, ...)
```

Arguments

x	A DimReduc object
y	One or more DimReduc objects
add.cell.ids	A character vector equal to the number of objects provided to append to all cell names; if TRUE, uses labels as add.cell.ids
...	Ignored

Value

A new [DimReduc](#) object with data merged from `c(x, y)`

See Also

Dimensional reduction object, validity, and interaction methods [CreateDimReducObject\(\)](#), [DimReduc-class](#), [DimReduc-validity](#), [\[,DimReduc\(\)](#), [\[\[.DimReduc\(\)](#), [dim.DimReduc\(\)](#), [print.DimReduc\(\)](#), [subset.DimReduc\(\)](#)

merge.Seurat

Merge Seurat Objects

Description

Merge Seurat Objects

Usage

```
## S3 method for class 'Seurat'
merge(
  x = NULL,
  y = NULL,
  add.cell.ids = NULL,
  collapse = FALSE,
  merge.data = TRUE,
  merge.dr = FALSE,
  project = getOption(x = "Seurat.object.project", default = "SeuratProject"),
  ...
)
```

Arguments

x	A Seurat object
y	A single Seurat object or a list of Seurat objects
add.cell.ids	A character vector of length(<code>x = c(x, y)</code>); appends the corresponding values to the start of each objects' cell names
collapse	If TRUE, merge layers of the same name together; if FALSE, appends labels to the layer name
merge.data	Merge the data slots instead of just merging the counts (which requires renormalization); this is recommended if the same normalization approach was applied to all objects
merge.dr	Choose how to handle merging dimensional reductions:

- “TRUE”: merge dimensional reductions with the same name across objects; dimensional reductions with different names are added as-is
- “NA”: keep dimensional reductions from separate objects separate; will append the project name for duplicate reduction names
- “FALSE”: do not add dimensional reductions

project [Project](#) name for the Seurat object
 ... Arguments passed to other methods

Value

merge: Merged object

Merge Details

When merging Seurat objects, the merge procedure will merge the Assay level counts and potentially the data slots (depending on the `merge.data` parameter). It will also merge the cell-level meta data that was stored with each object and preserve the cell identities that were active in the objects pre-merge. The merge will optionally merge reductions depending on the values passed to `merge.dr` if they have the same name across objects. Here the embeddings slots will be merged and if there are differing numbers of dimensions across objects, only the first N shared dimensions will be merged. The feature loadings slots will be filled by the values present in the first object. The merge will not preserve graphs, logged commands, or feature-level metadata that were present in the original objects. If `add.cell.ids` isn't specified and any cell names are duplicated, cell names will be appended with `_X`, where X is the numeric index of the object in `c(x, y)`.

See Also

Seurat object, validity, and interaction methods [\\$.Seurat\(\)](#), [Seurat-class](#), [Seurat-validity](#), [\[\[.Seurat\(\)](#), [\[\[<-, Seurat](#), [\[\[<-, Seurat, NULL, dim.Seurat\(\)](#), [dimnames.Seurat\(\)](#), [names.Seurat\(\)](#), [subset.Seurat\(\)](#)

Examples

```
# `merge` examples
# merge two objects
merge(pbmc_small, y = pbmc_small)
# to merge more than two objects, pass one to x and a list of objects to y
merge(pbmc_small, y = c(pbmc_small, pbmc_small))
```

Misc

Get and set miscellaneous data

Description

Get and set miscellaneous data

Usage

```
Misc(object, ...)  
  
Misc(object, ...) <- value  
  
## S3 method for class 'Assay'  
Misc(object, slot = NULL, ...)  
  
## S3 replacement method for class 'Assay'  
Misc(object, slot, ...) <- value  
  
## S3 method for class 'Assay5'  
Misc(object, slot = NULL, ...)  
  
## S3 replacement method for class 'Assay5'  
Misc(object, slot, ...) <- value  
  
## S3 method for class 'DimReduc'  
Misc(object, slot = NULL, ...)  
  
## S3 replacement method for class 'DimReduc'  
Misc(object, slot, ...) <- value  
  
## S3 method for class 'Seurat'  
Misc(object, slot = NULL, ...)  
  
## S3 replacement method for class 'Seurat'  
Misc(object, slot, ...) <- value
```

Arguments

object	An object
...	Arguments passed to other methods
value	Data to add
slot	Name of specific bit of meta data to pull

Value

Miscellaneous data
An object with miscellaneous data added

Examples

```
# Get the misc info  
Misc(object = pbmc_small, slot = "example")  
  
# Add misc info  
Misc(object = pbmc_small, slot = "example") <- "testing_misc"
```

Molecules-class	<i>The Spatial Molecules Class</i>
-----------------	------------------------------------

Description

The Spatial Molecules Class

Slots

.Data A list of [SpatialPoints](#) objects

key The key for the Molecules

See Also

Molecules methods: [Molecules-methods](#)

Segmentation layer classes: [Centroids-class](#), [Centroids-methods](#), [Molecules-methods](#), [Segmentation-class](#), [Segmentation-methods](#)

Molecules-methods	<i>Molecules Methods</i>
-------------------	--------------------------

Description

Methods for [Molecules](#) objects

Usage

```
## S3 method for class 'Molecules'
Features(x, ...)

## S3 method for class 'Molecules'
GetTissueCoordinates(object, features = NULL, ...)

## S3 method for class 'Molecules'
subset(x, features = NULL, ...)

## S4 method for signature 'Molecules'
show(object)
```

Arguments

x, object	A Molecules object
...	Arguments passed to other methods
features	A vector of molecule names to keep; if NULL, defaults to all molecules

Details

Features: Get spatially-resolved molecule names

GetTissueCoordinates: Get spatially-resolved molecule coordinates

subset: Subset a Molecules object to certain molecules

show: Display an object summary to stdout

Value

Features: A vector of spatially-resolved molecule names; if no molecular information present, returns NULL

GetTissueCoordinates: A data frame with three columns:

- “x”: the x-coordinate of a molecule
- “y”: the y-coordinate of a molecule
- “molecule”: the molecule name

subset: x subsetted to the features specified by features

show: Invisibly returns NULL

See Also

[Molecules-class](#)

Segmentation layer classes: [Centroids-class](#), [Centroids-methods](#), [Molecules-class](#), [Segmentation-class](#), [Segmentation-methods](#)

names.Seurat

Subobject Names

Description

Get the names of subobjects within a [Seurat](#) object

Usage

```
## S3 method for class 'Seurat'
names(x)
```

Arguments

x A [Seurat](#) object

Value

The names of all of the following subobjects within x:

- [v3](#) and [v5](#) assays
- [dimensional reductions](#)
- [images](#) and [FOVs](#)
- [nearest-neighbor graphs](#)

See Also

Seurat object, validity, and interaction methods `$.Seurat()`, `Seurat-class`, `Seurat-validity`, `[[.Seurat()`, `[[<-,Seurat`, `[[<-,Seurat, NULL`, `dim.Seurat()`, `dimnames.Seurat()`, `merge.Seurat()`, `subset.Seurat()`

Examples

```
names(pbmc_small)
```

Neighbor-class	<i>The Neighbor class</i>
----------------	---------------------------

Description

The Neighbor class is used to store the results of neighbor finding algorithms

Slots

`nn.idx` Matrix containing the nearest neighbor indices
`nn.dist` Matrix containing the nearest neighbor distances
`alg.idx` The neighbor finding index (if applicable). E.g. the annoy index
`alg.info` Any information associated with the algorithm that may be needed downstream (e.g. distance metric used with annoy is needed when reading in from stored file).
`cell.names` Names of the cells for which the neighbors have been computed.

Neighbor-methods	Neighbor <i>Methods</i>
------------------	-------------------------

Description

Methods for `Neighbor` objects for generics defined in other packages

Usage

```
## S3 method for class 'Neighbor'
dim(x)

## S4 method for signature 'Neighbor'
show(object)
```

Arguments

`x`, `object` A `Neighbor` object

Value

`dim` Dimensions of the indices matrix
`show`: Prints summary to `stdout` and invisibly returns `NULL`

Functions

- `dim(Neighbor)`: Dimensions of the neighbor indices
- `show(Neighbor)`: Overview of a Neighbor object

 Overlay

Overlay Spatial Objects Over One Another

Description

Create an overlay of some query spatial object (x) against some target object (y). Basically, find all components of a query that fall within the bounds of a target spatial region

Usage

```
Overlay(x, y, invert = FALSE, ...)

## S4 method for signature 'Centroids,SpatialPolygons'
Overlay(x, y, invert = FALSE, ...)

## S4 method for signature 'Segmentation,SpatialPolygons'
Overlay(x, y, invert = FALSE, ...)

## S4 method for signature 'Molecules,SpatialPolygons'
Overlay(x, y, invert = FALSE, ...)

## S4 method for signature 'FOV,Spatial'
Overlay(x, y, invert = FALSE, ...)

## S4 method for signature 'FOV,SpatialPolygons'
Overlay(x, y, invert = FALSE, ...)

## S4 method for signature 'FOV,FOV'
Overlay(x, y, invert = FALSE, ...)
```

Arguments

x	Query Spatial object
y	Target Spatial object
invert	Invert the overlay and return only the components of x that fall <i>outside</i> the bounds of y
...	Ignored

Value

x with only the components that fall within the bounds of y

Note

This function requires the **sf** package to be installed

PackageCheck	<i>Check the existence of a package</i>
--------------	---

Description

Check the existence of a package

Usage

```
PackageCheck(..., error = TRUE)
```

Arguments

...	Package names
error	If true, throw an error if the package doesn't exist

Value

Invisibly returns boolean denoting if the package is installed

Lifecycle**[Deprecated]**

PackageCheck was deprecated in version 5.0.0; please use [rlang::check_installed\(\)](#) instead

Examples

```
PackageCheck("SeuratObject", error = FALSE)
```

pbmc_small	<i>A small example version of the PBMC dataset</i>
------------	--

Description

A subsetted version of 10X Genomics' 3k PBMC dataset

Usage

```
pbmc_small
```

Format

A Seurat object with the following slots filled

assays Currently only contains one assay ("RNA" - scRNA-seq expression data)

counts - Raw expression data

- data - Normalized expression data
- scale.data - Scaled expression data
- var.features - names of the current features selected as variable
- meta.features - Assay level metadata such as mean and variance

meta.data Cell level metadata

active.assay Current default assay

active.ident Current default ident

graphs Neighbor graphs computed, currently stores the SNN

reductions Dimensional reductions: currently PCA and tSNE

version Seurat version used to create the object

commands Command history

Source

<https://support.10xgenomics.com/single-cell-gene-expression/datasets/1.1.0/pbmc3k>

print.DimReduc

Print Top Feature Loadings

Description

Prints a set of features that most strongly define a set of components; **note:** requires feature loadings to be present in order to work

Usage

```
## S3 method for class 'DimReduc'
print(x, dims = 1:5, nfeatures = 20, projected = FALSE, ...)
```

Arguments

x	A DimReduc object
dims	Number of dimensions to display
nfeatures	Number of genes to display
projected	Use projected slot
...	Ignored

Value

Displays set of features defining the components and invisibly returns x

See Also[cat](#)

Dimensional reduction object, validity, and interaction methods [CreateDimReducObject\(\)](#), [DimReduc-class](#), [DimReduc-validity](#), [\[.DimReduc\(\)\]](#), [\[\[.DimReduc\(\)\]](#), [dim.DimReduc\(\)](#), [merge.DimReduc\(\)](#), [subset.DimReduc\(\)](#)

Examples

```
pca <- pbmc_small[["pca"]]
print(pca)
```

Project

Get and set project information

Description

Get and set project information

Usage

```
Project(object, ...)

Project(object, ...) <- value

## S3 method for class 'Seurat'
Project(object, ...)

## S3 replacement method for class 'Seurat'
Project(object, ...) <- value
```

Arguments

object	An object
...	Arguments passed to other methods
value	Project information to set

Value

Project information
 An object with project information added

Radius	<i>Get the spot radius from an image</i>
--------	--

Description

Get the spot radius from an image

Usage

```
Radius(object, ...)
```

Arguments

object	An image object
...	Arguments passed to other methods

Value

The radius size

RandomName	<i>Generate a random name</i>
------------	-------------------------------

Description

Make a name from randomly sampled characters, pasted together with no spaces

Usage

```
RandomName(length = 5L, chars = letters, ...)
```

Arguments

length	How long should the name be
chars	A vector of 1-length characters to use to generate the name
...	Extra parameters passed to sample

Value

A character with `nchar == length` of randomly sampled letters

See Also

[sample](#)

Examples

```
set.seed(42L)
RandomName()
RandomName(7L, replace = TRUE)
```

RenameAssays	<i>Rename assays in a Seurat object</i>
--------------	---

Description

Rename assays in a Seurat object

Usage

```
RenameAssays(  
  object,  
  assay.name = NULL,  
  new.assay.name = NULL,  
  verbose = TRUE,  
  ...  
)
```

Arguments

object	A Seurat object
assay.name	original name of assay
new.assay.name	new name of assay
verbose	Whether to print messages
...	Named arguments as <code>old.assay = new.assay</code>

Value

object with assays renamed

Examples

```
RenameAssays(object = pbmc_small, RNA = 'rna')
```

RenameCells	<i>Rename cells</i>
-------------	---------------------

Description

Change the cell names in all the different parts of an object. Can be useful before combining multiple objects.

Usage

```

RenameCells(object, ...)

## S3 method for class 'Assay'
RenameCells(object, new.names = NULL, ...)

## S3 method for class 'Assay5'
RenameCells(object, new.names = NULL, ...)

## S3 method for class 'DimReduc'
RenameCells(object, new.names = NULL, ...)

## S3 method for class 'Neighbor'
RenameCells(object, old.names = NULL, new.names = NULL, ...)

## S3 method for class 'Seurat'
RenameCells(
  object,
  add.cell.id = missing_arg(),
  new.names = missing_arg(),
  for.merge = deprecated(),
  ...
)

```

Arguments

object	An object
...	Arguments passed to other methods
new.names	vector of new cell names
old.names	vector of old cell names
add.cell.id	prefix to add cell names
for.merge	Deprecated

Details

If `add.cell.id` is set a prefix is added to existing cell names. If `new.names` is set these will be used to replace existing names.

Value

An object with new cell names

Examples

```

# Rename cells in an Assay
head(x = colnames(x = pbmc_small[["RNA"]]))
renamed.assay <- RenameCells(
  pbmc_small[["RNA"]],
  new.names = paste0("A_", colnames(x = pbmc_small[["RNA"]]))
)
head(x = colnames(x = renamed.assay))

```

```

# Rename cells in a DimReduc
head(x = Cells(x = pbmc_small[["pca"]]))
renamed.dimreduc <- RenameCells(
  object = pbmc_small[["pca"]],
  new.names = paste0("A_", Cells(x = pbmc_small[["pca"]]))
)
head(x = Cells(x = renamed.dimreduc))

# Rename cells in a Seurat object
head(x = colnames(x = pbmc_small))
pbmc_small <- RenameCells(object = pbmc_small, add.cell.id = "A")
head(x = colnames(x = pbmc_small))

```

RowMergeSparseMatrices

Merge Sparse Matrices by Row

Description

Merge two or more sparse matrices by rowname.

Usage

```
RowMergeSparseMatrices(mat1, mat2)
```

Arguments

mat1	First matrix
mat2	Second matrix or list of matrices

Details

Shared matrix rows (with the same row name) will be merged, and unshared rows (with different names) will be filled with zeros in the matrix not containing the row.

Value

Returns a sparse matrix

SaveSeuratRds

Save and Load Seurat Objects from Rds files

Description

Save and Load Seurat Objects from Rds files

Usage

```
SaveSeuratRds(
  object,
  file = NULL,
  move = TRUE,
  destdir = deprecated(),
  relative = FALSE,
  ...
)

LoadSeuratRds(file, ...)
```

Arguments

object	A Seurat object
file	Path to save object to; defaults to <code>file.path(getwd(), paste0(Project(object), ".Rds"))</code>
move	Move on-disk layers into <code>dirname(file)</code>
destdir	[Deprecated]
relative	Save relative paths instead of absolute ones
...	Arguments passed on to base::saveRDS , base::readRDS
ascii	a logical. If TRUE or NA, an ASCII representation is written; otherwise (default), a binary one is used. See the comments in the help for save .
version	the workspace format version to use. NULL specifies the current default version (3). The only other supported value is 2, the default from R 1.4.0 to R 3.5.0.
compress	a logical specifying whether saving to a named file is to use "gzip" compression, or one of "gzip", "bzip2" or "xz" to indicate the type of compression to be used. Ignored if file is a connection.
refhook	a hook function for handling reference objects.

Value

Invisibly returns file

Progress Updates with progressr

This function uses **progressr** to render status updates and progress bars. To enable progress updates, wrap the function call in [with_progress](#) or run [handlers\(global = TRUE\)](#) before running this function. For more details about **progressr**, please read [vignette\("progressr-intro"\)](#)

Note

This function requires the **fs** package to be installed

See Also

[saveRDS\(\)](#) [readRDS\(\)](#)

Examples

```

if (requireNamespace("fs", quietly = TRUE)) {
  # Write out with DelayedArray
  if (requireNamespace("HDF5Array", quietly = TRUE)) {
    pbmc <- pbmc_small

    pbmc[["disk"]] <- CreateAssay5Object(list(
      mem = LayerData(pbmc, "counts"),
      disk = as(LayerData(pbmc, "counts"), "HDF5Array")
    ))

    # Save `pbmc` to an Rds file
    out <- tempfile(fileext = ".Rds")
    SaveSeuratRds(pbmc, file = out)

    # Object cache
    obj <- readRDS(out)
    Tool(obj, "SaveSeuratRds")

    # Load the saved object with on-disk layers back into memory
    pbmc2 <- LoadSeuratRds(out)
    pbmc2
    pbmc2[["disk"]]
  }

  # Write out with BPCells
  if (requireNamespace("BPCells", quietly = TRUE)) {
    pbmc <- pbmc_small

    bpm <- BPCells::write_matrix_dir(LayerData(pbmc, "counts"), dir = tempfile())
    bph <- BPCells::write_matrix_hdf5(
      LayerData(pbmc, "counts"),
      path = tempfile(fileext = ".h5"),
      group = "counts"
    )
    pbmc[["disk"]] <- CreateAssay5Object(list(dir = bpm, h5 = bph))

    # Save `pbmc` to an Rds file
    out <- tempfile(fileext = ".Rds")
    SaveSeuratRds(pbmc, file = out)

    # Object cache
    obj <- readRDS(out)
    Tool(obj, "SaveSeuratRds")

    # Load the saved object with on-disk layers back into memory
    pbmc2 <- LoadSeuratRds(out)
    pbmc2
    pbmc2[["disk"]]
  }
}

```

Description

The Segmentation Class

See Also

Segmentation methods: [Segmentation-methods](#)

Segmentation layer classes: [Centroids-class](#), [Centroids-methods](#), [Molecules-class](#), [Molecules-methods](#), [Segmentation-methods](#)

Segmentation-methods Segmentation *Methods*

Description

Methods for [Segmentation](#) objects

Usage

```
## S3 method for class 'Segmentation'
Cells(x, ...)

## S3 method for class 'Segmentation'
GetTissueCoordinates(object, full = TRUE, ...)

## S3 method for class 'Segmentation'
RenameCells(object, new.names = NULL, ...)

## S3 method for class 'Segmentation'
lengths(x, use.names = TRUE)

## S3 method for class 'Segmentation'
subset(x, cells = NULL, ...)

## S4 method for signature 'Segmentation,ANY,ANY,ANY'
x[i, j, ..., drop = TRUE]

## S4 method for signature 'Segmentation'
coordinates(obj, full = TRUE, ...)

## S4 method for signature 'Segmentation'
show(object)
```

Arguments

x, object, obj	A Segmentation object
...	Arguments passed to other methods
full	Expand the coordinates to the full polygon
new.names	vector of new cell names
use.names	Ignored
i, cells	A vector of cells to keep; if NULL, defaults to all cells
j, drop	Ignored

Details

Cells: Get cell names

GetTissueCoordinates, coordinates: Get tissue coordinates

RenameCells: Update cell names

lengths: Generate a run-length encoding of the cells present

subset, [: Subset a Segmentation object to certain cells

show: Display an object summary to stdout

Value

Cells: A vector of cell names

GetTissueCoordinates, coordinates: A data frame with three columns:

- “x”: the x-coordinate
- “y”: the y-coordinate
- “cell” or “ID”: the cell name

If full is TRUE, then each coordinate will indicate a vertex for the cell polygon; otherwise, each coordinate will indicate a centroid for the cell. Note: GetTissueCoordinates

RenameCells: object with the cells renamed to new.names

lengths: An [rle](#) object for the cells

subset, [: x subsetted to the cells specified by cells/i

show: Invisibly returns NULL

Progress Updates with progressr

The following methods use **progressr** to render status updates and progress bars:

- RenameCells

To enable progress updates, wrap the function call in [with_progress](#) or run `handlers(global = TRUE)` before running this function. For more details about **progressr**, please read `vignette("progressr-intro")`

Parallelization with future

The following methods use **future** to enable parallelization:

- RenameCells

Parallelization strategies can be set using [plan](#). Common plans include “sequential” for non-parallelized processing or “multisession” for parallel evaluation using multiple R sessions; for other plans, see the “Implemented evaluation strategies” section of `?future::plan`. For a more thorough introduction to **future**, see `vignette("future-1-overview")`

See Also

[Segmentation-class](#)

Segmentation layer classes: [Centroids-class](#), [Centroids-methods](#), [Molecules-class](#), [Molecules-methods](#), [Segmentation-class](#)

set-if-null	<i>Set If or If Not</i> NULL
-------------	------------------------------

Description

Set a default value depending on if an object is NULL

Usage

```
x %||% y
```

```
x %iff% y
```

Arguments

x An object to test

y A default value

Value

For %||%: y if x is NULL; otherwise x

For %iff%: y if x is **not** NULL; otherwise x

Author(s)

For %||%: **rlang** developers

See Also

[rlang::%||%](#)

Examples

```
# Set if NULL
1 %||% 2
NULL %||% 2

# Set if *not* NULL
1 %iff% 2
NULL %iff% 2
```

Seurat-class	<i>The Seurat Class</i>
--------------	-------------------------

Description

The Seurat object is a representation of single-cell expression data for R; each Seurat object revolves around a set of cells and consists of one or more [Assay](#) objects, or individual representations of expression data (eg. RNA-seq, ATAC-seq, etc). These assays can be reduced from their high-dimensional state to a lower-dimension state and stored as [DimReduc](#) objects. Seurat objects also store additional metadata, both at the cell and feature level (contained within individual assays). The object was designed to be as self-contained as possible, and easily extendable to new methods.

Slots

`assays` A list of assays for this project
`meta.data` Contains meta-information about each cell, starting with number of features detected (`nFeature`) and the original identity class (`orig.ident`); more information is added using [AddMetaData](#)
`active.assay` Name of the active, or default, assay; settable using [DefaultAssay](#)
`active.ident` The active cluster identity for this Seurat object; settable using [Idents](#)
`graphs` A list of [Graph](#) objects
`neighbors` ...
`reductions` A list of dimensional reduction objects for this object
`images` A list of spatial image objects
`project.name` Name of the project
`misc` A list of miscellaneous information
`version` Version of Seurat this object was built under
`commands` A list of logged commands run on this Seurat object
`tools` A list of miscellaneous data generated by other tools, should be filled by developers only using [Tool<-](#)

See Also

Seurat object, validity, and interaction methods [\\$.Seurat\(\)](#), [Seurat-validity](#), [\[\[.Seurat\(\)](#), [\[\[<-, Seurat](#), [\[\[<-, Seurat, NULL](#), [dim.Seurat\(\)](#), [dimnames.Seurat\(\)](#), [merge.Seurat\(\)](#), [names.Seurat\(\)](#), [subset.Seurat\(\)](#)

Seurat-validity	<i>Seurat Object Validity</i>
-----------------	-------------------------------

Description

Validation of Seurat objects is handled by [validObject](#)

See Also

[validObject](#)
 Seurat object, validity, and interaction methods [\\$.Seurat\(\)](#), [Seurat-class](#), [\[\[.Seurat\(\)](#), [\[\[<-, Seurat](#), [\[\[<-, Seurat, NULL](#), [dim.Seurat\(\)](#), [dimnames.Seurat\(\)](#), [merge.Seurat\(\)](#), [names.Seurat\(\)](#), [subset.Seurat\(\)](#)

SeuratCommand-class *The SeuratCommand Class*

Description

The SeuratCommand is used for logging commands that are run on a Seurat object; it stores parameters and timestamps

Slots

name Command name
time.stamp Timestamp of when command was tun
assay.used Optional name of assay used to generate SeuratCommand object
call.string String of the command call
params List of parameters used in the command call

See Also

Command log object and interaction methods [\\$.SeuratCommand\(\)](#), [.DollarNames.SeuratCommand\(\)](#), [LogSeuratCommand\(\)](#), [\[.SeuratCommand\(\)](#), [as.list.SeuratCommand\(\)](#)

show, LogMap-method [LogMap Object Overview](#)

Description

Overview of a [LogMap](#) object

Usage

```
## S4 method for signature 'LogMap'  
show(object)
```

Arguments

object A [LogMap](#) object

Value

Prints summary to [stdout](#) and invisibly returns NULL

Simplify

*Simplify Geometry***Description**

Simplify Geometry

Simplify segmentations by reducing the number of vertices

Usage

```
Simplify(coords, tol, topologyPreserve = TRUE)
```

```
## S3 method for class 'Spatial'
```

```
Simplify(coords, tol, topologyPreserve = TRUE)
```

Arguments

coords A ‘Segmentation’ object

tol Numerical tolerance value to be used by the Douglas-Peucker algorithm

topologyPreserve

Logical determining if the algorithm should attempt to preserve the topology of the original geometry

Value

A simplified version of coords

A ‘Segmentation’ object with simplified segmentation vertices

SpatialImage-class

*The SpatialImage class***Description**

The SpatialImage class is a virtual class representing spatial information for Seurat. All spatial image information must inherit from this class for use with Seurat objects

Slots

assay Name of assay to associate image data with; will give this image priority for visualization when the assay is set as the active/default assay in a Seurat object

key A one-length character vector with the object’s key; keys must be one or more alphanumeric characters followed by an underscore “_” (regex pattern “^[a-zA-Z][a-zA-Z0-9]*_\$”)

See Also

[SpatialImage-methods](#) for a list of required and provided methods

SpatialImage-methods SpatialImage *methods*

Description

Methods defined on the [SpatialImage](#) class. Some of these methods must be overridden in order to ensure proper functionality of the derived classes (see **Required methods** below). Other methods are designed to work across all SpatialImage-derived subclasses, and should only be overridden if necessary

Usage

```
## S3 method for class 'SpatialImage'  
Cells(x, ...)  
  
## S3 method for class 'SpatialImage'  
DefaultAssay(object, ...)  
  
## S3 replacement method for class 'SpatialImage'  
DefaultAssay(object, ...) <- value  
  
## S3 method for class 'SpatialImage'  
GetImage(object, mode = c("grob", "raster", "plotly", "raw"), ...)  
  
## S3 method for class 'SpatialImage'  
GetTissueCoordinates(object, ...)  
  
## S3 method for class 'SpatialImage'  
IsGlobal(object, ...)  
  
## S3 method for class 'SpatialImage'  
Key(object, ...)  
  
## S3 replacement method for class 'SpatialImage'  
Key(object, ...) <- value  
  
## S3 method for class 'SpatialImage'  
Radius(object, ...)  
  
## S3 method for class 'SpatialImage'  
RenameCells(object, new.names = NULL, ...)  
  
## S3 method for class 'SpatialImage'  
x[i, ...]  
  
## S3 method for class 'SpatialImage'  
dim(x)  
  
## S3 method for class 'SpatialImage'  
subset(x, cells, ...)
```

```
## S4 method for signature 'SpatialImage'
show(object)
```

Arguments

x, object	A SpatialImage-derived object
...	Arguments passed to other methods
value	Depends on the method: DefaultAssay<- Assay that the image should be associated with Key<- New key for the image
mode	How to return the image; should accept one of “grob”, “raster”, “plotly”, or “raw”
new.names	vector of new cell names
i, cells	A vector of cells to keep

Value

[Override] Cells: should return cell names
DefaultAssay: The associated assay of a SpatialImage-derived object
DefaultAssay<-: object with the associated assay updated
[Override] GetImage: The image data from a SpatialImage-derived object
[Override] GetTissueCoordinates: ...
IsGlobal: returns TRUE as images are, by default, global
Key: The key for a SpatialImage-derived object
Key<-: object with the key set to value
Radius: The spot radius size; by default, returns NULL
[Override] RenameCells: object with the new cell names
[, subset: x/object for only the cells requested
[Override] dim: The dimensions of the image data in (Y, X) format
show: Prints summary to [stdout](#) and invisibly returns NULL

Functions

- Cells(SpatialImage): Get the cell names from an image (**[Override]**)
- DefaultAssay(SpatialImage): Get the associated assay of a SpatialImage-derived object
- DefaultAssay(SpatialImage) <- value: Set the associated assay of a SpatialImage-derived object
- GetImage(SpatialImage): Get the image data from a SpatialImage-derived object
- GetTissueCoordinates(SpatialImage): Get tissue coordinates for a SpatialImage-derived object (**[Override]**)
- IsGlobal(SpatialImage): Globality test for SpatialImage-derived object
- Key(SpatialImage): Get the key for a SpatialImage-derived object
- Key(SpatialImage) <- value: Set the key for a SpatialImage-derived object
- Radius(SpatialImage): Get the spot radius size

- `RenameCells(SpatialImage)`: Rename cells in a `SpatialImage`-derived object (**[Override]**)
- `[]`: Subset a `SpatialImage`-derived object
- `dim(SpatialImage)`: Get the plotting dimensions of an image (**[Override]**)
- `subset(SpatialImage)`: Subset a `SpatialImage`-derived object (**[Override]**)
- `show(SpatialImage)`: Overview of a `SpatialImage`-derived object

Provided methods

These methods are defined on the `SpatialImage` object and should not be overridden without careful thought

- `DefaultAssay` and `DefaultAssay<-`
- `Key` and `Key<-`
- `GetImage`; this method *can* be overridden to provide image data, normally returns empty image data. If overridden, should default to returning a `grob` object
- `IsGlobal`
- `Radius`; this method *can* be overridden to provide a spot radius for image objects
- `[]`; this method *can* be overridden to change default subset behavior, normally returns `subset(x = x, cells = i)`. If overridden, should only accept `i`

Required methods

All subclasses of the `SpatialImage` class must define the following methods; simply relying on the `SpatialImage` method will result in errors. For required parameters and their values, see the `Usage` and `Arguments` sections

`Cells` Return the cell/spot barcodes associated with each position

`dim` Return the dimensions of the image for plotting in (Y, X) format

`GetTissueCoordinates` Return tissue coordinates; by default, must return a two-column `data.frame` with x-coordinates in the first column and y-coordinates in the second

`Radius` Return the spot radius; returns `NULL` by default for use with non-spot image technologies

`RenameCells` Rename the cell/spot barcodes for this image

`subset` Subset the image data by cells/spots

These methods are used throughout Seurat, so defining them and setting the proper defaults will allow subclasses of `SpatialImage` to work seamlessly

See Also

`DefaultAssay`

`GetImage`

`GetTissueCoordinates`

`IsGlobal`

`Key`

`RenameCells`

split.Assay

Split an Assay

Description

Split an Assay

Usage

```
## S3 method for class 'Assay'
split(x, f, drop = FALSE, layers = NA, ...)
```

Arguments

x	An <i>Assay</i> object
f	a ‘factor’ in the sense that as.factor(f) defines the grouping, or a list of such factors in which case their interaction is used for the grouping. If x is a data frame, f can also be a formula of the form $\sim g$ to split by the variable g, or more generally of the form $\sim g_1 + \dots + g_k$ to split by the interaction of the variables g_1, \dots, g_k , where these variables are evaluated in the data frame x using the usual non-standard evaluation rules.
drop	logical indicating if levels that do not occur should be dropped (if f is a factor or a list).
layers	Names of layers to include in the split; pass NA for all layers; pass NULL for the default layer
...	Ignored

Value

Returns a v5 assay with splitted layers

See Also

v3 Assay object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [Assay-validity](#), [CreateAssayObject\(\)](#), [\[.Assay\(\)](#), [\[\[.Assay\(\)](#), [dim.Assay\(\)](#), [dimnames.Assay\(\)](#), [merge.Assay\(\)](#), [subset.Assay\(\)](#)

split.Assay5

Split an Assay

Description

Split an Assay

Usage

```
## S3 method for class 'Assay5'
split(
  x,
  f,
  drop = FALSE,
  layers = c("counts", "data"),
  ret = c("assay", "multiassays", "layers"),
  ...
)
```

Arguments

x	An Assay5 object
f	a ‘factor’ in the sense that as.factor(f) defines the grouping, or a list of such factors in which case their interaction is used for the grouping. If x is a data frame, f can also be a formula of the form $\sim g$ to split by the variable g, or more generally of the form $\sim g_1 + \dots + g_k$ to split by the interaction of the variables g_1, \dots, g_k , where these variables are evaluated in the data frame x using the usual non-standard evaluation rules.
drop	logical indicating if levels that do not occur should be dropped (if f is a factor or a list).
layers	Names of layers to include in the split; pass NA for all layers; pass NULL for the default layer
ret	Type of return value; choose from: <ul style="list-style-type: none"> • “assay”: a single Assay5 object • “multiassay”: a list of Assay5 objects • “layers”: a list of layer matrices
...	Ignored

Value

Depends on the value of ret:

- “assay”: x with the layers requested in layers split based on f; all other layers are left as-is
- “multiassay”: a list of [Assay5](#) objects; the list contains one value per split and each assay contains only the layers requested in layers with the [key](#) set to the split
- “layers”: a list of matrices of length $\text{length}(\text{assays}) * \text{length}(\text{unique}(f))$; the list is named as “layer.split”

Progress Updates with progressr

This function uses **progressr** to render status updates and progress bars. To enable progress updates, wrap the function call in [with_progress](#) or run [handlers\(global = TRUE\)](#) before running this function. For more details about **progressr**, please read [vignette\("progressr-intro"\)](#)

See Also

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-class](#), [Assay5-validity](#), [\[.Assay5\(\)](#), [\[\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [merge.Assay5\(\)](#), [subset.Assay5\(\)](#)

Stdev	<i>Get the standard deviations for an object</i>
-------	--

Description

Get the standard deviations for an object

Usage

```
Stdev(object, ...)
```

```
## S3 method for class 'DimReduc'
```

```
Stdev(object, ...)
```

```
## S3 method for class 'Seurat'
```

```
Stdev(object, reduction = "pca", ...)
```

Arguments

object	An object
...	Arguments passed to other methods
reduction	Name of reduction to use

Value

The standard deviations

Examples

```
# Get the standard deviations for each PC from the DimReduc object
```

```
Stdev(object = pbmc_small[["pca"]])
```

```
# Get the standard deviations for each PC from the Seurat object
```

```
Stdev(object = pbmc_small, reduction = "pca")
```

StitchMatrix	<i>Stitch Matrices Together</i>
--------------	---------------------------------

Description

Stitch Matrices Together

Usage

```
StitchMatrix(x, y, rowmap, colmap, ...)
```

Arguments

x	A matrix
y	One or more matrices of the same class or coercible to the same class as x
rowmap, colmap	LogMaps describing the row and cell membership of each matrix; the LogMap entries are assumed to be in the order of c(x, y)
...	Arguments passed to other methods

Value

A single matrix of type class(x) consisting of all values in component matrices

subset.Assay	<i>Subset an Assay</i>
--------------	------------------------

Description

Subset an Assay

Usage

```
## S3 method for class 'Assay'
subset(x, cells = NULL, features = NULL, ...)
```

Arguments

x	An Assay object
cells	Cell names
features	Feature names
...	Ignored

Value

x with just the cells and features specified by cells and features

See Also

v3 Assay object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [Assay-validity](#), [CreateAssayObject\(\)](#), [\[.Assay\(\)](#), [\[\[.Assay\(\)](#), [dim.Assay\(\)](#), [dimnames.Assay\(\)](#), [merge.Assay\(\)](#), [split.Assay\(\)](#)

Examples

```
rna <- pbmc_small[["RNA"]]
rna2 <- subset(rna, features = VariableFeatures(rna))
rna2
```

subset.Assay5 *Subset an Assay*

Description

Subset an Assay

Usage

```
## S3 method for class 'Assay5'
subset(x, cells = NULL, features = NULL, layers = NULL, ...)
```

Arguments

x	An Assay5 object
cells	Cell names
features	Feature names
layers	Layer to keep; defaults to all layers
...	Ignored

Value

x with just the cells and features specified by cells and features for the layers specified by layers

See Also

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-class](#), [Assay5-validity](#), [\[.Assay5\(\)](#), [\[\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [merge.Assay5\(\)](#), [split.Assay5\(\)](#)

subset.DimReduc *Subset a Dimensional Reduction*

Description

Subset a [DimReduc](#) object

Usage

```
## S3 method for class 'DimReduc'
subset(x, cells = NULL, features = NULL, ...)
```

Arguments

x	A DimReduc object
cells, features	Cells and features to keep during the subset
...	Ignored

Value

x for cells cells and features features

See Also

Dimensional reduction object, validity, and interaction methods [CreateDimReducObject\(\)](#), [DimReduc-class](#), [DimReduc-validity](#), [\[.DimReduc\(\)](#), [\[\[.DimReduc\(\)](#), [dim.DimReduc\(\)](#), [merge.DimReduc\(\)](#), [print.DimReduc\(\)](#)

subset.Seurat

Subset Seurat Objects

Description

Subset Seurat Objects

Usage

```
## S3 method for class 'Seurat'
subset(
  x,
  subset,
  cells = NULL,
  features = NULL,
  idents = NULL,
  return.null = FALSE,
  ...
)

## S3 method for class 'Seurat'
x[i, j, ...]
```

Arguments

x	A Seurat object
subset	Logical expression indicating features/variables to keep
cells, j	A vector of cell names or indices to keep
features, i	A vector of feature names or indices to keep
idents	A vector of identity classes to keep
return.null	If no cells are requested, return a NULL; by default, throws an error
...	Arguments passed to WhichCells

Value

subset: A subsetted Seurat object

[: object x with features i and cells j

See Also[WhichCells](#)

Seurat object, validity, and interaction methods [\\$.Seurat\(\)](#), [Seurat-class](#), [Seurat-validity](#), [\[\[.Seurat\(\)](#), [\[\[<-, Seurat](#), [\[\[<-, Seurat, NULL](#), [dim.Seurat\(\)](#), [dimnames.Seurat\(\)](#), [merge.Seurat\(\)](#), [names.Seurat\(\)](#)

Examples

```
# `subset` examples
subset(pbmc_small, subset = MS4A1 > 4)
subset(pbmc_small, subset = `DLGAP1-AS1` > 2)
subset(pbmc_small, idents = '0', invert = TRUE)
subset(pbmc_small, subset = MS4A1 > 3, slot = 'counts')
subset(pbmc_small, features = VariableFeatures(object = pbmc_small))

# `[` examples
pbmc_small[VariableFeatures(object = pbmc_small), ]
pbmc_small[, 1:10]
```

Theta*Get the offset angle*

Description

Get the offset angle

Usage

Theta(object)

Arguments

object An object

Tool*Get and Set Additional Tool Data*

Description

Use Tool to get tool data. If no additional arguments are provided, will return a vector with the names of tools in the object.

Usage

```

Tool(object, ...)

Tool(object, ...) <- value

## S3 method for class 'Seurat'
Tool(object, slot = NULL, ...)

## S3 replacement method for class 'Seurat'
Tool(object, ...) <- value

```

Arguments

object	An object
...	Arguments passed to other methods
value	Information to be added to tool list
slot	Name of tool to pull

Value

If no additional arguments, returns the names of the tools in the object; otherwise returns the data placed by the tool requested

Note

For developers: set tool data using `Tool<-`. `Tool<-` will automatically set the name of the tool to the function that called `Tool<-`, so each function gets one entry in the tools list and cannot overwrite another function's entry. The automatic naming will also remove any method identifiers (eg. `RunPCA.Seurat` will become `RunPCA`); please plan accordingly

Examples

```

# Example function that adds unstructured data to tools
MyTool <- function(object) {
  sample.tool.output <- matrix(rnorm(n = 16), nrow = 4)
  # Note: `Tool<-` must be called from within a function
  # and the name of the tool will be generated from the function name
  Tool(object) <- sample.tool.output
  return(object)
}

# Run our tool
set.seed(42L)
pbmc_small <- MyTool(pbmc_small)

# Get a list of tools run
Tool(pbmc_small)

# Access specific tool data
Tool(pbmc_small, slot = "MyTool")

```

UpdateSeuratObject	<i>Update old Seurat object to accommodate new features</i>
--------------------	---

Description

Updates Seurat objects to new structure for storing data/calculations. For Seurat v3 objects, will validate object structure ensuring all keys and feature names are formed properly.

Usage

```
UpdateSeuratObject(object)
```

Arguments

object	Seurat object
--------	---------------

Value

Returns a Seurat object compatible with latest changes

Examples

```
## Not run:  
updated_seurat_object = UpdateSeuratObject(object = old_seurat_object)  
  
## End(Not run)
```

UpdateSlots	<i>Update slots in an object</i>
-------------	----------------------------------

Description

Update slots in an object

Usage

```
UpdateSlots(object)
```

Arguments

object	An object to update
--------	---------------------

Value

object with the latest slot definitions

Version	<i>Get Version Information</i>
---------	--------------------------------

Description

Get Version Information

Usage

```
Version(object, ...)

## S3 method for class 'Seurat'
Version(object, ...)
```

Arguments

object	An object
...	Arguments passed to other methods

Examples

```
Version(pbmc_small)
```

WhichCells	<i>Identify cells matching certain criteria</i>
------------	---

Description

Returns a list of cells that match a particular set of criteria such as identity class, high/low values for particular PCs, etc.

Usage

```
WhichCells(object, ...)

## S3 method for class 'Assay'
WhichCells(object, cells = NULL, expression, invert = FALSE, ...)

## S3 method for class 'Seurat'
WhichCells(
  object,
  cells = NULL,
  idents = NULL,
  expression,
  slot = "data",
  invert = FALSE,
  downsample = Inf,
  seed = 1,
  ...
)
```

Arguments

object	An object
...	Arguments passed on to CellsByIdentities return.null If no cells are requested, return a NULL; by default, throws an error
cells	Subset of cell names
expression	A predicate expression for feature/variable expression, can evaluate anything that can be pulled by FetchData ; please note, you may need to wrap feature names in backticks (``) if dashes between numbers are present in the feature name
invert	Invert the selection of cells
idents	A vector of identity classes to keep
slot	Slot to pull feature data for
downsample	Maximum number of cells per identity class, default is Inf; downsampling will happen after all other operations, including inverting the cell selection
seed	Random seed for downsampling. If NULL, does not set a seed

Value

A vector of cell names

See Also

[FetchData](#)

Examples

```
WhichCells(pbmc_small, idents = 2)
WhichCells(pbmc_small, expression = MS4A1 > 3)
levels(pbmc_small)
WhichCells(pbmc_small, idents = c(1, 2), invert = TRUE)
```

[.Assay

Layer Data

Description

Get and set layer data

Usage

```
## S3 method for class 'Assay'
x[i = missing_arg(), j = missing_arg(), ...]

## S4 replacement method for signature 'Assay,character,ANY,ANY'
x[i, j, ...] <- value
```

Arguments

x	An <i>Assay</i> object
i	Name of layer data to get or set
j	Ignored
...	Arguments passed to <i>LayerData</i>
value	A matrix-like object to add as a new layer

Value

[: The layer data for layer i
 [<- : x with layer data value saved as i

See Also

[LayerData](#)

v3 *Assay* object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [Assay-validity](#), [CreateAssayObject\(\)](#), [\[.Assay\(\)](#), [dim.Assay\(\)](#), [dimnames.Assay\(\)](#), [merge.Assay\(\)](#), [split.Assay\(\)](#), [subset.Assay\(\)](#)

Examples

```
rna <- pbmc_small[["RNA"]]

# Get a vector of layer names in this assay
rna[]

# Fetch layer data
rna["data"][1:10, 1:4]

# Set layer data
rna["data"] <- rna["counts"]
rna["data"][1:10, 1:4]
```

[.Assay5

Layer Data

Description

Get and set layer data

Usage

```
## S3 method for class 'Assay5'
x[i = missing_arg(), j = missing_arg(), ...]

## S4 replacement method for signature 'Assay5,character,ANY,ANY'
x[i, j, ...] <- value
```

Arguments

x	An Assay5 object
i	Name of layer data to get or set
j	Ignored
...	Arguments passed to LayerData
value	A matrix-like object to add as a new layer

Value

[: The layer data for layer i
 [<-: x with layer data value saved as i

See Also

[LayerData](#)

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-class](#), [Assay5-validity](#), [\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [merge.Assay5\(\)](#), [split.Assay5\(\)](#), [subset.Assay5\(\)](#)

[.DimReduc

Get Feature Loadings

Description

Pull feature loadings from a [dimensional reduction](#)

Usage

```
## S3 method for class 'DimReduc'
x[i, j, drop = FALSE, ...]
```

Arguments

x	A DimReduc object
i	Feature identifiers or indices
j	Dimension identifiers or indices
drop	Coerce the result to the lowest possible dimension; see drop for further details
...	Arguments passed to other methods

Details

[does not distinguish between projected and unprojected feature loadings; to select whether projected or unprojected loadings should be pulled, please use [Loadings](#)

Value

Feature loadings for features i and dimensions j

See Also[Loadings](#)

Dimensional reduction object, validity, and interaction methods [CreateDimReducObject\(\)](#), [DimReduc-class](#), [DimReduc-validity](#), [\[.DimReduc\(\)](#), [dim.DimReduc\(\)](#), [merge.DimReduc\(\)](#), [print.DimReduc\(\)](#), [subset.DimReduc\(\)](#)

Examples

```
pca <- pbmc_small[["pca"]]
pca[1:10, 1:5]
```

[.SeuratCommand

*Command Log Data Access***Description**

Access data from a SeuratCommand object

Usage

```
## S3 method for class 'SeuratCommand'
x[i, ...]
```

Arguments

x	A SeuratCommand object
i	The name of a command log slot
...	Ignored

Value

[: Slot i from x

See Also

Command log object and interaction methods [\\$.SeuratCommand\(\)](#), [.DollarNames.SeuratCommand\(\)](#), [LogSeuratCommand\(\)](#), [SeuratCommand-class](#), [as.list.SeuratCommand\(\)](#)

Examples

```
cmd <- pbmc_small[["NormalizeData.RNA"]]
cmd["call.string"]
```

[[.Assay

*Feature-Level Meta Data***Description**

Get and set feature-level meta data

Usage

```
## S3 method for class 'Assay'
x[[i, ..., drop = FALSE]]

## S4 replacement method for signature 'Assay,ANY,ANY,ANY'
x[[i, j, ...]] <- value

## S3 method for class 'Assay'
head(x, n = 10L, ...)

## S3 method for class 'Assay'
tail(x, n = 10L, ...)

## S4 replacement method for signature 'Assay,missing,missing,data.frame'
x[[i, j, ...]] <- value
```

Arguments

x	An <i>Assay</i> object
i	Name of feature-level meta data to fetch or add
...	Ignored
drop	See drop
j	Ignored
value	Feature-level meta data to add
n	Number of meta data rows to show

Value

[[: The feature-level meta data for i
 [[<-: x with value added as i in feature-level meta data
 head: The first n rows of feature-level meta data
 tail: the last n rows of feature-level meta data

See Also

v3 Assay object, validity, and interaction methods: [\\$.Assay\(\)](#), [Assay-class](#), [Assay-validity](#), [CreateAssayObject\(\)](#), [\[\[.Assay\(\)](#), [dim.Assay\(\)](#), [dimnames.Assay\(\)](#), [merge.Assay\(\)](#), [split.Assay\(\)](#), [subset.Assay\(\)](#)

Examples

```

rna <- pbmc_small[["RNA"]]

# Pull the entire feature-level meta data data frame
head(rna[[]])

# Pull a specific column of feature-level meta data
head(rna[["vst.mean"]])
head(rna[["vst.mean"], drop = TRUE])

# `head` and `tail` can be used to quickly view feature-level meta data
head(rna)

tail(rna)

```

[[.Assay5

*Feature-Level Meta Data***Description**

Get and set feature-level meta data

Usage

```

## S3 method for class 'Assay5'
x[[i, j, ..., drop = FALSE]]

## S4 replacement method for signature 'Assay5,ANY,ANY,ANY'
x[[i, j, ...]] <- value

## S3 method for class 'Assay5'
head(x, n = 10L, ...)

## S3 method for class 'Assay5'
tail(x, n = 10L, ...)

```

Arguments

x	An Assay5 object
i	Name of feature-level meta data to fetch or add
j	Ignored
...	Ignored
drop	See drop
value	Feature-level meta data to add
n	Number of meta data rows to show

Value

[[: The feature-level meta data for i
 [[<-: x with value added as i in feature-level meta data
 head: The first n rows of feature-level meta data
 tail: the last n rows of feature-level meta data

See Also

v5 Assay object, validity, and interaction methods: [\\$.Assay5\(\)](#), [Assay5-class](#), [Assay5-validity](#),
[\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [merge.Assay5\(\)](#), [split.Assay5\(\)](#), [subset.Assay5\(\)](#)

[[.DimReduc

*Get Cell Embeddings***Description**

Pull cell embeddings from a [dimensional reduction](#)

Usage

```
## S3 method for class 'DimReduc'
x[[i, j, drop = FALSE, ...]]
```

Arguments

x	A DimReduc object
i	Cell names or indices
j	Dimension identifiers or indices
drop	Coerce the result to the lowest possible dimension; see drop for further details
...	Arguments passed to other methods

Value

Cell embeddings for cells i and dimensions j

See Also

[Embeddings](#)

Dimensional reduction object, validity, and interaction methods [CreateDimReducObject\(\)](#), [DimReduc-class](#),
[DimReduc-validity](#), [\[.DimReduc\(\)](#), [dim.DimReduc\(\)](#), [merge.DimReduc\(\)](#), [print.DimReduc\(\)](#),
[subset.DimReduc\(\)](#)

Examples

```
pca <- pbmc_small[["pca"]]
pca[[1:10, 1:5]]
```


[[.Seurat

*Subobjects and Cell-Level Meta Data***Description**

The [[operator pulls either subobjects (eg. `v3` or `v5` assays, [dimensional reduction](#) information, or [nearest-neighbor graphs](#)) or cell-level meta data from a `Seurat` object

Usage

```
## S3 method for class 'Seurat'
x[[i = missing_arg(), ..., drop = FALSE, na.rm = FALSE]]

## S3 method for class 'Seurat'
head(x, n = 10L, ...)

## S3 method for class 'Seurat'
tail(x, n = 10L, ...)
```

Arguments

<code>x</code>	A <code>Seurat</code> object
<code>i</code>	Name of cell-level meta data
<code>...</code>	Ignored
<code>drop</code>	See drop
<code>na.rm</code>	Remove cells where meta data is all NA
<code>n</code>	Number of meta data rows to show

Value

Varies based on the value of `i`:

- If `i` is missing, a data frame with cell-level meta data
- If `i` is a vector with cell-level meta data names, a data frame (or vector of `drop = TRUE`) with cell-level meta data requested
- If `i` is a one-length character with the [name of a subobject](#), the subobject specified by `i`

`head`: The first `n` rows of cell-level metadata

`tail`: The last `n` rows of cell-level metadata

See Also

See [here](#) for adding meta data with `[[<-`, [here](#) for adding subobjects with `[[<-`, and [here](#) for removing subobjects and cell-level meta data with `[[<-`

`Seurat` object, validity, and interaction methods `$.Seurat()`, `Seurat-class`, `Seurat-validity`, `[[<-, Seurat`, `[[<-, Seurat, NULL`, `dim.Seurat()`, `dimnames.Seurat()`, `merge.Seurat()`, `names.Seurat()`, `subset.Seurat()`

Examples

```
# Get the cell-level metadata data frame
head(pbmc_small[[[]])

# Pull specific metadata information
head(pbmc_small[[c("letter.ident", "groups")]])
head(pbmc_small[["groups", drop = TRUE]])

# Get a sub-object (eg. an `Assay` or `DimReduc`)
pbmc_small[["RNA"]]
pbmc_small[["pca"]]

# Get the first 10 rows of cell-level metadata
head(pbmc_small)

# Get the last 10 rows of cell-level metadata
tail(pbmc_small)
```

[[<-,Seurat

*Add Subobjects***Description**

Add subobjects containing expression, dimensional reduction, or other containerized data to a [Seurat](#) object. Subobjects can be accessed with `[[` and manipulated directly within the Seurat object or used independently

Usage

```
## S4 replacement method for signature 'Seurat,character,missing,Assay'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,Assay5'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,DimReduc'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,Graph'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,Neighbor'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,SeuratCommand'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,SpatialImage'
x[[i, j, ...]] <- value
```

Arguments

x	A Seurat object
i	Name to add subobject as
j	Ignored
...	Ignored
value	A valid subobject (eg. a v3 or v5 assay, or a dimensional reduction)

Value

x with value added as i

See Also

See [here](#) for pulling subobjects using `[[`, [here](#) for adding metadata with `[[<-`, and [here](#) for removing subobjects and cell-level meta data with `[[<-`

Seurat object, validity, and interaction methods `$.Seurat()`, `Seurat-class`, `Seurat-validity`, `[[.Seurat()`, `[[<- ,Seurat,NULL`, `dim.Seurat()`, `dimnames.Seurat()`, `merge.Seurat()`, `names.Seurat()`, `subset.Seurat()`

`[[<- ,Seurat,NULL` *Remove Subobjects and Cell-Level Meta Data*

Description

Remove Subobjects and Cell-Level Meta Data

Usage

```
## S4 replacement method for signature 'Seurat,character,missing,NULL'
x[[i, j, ...]] <- value
```

Arguments

x	A Seurat object
i	Name(s) of subobject(s) or cell-level meta data to remove
j	Ignored
...	Ignored
value	NULL

Value

x with i removed from the object

See Also

See [here](#) for pulling subobjects using `[[`, [here](#) for adding metadata with `[[<-`, and [here](#) for adding subobjects with `[[<-`

Seurat object, validity, and interaction methods `$.Seurat()`, `Seurat-class`, `Seurat-validity`, `[[.Seurat()`, `[[<- ,Seurat`, `dim.Seurat()`, `dimnames.Seurat()`, `merge.Seurat()`, `names.Seurat()`, `subset.Seurat()`

\$.Assay	<i>Layer Data</i>
----------	-------------------

Description

Get and set layer data

Usage

```
## S3 method for class 'Assay'
x$i

## S3 replacement method for class 'Assay'
x$i <- value
```

Arguments

x	An <i>Assay</i> object
i	Name of layer data to get or set
value	A matrix-like object to add as a new layer

Value

\$: Layer data for layer i
 \$<-: x with layer data value saved as i

See Also

v3 Assay object, validity, and interaction methods: [Assay-class](#), [Assay-validity](#), [CreateAssayObject\(\)](#), [\\$.Assay\(\)](#), [\[\[.Assay\(\)](#), [dim.Assay\(\)](#), [dimnames.Assay\(\)](#), [merge.Assay\(\)](#), [split.Assay\(\)](#), [subset.Assay\(\)](#)

Examples

```
rna <- pbmc_small[["RNA"]]

# Fetch a layer with `$$`
rna$data[1:10, 1:4]

# Add a layer with `$$`
rna$data <- rna$counts
rna$data[1:10, 1:4]
```

\$.Assay5	<i>Layer Data</i>
-----------	-------------------

Description

Get and set layer data

Usage

```
## S3 method for class 'Assay5'
x$i

## S3 replacement method for class 'Assay5'
x$i <- value
```

Arguments

x	An <i>Assay5</i> object
i	Name of layer data to get or set
value	A matrix-like object to add as a new layer

Value

\$. Layer data for layer i
 \$<-: x with layer data value saved as i

See Also

v5 Assay object, validity, and interaction methods: [Assay5-class](#), [Assay5-validity](#), [\[.Assay5\(\)](#), [\[\[.Assay5\(\)](#), [dim.Assay5\(\)](#), [dimnames.Assay5\(\)](#), [merge.Assay5\(\)](#), [split.Assay5\(\)](#), [subset.Assay5\(\)](#)

\$.Seurat	<i>Cell-Level Meta Data</i>
-----------	-----------------------------

Description

Get and set cell-level meta data

Usage

```
## S3 method for class 'Seurat'
x$i

## S3 replacement method for class 'Seurat'
x$i, ... <- value

## S4 replacement method for signature 'Seurat,character,missing,data.frame'
x[[i, j, ...]] <- value
```

```
## S4 replacement method for signature 'Seurat,missing,missing,data.frame'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,factor'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,list'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,missing,missing,list'
x[[i, j, ...]] <- value

## S4 replacement method for signature 'Seurat,character,missing,vector'
x[[i, j, ...]] <- value
```

Arguments

x	A Seurat object
i	Name of cell-level meta data
...	Ignored
value	A vector to add as cell-level meta data
j	Ignored

Value

\$. Metadata column i for object x; **note:** unlike `[[`, `$` drops the shape of the metadata to return a vector instead of a data frame

`$<-`: x with metadata value saved as i

See Also

Seurat object, validity, and interaction methods [Seurat-class](#), [Seurat-validity](#), [\[\[.Seurat\(\)](#)], [\[\[<- , Seurat](#)], [\[\[<- , Seurat, NULL](#)], [dim.Seurat\(\)](#)], [dimnames.Seurat\(\)](#)], [merge.Seurat\(\)](#)], [names.Seurat\(\)](#)], [subset.Seurat\(\)](#)

Examples

```
# Get metadata using `$$'
head(pbmc_small$groups)

# Add metadata using the `$$' operator
set.seed(42)
pbmc_small$value <- sample(1:3, size = ncol(pbmc_small), replace = TRUE)
head(pbmc_small[["value"]])
```

\$.SeuratCommand	<i>Command Log Parameter Access</i>
------------------	-------------------------------------

Description

Pull parameter values from a [SeuratCommand](#) object

Usage

```
## S3 method for class 'SeuratCommand'  
x$i
```

Arguments

x	A SeuratCommand object
i	A parameter name

Value

The value for parameter i

See Also

Command log object and interaction methods [.DollarNames.SeuratCommand\(\)](#), [LogSeuratCommand\(\)](#), [SeuratCommand-class](#), [\[.SeuratCommand\(\)](#), [as.list.SeuratCommand\(\)](#)

Examples

```
cmd <- pbmc_small[["NormalizeData.RNA"]]  
cmd$normalization.method
```

Index

- * **assay5**
 - [.Assay5, 115
 - [[.Assay5, 119
 - \$.Assay5, 125
 - Assay5-class, 14
 - Assay5-validity, 15
 - CastAssay, 19
 - DefaultLayer, 38
 - dim.Assay5, 39
 - dimnames.Assay5, 43
 - JoinLayers, 67
 - merge.Assay5, 78
 - split.Assay5, 104
 - subset.Assay5, 108
- * **assay**
 - [.Assay, 114
 - [[.Assay, 118
 - \$.Assay, 124
 - Assay-class, 12
 - Assay-validity, 13
 - CreateAssay5Object, 26
 - CreateAssayObject, 27
 - dim.Assay, 39
 - dimnames.Assay, 42
 - merge.Assay, 77
 - split.Assay, 104
 - subset.Assay, 107
- * **command**
 - .DollarNames.SeuratCommand, 6
 - [.SeuratCommand, 117
 - \$.SeuratCommand, 127
 - as.list.SeuratCommand, 9
 - LogSeuratCommand, 76
 - SeuratCommand-class, 99
- * **data-access**
 - AssayData, 15
 - Assays, 17
 - Cells, 20
 - CellsByIdentities, 21
 - CellsByImage, 22
 - Command, 26
 - DefaultAssay, 35
 - Distances, 46
 - Embeddings, 47
 - FetchData, 49
 - GetImage, 54
 - GetTissueCoordinates, 55
 - HVInfo, 56
 - Images, 61
 - Index, 62
 - Indices, 62
 - IsGlobal, 64
 - Key, 68
 - LayerData, 71
 - Loadings, 73
 - Misc, 80
 - Stdev, 106
 - Tool, 110
 - Version, 113
 - WhichCells, 113
- * **datasets**
 - pbmc_small, 86
- * **dimnames**
 - Cells, 20
 - dimnames.Assay, 42
 - dimnames.Assay5, 43
 - dimnames.Seurat, 43
- * **dimreduc**
 - [.DimReduc, 116
 - [[.DimReduc, 120
 - CreateDimReducObject, 29
 - dim.DimReduc, 40
 - DimReduc-class, 44
 - DimReduc-validity, 45
 - merge.DimReduc, 78
 - print.DimReduc, 87
 - subset.DimReduc, 108
- * **fov**
 - FOV-class, 50
 - FOV-methods, 51
 - FOV-validity, 53
- * **future**
 - Segmentation-methods, 95
- * **graph**
 - as.Graph, 8
 - Graph-class, 55

- * **jackstraw**
 - JackStrawData-methods, 66
 - JS, 68
- * **logmap**
 - as.matrix.LogMap, 10
 - droplevels.LogMap, 46
 - intersect.LogMap, 63
 - labels.LogMap, 70
 - LogMap, 74
 - LogMap-validity, 75
 - show, LogMap-method, 99
- * **neighbor**
 - as.Neighbor, 11
 - Neighbor-methods, 84
- * **segmentation**
 - Centroids-class, 22
 - Centroids-methods, 23
 - Molecules-class, 82
 - Molecules-methods, 82
 - Segmentation-class, 94
 - Segmentation-methods, 95
- * **seurat**
 - [.Seurat, 121
 - [<- , Seurat, 122
 - [<- , Seurat, NULL, 123
 - \$.Seurat, 125
 - AddMetaData, 7
 - as.Seurat, 11
 - CreateSeuratObject, 33
 - dim.Seurat, 41
 - dimnames.Seurat, 43
 - Idents, 59
 - merge.Seurat, 79
 - names.Seurat, 83
 - Project, 88
 - RenameAssays, 90
 - RenameCells, 90
 - Seurat-class, 98
 - Seurat-validity, 98
 - subset.Seurat, 109
 - UpdateSeuratObject, 112
- * **spatialimage**
 - Radius, 89
 - SpatialImage-methods, 101
- * **spatial**
 - as.Centroids, 8
 - Boundaries, 18
 - CreateCentroids, 28
 - CreateFOV, 30
 - CreateMolecules, 31
 - CreateSegmentation, 32
 - Crop, 35
 - DefaultFOV, 37
 - Overlay, 85
 - Simplify, 100
 - Theta, 110
- * **utils**
 - as.sparse, 12
 - AttachDeps, 18
 - CheckGC, 25
 - CheckLayersName, 25
 - DefaultDimReduc, 37
 - EmptyMatrix, 48
 - FilterObjects, 50
 - IsEmptyMatrix, 64
 - IsNamedList, 65
 - PackageCheck, 86
 - RandomName, 89
 - RowMergeSparseMatrices, 92
 - SaveSeuratRds, 92
 - set-if-null, 97
 - StitchMatrix, 106
 - UpdateSlots, 112
 - .DollarNames.JackStrawData
 - (JackStrawData-methods), 66
 - .DollarNames.SeuratCommand, 6, 10, 76, 99, 117, 127
 - .FilterObjects, 50
 - .onAttach, 18
 - ?future::plan, 96
 - [, 103
 - [, Centroids, character, ANY, ANY-method
 - (Centroids-methods), 23
 - [, Centroids, numeric, ANY, ANY-method
 - (Centroids-methods), 23
 - [, Segmentation, ANY, ANY, ANY-method
 - (Segmentation-methods), 95
 - [.Assay, 13, 14, 28, 39, 42, 77, 104, 107, 114, 118, 124
 - [.Assay5, 14, 15, 40, 43, 78, 105, 108, 115, 120, 125
 - [.DimReduc, 29, 40, 45, 79, 88, 109, 116, 120
 - [.FOV (FOV-methods), 51
 - [.Seurat (subset.Seurat), 109
 - [.SeuratCommand, 6, 10, 76, 99, 117, 127
 - [.SpatialImage (SpatialImage-methods), 101
 - [<- , Assay, character, ANY, ANY-method
 - ([.Assay), 114
 - [<- , Assay5, character, ANY, ANY-method
 - ([.Assay5), 115
 - [[, 122
 - [[, LogMap, NULL, missing-method (LogMap), 74

- [[,LogMap,character,missing-method
(LogMap), 74
- [[,LogMap,missing,missing-method
(LogMap), 74
- [[.Assay, 13, 14, 28, 39, 42, 77, 104, 107,
115, 118, 124
- [[.Assay5, 14, 15, 40, 43, 78, 105, 108, 116,
119, 125
- [[.DimReduc, 29, 40, 45, 79, 88, 109, 117, 120
- [[.FOV (FOV-methods), 51
- [[.Seurat, 41, 44, 80, 84, 98, 110, 121, 123,
126
- [[<- ,Seurat, 122
- [[<- ,Seurat,NULL, 123
- [[<- ,Assay,ANY,ANY,ANY-method
([[.Assay), 118
- [[<- ,Assay,missing,missing,data.frame-method
([[.Assay), 118
- [[<- ,Assay5,ANY,ANY,ANY-method
([[.Assay5), 119
- [[<- ,FOV,character,missing,Centroids-method
(FOV-methods), 51
- [[<- ,FOV,character,missing,Molecules-method
(FOV-methods), 51
- [[<- ,FOV,character,missing,NULL-method
(FOV-methods), 51
- [[<- ,FOV,character,missing,Segmentation-method
(FOV-methods), 51
- [[<- ,LogMap,character,missing,NULL-method
(LogMap), 74
- [[<- ,LogMap,character,missing,character-method
(LogMap), 74
- [[<- ,LogMap,character,missing,integer-method
(LogMap), 74
- [[<- ,LogMap,character,missing,numeric-method
(LogMap), 74
- [[<- ,Seurat,character,missing,Assay-method
([[<- ,Seurat), 122
- [[<- ,Seurat,character,missing,Assay5-method
([[<- ,Seurat), 122
- [[<- ,Seurat,character,missing,DimReduc-method
([[<- ,Seurat), 122
- [[<- ,Seurat,character,missing,Graph-method
([[<- ,Seurat), 122
- [[<- ,Seurat,character,missing,NULL-method
([[<- ,Seurat,NULL), 123
- [[<- ,Seurat,character,missing,Neighbor-method
([[<- ,Seurat), 122
- [[<- ,Seurat,character,missing,SeuratCommand-method
([[<- ,Seurat), 122
- [[<- ,Seurat,character,missing,SpatialImage-method
([[<- ,Seurat), 122
- [[<- ,Seurat,character,missing,data.frame-method
(\$.Seurat), 125
- [[<- ,Seurat,character,missing,factor-method
(\$.Seurat), 125
- [[<- ,Seurat,character,missing,list-method
(\$.Seurat), 125
- [[<- ,Seurat,character,missing,vector-method
(\$.Seurat), 125
- [[<- ,Seurat,missing,missing,data.frame-method
(\$.Seurat), 125
- [[<- ,Seurat,missing,missing,list-method
(\$.Seurat), 125
- [[<- .Seurat ([[<- ,Seurat), 122
- \$.Assay, 13, 14, 28, 39, 42, 77, 104, 107, 115,
118, 124
- \$.Assay5, 14, 15, 40, 43, 78, 105, 108, 116,
120, 125
- \$.FOV (FOV-methods), 51
- \$.JackStrawData
(JackStrawData-methods), 66
- \$.Seurat, 41, 44, 80, 84, 98, 110, 121, 123,
125
- \$.SeuratCommand, 6, 10, 76, 99, 117, 127
- \$<- .Assay (\$.Assay), 124
- \$<- .Assay5 (\$.Assay5), 125
- \$<- .Seurat (\$.Seurat), 125
- %iff%(set-if-null), 97
- AddMetaData, 7, 98
- AddSamples (merge.Seurat), 79
- as.Centroids, 8
- as.factor, 104, 105
- as.Graph, 8, 55
- as.list.SeuratCommand, 6, 9, 76, 99, 117,
127
- as.logical.JackStrawData
(JackStrawData-methods), 66
- as.matrix.LogMap, 10, 46, 63, 71, 75, 76
- as.Neighbor, 11
- as.Segmentation (as.Centroids), 8
- as.Seurat, 11
- as.sparse, 12, 27
- Assay, 15, 17, 28, 34, 39, 42, 56, 77, 98, 104,
107, 115, 118, 124
- Assay (Assay-class), 12
- Assay-class, 12
- Assay-validity, 13
- Assay5, 26, 27, 39, 43, 78, 105, 108, 116, 119,
125
- Assay5 (Assay5-class), 14
- Assay5-class, 14
- Assay5-validity, 15
- AssayData, 15

- Assays, 17
- AttachDeps, 18
- base::readRDS, 93
- base::saveRDS, 93
- Boundaries, 18
- CastAssay, 19
- cat, 88
- Cells, 20, 42–44, 103
- Cells.Centroids (Centroids-methods), 23
- Cells.FOV (FOV-methods), 51
- Cells.Segmentation (Segmentation-methods), 95
- Cells.SpatialImage (SpatialImage-methods), 101
- CellsByIdentities, 21, 114
- CellsByImage, 22
- Centroids, 8, 23, 28, 31, 50, 52, 53
- Centroids-class, 22
- Centroids-methods, 23
- CheckGC, 25
- CheckLayersName, 25
- Command, 26, 76
- coordinates, Segmentation-method (Segmentation-methods), 95
- CreateAssay5Object, 26
- CreateAssayObject, 13, 14, 27, 39, 42, 77, 104, 107, 115, 118, 124
- CreateCentroids, 28
- CreateDimReducObject, 29, 40, 45, 79, 88, 109, 117, 120
- CreateFOV, 30
- CreateMolecules, 31
- CreateSegmentation, 32
- CreateSeuratObject, 33
- Crop, 35
- CsparseMatrix, 48
- data frame, 14
- data.frame, 31, 34
- default assay, 16, 44
- default layer, 14, 104, 105
- DefaultAssay, 35, 98, 103
- DefaultAssay.SpatialImage (SpatialImage-methods), 101
- DefaultAssay<- (DefaultAssay), 35
- DefaultAssay<- .SpatialImage (SpatialImage-methods), 101
- DefaultBoundary (Boundaries), 18
- DefaultBoundary<- (Boundaries), 18
- DefaultDimReduc, 37
- DefaultFOV, 37
- DefaultFOV<- (DefaultFOV), 37
- DefaultLayer, 38
- DefaultLayer<- (DefaultLayer), 38
- dgCMatix, 55
- dim, 103
- dim.Assay, 13, 14, 28, 39, 42, 77, 104, 107, 115, 118, 124
- dim.Assay5, 14, 15, 39, 43, 78, 105, 108, 116, 120, 125
- dim.DimReduc, 29, 40, 45, 79, 88, 109, 117, 120
- dim.Neighbor (Neighbor-methods), 84
- dim.Seurat, 41, 44, 80, 84, 98, 110, 121, 123, 126
- dim.SpatialImage (SpatialImage-methods), 101
- dimensional reduction, 40, 78, 116, 120, 121, 123
- dimensional reductions, 83
- dimnames.Assay, 13, 14, 21, 28, 39, 42, 43, 44, 77, 104, 107, 115, 118, 124
- dimnames.Assay5, 14, 15, 21, 40, 42, 43, 44, 78, 105, 108, 116, 120, 125
- dimnames.DimReduc (dim.DimReduc), 40
- dimnames.Seurat, 21, 41–43, 43, 80, 84, 98, 110, 121, 123, 126
- dimnames<- .Assay (dimnames.Assay), 42
- dimnames<- .Assay5 (dimnames.Assay5), 43
- dimnames<- .Seurat (dimnames.Seurat), 43
- DimReduc, 17, 29, 37, 40, 79, 87, 98, 108, 116, 120
- DimReduc (DimReduc-class), 44
- DimReduc-class, 44
- DimReduc-validity, 45
- Distances, 46
- drop, 116, 118–121
- droplevels.LogMap, 10, 46, 63, 71, 75, 76
- droplevels.Seurat (Idents), 59
- Embeddings, 47, 120
- EmptyMatrix, 48, 65
- Features (Cells), 20
- Features.FOV (FOV-methods), 51
- Features.Molecules (Molecules-methods), 82
- FetchData, 49, 60, 114
- FetchData.FOV (FOV-methods), 51
- FilterObjects, 50
- FOV, 31, 38, 51, 52
- FOV (FOV-class), 50
- FOV-class, 50
- FOV-methods, 51

- FOV-validity, [53](#)
- FOVs, [83](#)
- GetAssayData (AssayData), [15](#)
- GetImage, [54](#), [103](#)
- GetImage.SpatialImage
 - (SpatialImage-methods), [101](#)
- GetTissueCoordinates, [35](#), [55](#), [103](#)
- GetTissueCoordinates.Centroids
 - (Centroids-methods), [23](#)
- GetTissueCoordinates.FOV (FOV-methods), [51](#)
- GetTissueCoordinates.Molecules
 - (Molecules-methods), [82](#)
- GetTissueCoordinates.Segmentation
 - (Segmentation-methods), [95](#)
- GetTissueCoordinates.SpatialImage
 - (SpatialImage-methods), [101](#)
- Graph, [8](#), [9](#), [17](#), [98](#)
- Graph (Graph-class), [55](#)
- Graph-class, [55](#)
- Graphs (Assays), [17](#)
- grob, [103](#)
- head.Assay ([[. Assay]), [118](#)
- head.Assay5 ([[. Assay5]), [119](#)
- head.Seurat ([[. Seurat]), [121](#)
- here, [121](#), [123](#)
- HVFInfo, [56](#)
- Idents, [59](#), [98](#)
- Idents<- (Idents), [59](#)
- Images, [61](#)
- images, [83](#)
- Index, [62](#)
- Index<- (Index), [62](#)
- Indices, [62](#)
- Inf, [8](#), [28](#), [31](#)
- intersect.LogMap, [10](#), [46](#), [63](#), [71](#), [75](#), [76](#)
- is.finite.Centroids
 - (Centroids-methods), [23](#)
- is.infinite.Centroids
 - (Centroids-methods), [23](#)
- IsGlobal, [64](#), [103](#)
- IsGlobal.SpatialImage
 - (SpatialImage-methods), [101](#)
- IsMatrixEmpty, [48](#), [64](#)
- IsNamedList, [65](#)
- JackStrawData, [66](#), [68](#)
- JackStrawData (JackStrawData-class), [66](#)
- JackStrawData-class, [66](#)
- JackStrawData-methods, [66](#)
- JoinLayers, [67](#)
- JS, [68](#)
- JS<- (JS), [68](#)
- Key, [68](#), [103](#)
- key, [105](#)
- Key.SpatialImage
 - (SpatialImage-methods), [101](#)
- Key<- (Key), [68](#)
- Key<- .SpatialImage
 - (SpatialImage-methods), [101](#)
- Keys (Key), [68](#)
- Keys.FOV (FOV-methods), [51](#)
- labels.LogMap, [10](#), [46](#), [63](#), [70](#), [75](#), [76](#)
- LayerData, [16](#), [71](#), [115](#), [116](#)
- LayerData<- (LayerData), [71](#)
- Layers (LayerData), [71](#)
- layout, [54](#)
- length.Centroids (Centroids-methods), [23](#)
- length.DimReduc (dim.DimReduc), [40](#)
- length.FOV (FOV-methods), [51](#)
- lengths.Centroids (Centroids-methods), [23](#)
- lengths.Segmentation
 - (Segmentation-methods), [95](#)
- levels.Seurat (Idents), [59](#)
- levels<- .Seurat (Idents), [59](#)
- Loadings, [73](#), [116](#), [117](#)
- Loadings<- (Loadings), [73](#)
- LoadSeuratRds (SaveSeuratRds), [92](#)
- logical map, [10](#), [46](#), [63](#), [70](#)
- logical mapping, [14](#)
- LogMap, [10](#), [46](#), [63](#), [70](#), [71](#), [74](#), [76](#), [99](#), [107](#)
- LogMap-class (LogMap), [74](#)
- LogMap-validity, [75](#)
- LogSeuratCommand, [6](#), [10](#), [76](#), [99](#), [117](#), [127](#)
- Matrix, [8](#)
- matrix, [8](#), [34](#), [48](#)
- mean, [60](#)
- merge (merge.Seurat), [79](#)
- merge.Assay, [13](#), [14](#), [28](#), [39](#), [42](#), [77](#), [104](#), [107](#), [115](#), [118](#), [124](#)
- merge.Assay5, [14](#), [15](#), [40](#), [43](#), [78](#), [105](#), [108](#), [116](#), [120](#), [125](#)
- merge.DimReduc, [29](#), [40](#), [45](#), [78](#), [88](#), [109](#), [117](#), [120](#)
- merge.Seurat, [41](#), [44](#), [79](#), [84](#), [98](#), [110](#), [121](#), [123](#), [126](#)
- MergeSeurat (merge.Seurat), [79](#)
- Misc, [80](#)
- Misc<- (Misc), [80](#)

- Molecules, [31](#), [32](#), [50](#), [52](#), [82](#)
- Molecules (Boundaries), [18](#)
- Molecules-class, [82](#)
- Molecules-methods, [82](#)
- name of a subobject, [121](#)
- names.DimReduc (dim.DimReduc), [40](#)
- names.FOV (FOV-methods), [51](#)
- names.Seurat, [41](#), [44](#), [80](#), [83](#), [98](#), [110](#), [121](#), [123](#), [126](#)
- nearest-neighbor graphs, [83](#), [121](#)
- Neighbor, [11](#), [17](#), [84](#)
- Neighbor (Neighbor-class), [84](#)
- Neighbor-class, [84](#)
- Neighbor-methods, [84](#)
- Neighbors (Assays), [17](#)
- Overlay, [85](#)
- Overlay, Centroids, SpatialPolygons-method (Overlay), [85](#)
- Overlay, FOV, FOV-method (Overlay), [85](#)
- Overlay, FOV, Spatial-method (Overlay), [85](#)
- Overlay, FOV, SpatialPolygons-method (Overlay), [85](#)
- Overlay, Molecules, SpatialPolygons-method (Overlay), [85](#)
- Overlay, Segmentation, SpatialPolygons-method (Overlay), [85](#)
- PackageCheck, [86](#)
- pbmc_small, [86](#)
- plan, [96](#)
- plotly::layout, [54](#)
- print (print.DimReduc), [87](#)
- print.DimReduc, [29](#), [40](#), [45](#), [79](#), [87](#), [109](#), [117](#), [120](#)
- Project, [34](#), [80](#), [88](#)
- Project<- (Project), [88](#)
- Radius, [89](#), [103](#)
- Radius.Centroids (Centroids-methods), [23](#)
- Radius.SpatialImage (SpatialImage-methods), [101](#)
- RandomName, [89](#)
- readRDS, [93](#)
- Reductions (Assays), [17](#)
- regular expression, [72](#)
- remove-object ([[<- , Seurat, NULL), [123](#)
- remove-objects ([[<- , Seurat, NULL), [123](#)
- RenameAssays, [90](#)
- RenameCells, [90](#), [103](#)
- RenameCells.Centroids (Centroids-methods), [23](#)
- RenameCells.FOV (FOV-methods), [51](#)
- RenameCells.Segmentation (Segmentation-methods), [95](#)
- RenameCells.SpatialImage (SpatialImage-methods), [101](#)
- RenameIdent (Idents), [59](#)
- RenameIdents (Idents), [59](#)
- ReorderIdent (Idents), [59](#)
- rlang::%, [97](#)
- rlang::check_installed, [86](#)
- rle, [24](#), [96](#)
- RowMergeSparseMatrices, [92](#)
- RsparseMatrix, [48](#)
- sample, [89](#)
- save, [93](#)
- saveRDS, [93](#)
- SaveSeuratRds, [92](#)
- Segmentation, [8](#), [31](#), [32](#), [50](#), [52](#), [53](#), [95](#)
- Segmentation-class, [94](#)
- Segmentation-methods, [95](#)
- set-if-null, [97](#)
- SetAssayData (AssayData), [15](#)
- SetDimReduction (CreateDimReducObject), [29](#)
- SetIdent (Idents), [59](#)
- Seurat, [11](#), [17](#), [34](#), [37](#), [38](#), [41](#), [43](#), [44](#), [50](#), [79](#), [83](#), [93](#), [109](#), [121–123](#), [126](#)
- Seurat (Seurat-class), [98](#)
- Seurat-class, [98](#)
- Seurat-validity, [98](#)
- SeuratAccess (AddMetaData), [7](#)
- SeuratCommand, [6](#), [9](#), [76](#), [117](#), [127](#)
- SeuratCommand (SeuratCommand-class), [99](#)
- SeuratCommand-class, [99](#)
- SeuratObject (SeuratObject-package), [5](#)
- SeuratObject-package, [5](#)
- show, Centroids-method (Centroids-methods), [23](#)
- show, FOV-method (FOV-methods), [51](#)
- show, JackStrawData-method (JackStrawData-methods), [66](#)
- show, LogMap-method, [99](#)
- show, Molecules-method (Molecules-methods), [82](#)
- show, Neighbor-method (Neighbor-methods), [84](#)
- show, Segmentation-method (Segmentation-methods), [95](#)
- show, SpatialImage-method (SpatialImage-methods), [101](#)
- Simplify, [100](#)
- spam, [48](#)

- SpatialImage, [50, 101](#)
- SpatialImage (SpatialImage-class), [100](#)
- SpatialImage-class, [100](#)
- SpatialImage-methods, [101](#)
- SpatiallyVariableFeatures (HVFIInfo), [56](#)
- SpatialPoints, [82](#)
- split.Assay, [13, 14, 28, 39, 42, 77, 104, 107, 115, 118, 124](#)
- split.Assay5, [14, 15, 40, 43, 78, 104, 108, 116, 120, 125](#)
- StashIdent (Idents), [59](#)
- Stdev, [106](#)
- stdout, [66, 84, 99, 102](#)
- StitchMatrix, [106](#)
- subset, [103](#)
- subset (subset.Seurat), [109](#)
- subset.Assay, [13, 14, 28, 39, 42, 77, 104, 107, 115, 118, 124](#)
- subset.Assay5, [14, 15, 40, 43, 78, 105, 108, 116, 120, 125](#)
- subset.Centroids (Centroids-methods), [23](#)
- subset.DimReduc, [29, 40, 45, 79, 88, 108, 117, 120](#)
- subset.FOV (FOV-methods), [51](#)
- subset.Molecules (Molecules-methods), [82](#)
- subset.Segmentation (Segmentation-methods), [95](#)
- subset.Seurat, [41, 44, 80, 84, 98, 109, 121, 123, 126](#)
- subset.SpatialImage (SpatialImage-methods), [101](#)
- SVFIInfo (HVFIInfo), [56](#)

- tail.Assay ([[.Assay]), [118](#)
- tail.Assay5 ([[.Assay5]), [119](#)
- tail.Seurat ([[.Seurat]), [121](#)
- Theta, [110](#)
- Theta.Centroids (Centroids-methods), [23](#)
- Tool, [98, 110](#)
- Tool<- (Tool), [110](#)
- Tools (Tool), [110](#)
- TsparseMatrix, [48](#)

- unpackedMatrix, [48](#)
- UpdateSeuratObject, [112](#)
- UpdateSlots, [112](#)

- v3, [83, 121, 123](#)
- v5, [83, 121, 123](#)
- validObject, [13–15, 45, 53, 75, 76, 98](#)
- VariableFeatures (HVFIInfo), [56](#)
- VariableFeatures<- (HVFIInfo), [56](#)
- Version, [113](#)
- WhichCells, [109, 110, 113](#)
- with_progress, [93, 96, 105](#)