

# Package ‘xenLite’

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**Title** Simple classes and methods for managing Xenium datasets

**Version** 1.0.0

**Description** Define a relatively light class for managing Xenium data using Bioconductor. Address use of parquet for coordinates, SpatialExperiment for assay and sample data. Address serialization and use of cloud storage.

**License** Artistic-2.0

**Encoding** UTF-8

**Depends** R (>= 4.1)

**Suggests** knitr, testthat, BiocStyle, yesno, terra,  
SpatialFeatureExperiment, SFEData, tiff

**Imports** SpatialExperiment, BiocFileCache, Matrix, S4Vectors,  
SummarizedExperiment, methods, utils, EBImage, shiny,  
HDF5Array, arrow, ggplot2, SingleCellExperiment, TENxIO, dplyr,  
graphics, stats

**VignetteBuilder** knitr

**biocViews** Infrastructure

**RoxygenNote** 7.3.2

**URL** <https://github.com/vjcitn/xenLite>

**BugReports** <https://github.com/vjcitn/xenLite/issues>

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## Contents

cacheMtif . . . . .	2
cacheSfeLungNtx . . . . .	3
cacheXenLuad . . . . .	4
cacheXenPdmelLite . . . . .	4
cacheXenProstLite . . . . .	5
clipRect . . . . .	6
demoapp . . . . .	6
e2sym . . . . .	7
e79sym . . . . .	7
getCellBoundaries . . . . .	8
getCellBoundaries,XenSPEP-method . . . . .	8
getNucleusBoundaries . . . . .	9
getNucleusBoundaries,XenSPEP-method . . . . .	9
getTranscripts . . . . .	10
getTranscripts,XenSPEP-method . . . . .	10
ggprepSeg . . . . .	11
ingest_xen . . . . .	11
loadGeometry . . . . .	12
loadGeometry,XenSPEP-method . . . . .	13
plotXenGgprep . . . . .	13
printXenGgprep . . . . .	14
resetParqPaths . . . . .	14
restoreZipXenSPEP . . . . .	15
show,XenSPEP-method . . . . .	15
viewSeg . . . . .	16
viewSegG2 . . . . .	16
XenSPEP . . . . .	17
XenSPEP-class . . . . .	18
zipXenSPEP . . . . .	18
[,XenSPEP,ANY,ANY,ANY-method . . . . .	19
<b>Index</b>	<b>20</b>

---

cacheMtif

*cache and/or retrieve path to an ome.tif file for demonstration*

---

### Description

cache and/or retrieve path to an ome.tif file for demonstration

### Usage

```
cacheMtif(
  cache = BiocFileCache::BiocFileCache(),
  url =
    "https://mghep.osn.xsede.org/bir190004-bucket01/BiocXenData/morphology_focus_0001.ome.tif"
)
```

**Arguments**

cache defaults to BiocFileCache::BiocFileCache()  
 url location where tiff file can be retrieved

**Value**

path to cached resource

**Note**

The tiff file was retrieved after running `SFEData::XeniumOutput("v2")`, and depicts a pancreas tissue sample.

**Examples**

```
pa <- cacheMtif()
if (!requireNamespace("tiff")) stop("install tiff package to run this example")
x <- tiff::readTIFF(pa)
plot(0, xlim = c(0, 1000), ylim = c(0, 1000), xlab = " ", ylab = " ")
rasterImage(x * 5.5, 0, 0, 1000, 1000)
```

---

cacheSfeLungNtx      *cache and/or retrieve path to an SFE of V1 lung demo data from 10x*

---

**Description**

cache and/or retrieve path to an SFE of V1 lung demo data from 10x

**Usage**

```
cacheSfeLungNtx(
  cache = BiocFileCache::BiocFileCache(),
  url = "https://mgdp.osn.xsede.org/bir190004-bucket01/BiocXenData/sfeLung.zip"
)
```

**Arguments**

cache defaults to BiocFileCache::BiocFileCache()  
 url location where zip file can be retrieved

**Value**

path to cached resource

**Note**

Lacks transcript coordinates

---

cacheXenLuad	<i>cache and/or retrieve path to Xenium Lung Adenocarcinoma example data, zipped SPEP accompanied by parquet</i>
--------------	--

---

**Description**

cache and/or retrieve path to Xenium Lung Adenocarcinoma example data, zipped SPEP accompanied by parquet

**Usage**

```
cacheXenLuad(
  cache = BiocFileCache::BiocFileCache(),
  url = "https://mghp.osn.xsede.org/bir190004-bucket01/BiocXenData/luad_lite.zip"
)
```

**Arguments**

cache	defaults to BiocFileCache::BiocFileCache()
url	location where zip file can be retrieved

**Value**

path to cached resource

**Examples**

```
if (interactive()) {
  pa <- cacheXenLuad()
  luad <- restoreZipXenSPEP(pa)
  print(luad)
  print(slot(luad, "cellbounds_path"))
  viewSeg(luad, xlim = c(4000, 4500), ylim = c(2000, 2500))
}
```

---

cacheXenPdmelLite	<i>counts-in-memory version of melanoma 5k dataset</i>
-------------------	--

---

**Description**

counts-in-memory version of melanoma 5k dataset

**Usage**

```
cacheXenPdmelLite(
  cache = BiocFileCache::BiocFileCache(),
  url = "https://mghp.osn.xsede.org/bir190004-bucket01/BiocXenData/pdmel_lite.zip"
)
```

**Arguments**

cache defaults to BiocFileCache::BiocFileCache()  
url location where zip file can be retrieved

**Value**

path to cached resource

**Examples**

```
if (interactive()) {  
  pa <- cacheXenPdmelLite()  
  pdmel_lite <- restoreZipXenSPEP(pa)  
  print(pdmel_lite)  
}
```

---

cacheXenProstLite *counts-in-memory version of prostate 5k dataset*

---

**Description**

counts-in-memory version of prostate 5k dataset

**Usage**

```
cacheXenProstLite(  
  cache = BiocFileCache::BiocFileCache(),  
  url = "https://mghp.osn.xsede.org/bir190004-bucket01/BiocXenData/prost_lite.zip"  
)
```

**Arguments**

cache defaults to BiocFileCache::BiocFileCache()  
url location where zip file can be retrieved

**Value**

path to cached resource

**Examples**

```
if (interactive()) {  
  pa <- cacheXenProstLite()  
  prost_lite <- restoreZipXenSPEP(pa)  
  print(prost_lite)  
}
```

---

clipRect	<i>restrict XenSPEP to cells with centroids in specified rectangle, also restrict boundary and transcript location features</i>
----------	---

---

**Description**

restrict XenSPEP to cells with centroids in specified rectangle, also restrict boundary and transcript location features

**Usage**

```
clipRect(xsce, xlim, ylim)
```

**Arguments**

xsce	XenSPEP instance
xlim	numeric(2)
ylim	numeric(2)

**Value**

XenSPEP instance

**Note**

Could be too RAM-hungry.

**Examples**

```
args(clipRect)
```

---

demoapp	<i>simple app to explore an image</i>
---------	---------------------------------------

---

**Description**

simple app to explore an image

**Usage**

```
demoapp(simple = FALSE)
```

**Arguments**

simple	logical(1) if TRUE, use a cached tiff for illustration
--------	--

**Value**

No value returned, run for side effect of app initiation.

**Note**

Navigate file input control to location of tiffs

**Examples**

```
if (interactive()) demoapp(simple = TRUE)
```

---

**e2sym***helper function to map ENS ids to symbols*

---

**Description**

helper function to map ENS ids to symbols

**Usage**

```
e2sym(x)
```

**Arguments**

x                      character() mix of Ensembl Ids and other strings; the latter are left unchanged

**Value**

a vector like x with gene symbols from v79 mapping substituted where possible

**Examples**

```
e2sym(c("ABC", "ENSG00000213088", "ENSG00000107796", "ENSG00000163017"))
```

---

**e79sym***mapping from ENSG to symbols based on EnsDb.Hsapiens.v79*

---

**Description**

mapping from ENSG to symbols based on EnsDb.Hsapiens.v79

**Usage**

```
e79sym
```

**Format**

```
character()
```

**Value**

character vector

**Note**

named character vector with values gene symbols, name ENSG ids

**Examples**

```
data(e79sym)
head(e79sym)
```

---

`getCellBoundaries`      *method for cell boundary extraction*

---

**Description**

method for cell boundary extraction

**Usage**

```
getCellBoundaries(x)
```

**Arguments**

x                      instance of XenSPEP

**Value**

reference to ingested parquet

**Examples**

```
showMethods("getCellBoundaries")
```

---

`getCellBoundaries, XenSPEP-method`  
*method for cell boundary extraction*

---

**Description**

method for cell boundary extraction

**Usage**

```
## S4 method for signature 'XenSPEP'
getCellBoundaries(x)
```

**Arguments**

x                      instance of XenSPEP

**Value**

reference to ingested parquet

---

getNucleusBoundaries *method for nucleus boundary extraction*

---

### **Description**

method for nucleus boundary extraction

### **Usage**

```
getNucleusBoundaries(x)
```

### **Arguments**

x                    instance of XenSPEP

### **Value**

reference to ingested parquet

### **Examples**

```
showMethods("getNucleusBoundaries")
```

---

getNucleusBoundaries, XenSPEP-method  
*method for nucleus boundary extraction*

---

### **Description**

method for nucleus boundary extraction

### **Usage**

```
## S4 method for signature 'XenSPEP'  
getNucleusBoundaries(x)
```

### **Arguments**

x                    instance of XenSPEP

### **Value**

reference to ingested parquet

---

`getTranscripts`            *method for transcript extraction*

---

**Description**

method for transcript extraction

**Usage**

```
getTranscripts(x)
```

**Arguments**

x                    instance of XenSPEP

**Value**

reference to ingested parquet

**Examples**

```
showMethods("getTranscripts")
```

---

`getTranscripts, XenSPEP-method`  
*method for transcript extraction*

---

**Description**

method for transcript extraction

**Usage**

```
## S4 method for signature 'XenSPEP'  
getTranscripts(x)
```

**Arguments**

x                    instance of XenSPEP

**Value**

reference to ingested parquet

**Examples**

```
showMethods("getTranscripts")
```

---

ggprepSeg	<i>prepare a XenSPEP for ggplot2 visualization</i>
-----------	--

---

**Description**

prepare a XenSPEP for ggplot2 visualization

**Usage**

```
ggprepSeg(xsce, xlim = c(5800, 6200), ylim = c(6300, 6700))
```

**Arguments**

xsce	XenSPEP instance
xlim	numeric(2)
ylim	numeric(2)

**Value**

a list with components 'bounds' (data.frame including relevant colData rows (all colData variables) and cell boundary coordinates) and 'txdata', a filtered arrow Table.

**Note**

This is idiosyncratic. Quintiles of cell\_area (values in 'sizq') are produced, and transcript locations are filtered. A more general approach that allows selection of coloring of cells by feature characteristics is needed.

**Examples**

```
pa <- cacheXenLuad()
luad <- restoreZipXenSPEP(pa)
hh <- ggprepSeg(luad, c(4000, 4500), c(2000, 2500))
ggplot2::ggplot(hh$bounds, ggplot2::aes(
  x = vertex_x, y = vertex_y, group = cell_id,
  colour = sizq, fill = sizq
)) +
  ggplot2::geom_polygon(alpha = .5)
```

---

ingest_xen	<i>produce a pre-loaded XenSPEP (SpatialExperiment with parquet references)</i>
------------	---

---

**Description**

produce a pre-loaded XenSPEP (SpatialExperiment with parquet references)

**Usage**

```
ingest_xen(folder)
```

**Arguments**

folder                    character(1) 'standard' Xenium output folder

**Value**

instance of XenSPEP

**Examples**

```
chkns <- function(pkstring) {
  if (!requireNamespace(pkstring)) {
    message(sprintf("install %s to use this feature; returning NULL", pkstring))
    return(NULL)
  }
}
chkns("SFEData")
chkns("HDF5Array")
chkns("SingleCellExperiment")
if (requireNamespace("SFEData")) {
  td <- tempdir()
  z <- SFEData::XeniumOutput("v2", td)
  ii <- ingest_xen(file.path(td, "xenium2"))
  print(validObject(ii))
  plot(SpatialExperiment::spatialCoords(ii), pch = ".")
}
```

---

loadGeometry

*read and bind parquet data to XenSPEP*

---

**Description**

read and bind parquet data to XenSPEP

**Usage**

```
loadGeometry(x)
```

**Arguments**

x                        instance of XenSPEP

**Value**

instance of XenSPEP

---

```
loadGeometry,XenSPEP-method
      read and bind parquet data to XenSPEP
```

---

**Description**

read and bind parquet data to XenSPEP

**Usage**

```
## S4 method for signature 'XenSPEP'
loadGeometry(x)
```

**Arguments**

x                    instance of XenSPEP

**Value**

instance of XenSPEP

---

```
plotXenGgprep            plot method for ggplot2-prepared XenSPEP
```

---

**Description**

plot method for ggplot2-prepared XenSPEP

**Usage**

```
plotXenGgprep(x, y, ...)
```

**Arguments**

x                    instance of S3 class 'xen\_ggprep'  
y                    not used  
...                   not used

**Value**

ggplot

**Note**

roxygen had problems with this

**Examples**

```
pa <- cacheXenLuad()
luad <- restoreZipXenSPEP(pa)
hh <- ggprepSeg(luad, c(4000, 4500), c(2000, 2500))
plotXenGgprep(hh)
```

---

printXenGgprep      *print method for ggplot2-prepared XenSPEP*

---

**Description**

print method for ggplot2-prepared XenSPEP

**Usage**

```
printXenGgprep(x, ...)
```

**Arguments**

x	instance of S3 class 'xen_ggprep'
...	not used

**Value**

operates with cat()

---

resetParqPaths      *utility for dealing with cached Xen\_SPEP in temp folder*

---

**Description**

utility for dealing with cached Xen\_SPEP in temp folder

**Usage**

```
resetParqPaths(xsp, base)
```

**Arguments**

xsp	instance of XenSPEP
base	folder path where parquet files are found

**Value**

XenSPEP instance

**Note**

Will prepend current folder path to parquet-oriented slot values.

---

restoreZipXenSPEP      *use unzip, readRDS, and loadGeometry to restore a XenSPEP*

---

**Description**

use unzip, readRDS, and loadGeometry to restore a XenSPEP

**Usage**

```
restoreZipXenSPEP(zipf, exdir = tempdir())
```

**Arguments**

zipf	character(1) path to zip file created with 'zipXenSPEP'
exdir	character(1) defaults to tempdir(), where contents are unpacked

**Value**

instance of XenSPEP

**Note**

Session folder position will change with setwd(), on.exit ensures return to position when started.

**Examples**

```
# used implicitly
if (interactive()) {
  example(cacheXenLuad)
}
```

---

show,XenSPEP-method      *display aspects of XenSPEP*

---

**Description**

display aspects of XenSPEP

**Usage**

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

**Arguments**

object	instance of XenSPEP
--------	---------------------

**Value**

operates with cat()

---

viewSeg	<i>naive polygon viewer</i>
---------	-----------------------------

---

**Description**

naive polygon viewer

**Usage**

```
viewSeg(x, xlim, ylim, show_tx = FALSE, ...)
```

**Arguments**

x	instance of XenSPEP
xlim	numeric(2) ordered vector of max and min on x
ylim	numeric(2) ordered vector of max and min on y
show_tx	logical(1) display transcript locations if TRUE, defaults to FALSE.
...	passed to polygon()

**Value**

run for side effect of plotting

**Note**

This is more RAM-sparing than clipRect followed by view.

**Examples**

```
luad <- cacheXenLuad()
pa <- cacheXenLuad()
luad <- restoreZipXenSPEP(pa)
rownames(luad) <- make.names(SummarizedExperiment::rowData(luad)$Symbol, unique = TRUE)
out <- viewSeg(luad, c(5800, 6300), c(1300, 1800), lwd = .5)
out$ncells
```

---

viewSegG2	<i>naive polygon viewer, will indicate presence of transcripts for two genes in cells</i>
-----------	---

---

**Description**

naive polygon viewer, will indicate presence of transcripts for two genes in cells

**Usage**

```
viewSegG2(x, xlim, ylim, gene1, gene2, show_tx = FALSE, ...)
```

**Arguments**

x	instance of XenSPEP
xlim	numeric(2) ordered vector of max and min on x
ylim	numeric(2) ordered vector of max and min on y
gene1	character(1) gene to be checked, cell polygon will be filled if gene has non-zero count
gene2	character(1) gene to be checked, cell polygon will be filled if gene has non-zero count
show_tx	logical(1) display transcript locations if TRUE, defaults to FALSE.
...	passed to polygon()

**Value**

Primarily for plotting. A list is invisibly returned with elements polys, ncells and call.

**Note**

This is more RAM-sparing than clipRect followed by view. Colors are pre-assigned for individual and joint occupancies in this draft of this visualizer.

**Examples**

```
luad <- cacheXenLuad()
pa <- cacheXenLuad()
luad <- restoreZipXenSPEP(pa)
rownames(luad) <- make.names(SummarizedExperiment::rowData(luad)$Symbol, unique = TRUE)
out <- viewSegG2(luad, c(5800, 6300), c(1300, 1800), lwd = .5, gene1 = "CD4", gene2 = "EPCAM")
legend(5800, 1370, fill = c("purple", "cyan", "pink"), legend = c("CD4", "EPCAM", "both"))
out$ncells
```

XenSPEP

*XenSPEP (SpatialExperiment with parquet references) constructor***Description**

XenSPEP (SpatialExperiment with parquet references) constructor

**Usage**

```
XenSPEP(folder)
```

**Arguments**

folder	character(1) 'standard' Xenium output folder
--------	--

**Value**

instance of XenSPEP

**Examples**

```
# is not used yet
args(XenSPEP)
```

---

XenSPEP-class	<i>manage SpatialExperiment with parquet references</i>
---------------	---

---

**Description**

manage SpatialExperiment with parquet references

---

zipXenSPEP	<i>serialize the collection of XenSPEP and parquet with zip</i>
------------	---

---

**Description**

serialize the collection of XenSPEP and parquet with zip

**Usage**

```
zipXenSPEP(xsp, targetfile)
```

**Arguments**

xsp	instance of XenSPEP with geometry loaded
targetfile	character(1) destination of zip process

**Value**

output of zip()

**Note**

a .rds and three parquet files are zipped together for restoration by 'restoreZipXenSPEP'. The outcome is 'paste0(targetfile, ".zip")'.

**Examples**

```
zipXenSPEP
```

---

[,XenSPEP,ANY,ANY,ANY-method

*formal bracket definition, that leaves parquet geometry information alone.*

---

### **Description**

formal bracket definition, that leaves parquet geometry information alone.

### **Usage**

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

### **Arguments**

x	instance of XenSPEP
i	feature selection
j	cell selection
...	passed to SpatialExperiment methods
drop	logical(1)

### **Value**

XenSPEP instance

### **Note**

Gives a message and calls callNextMethod.

# Index

## \* datasets

- e79sym, [7](#)
- [, XenSPEP, ANY, ANY, ANY-method, [19](#)
  
- cacheMtif, [2](#)
- cacheSfeLungNtx, [3](#)
- cacheXenLuad, [4](#)
- cacheXenPdmellite, [4](#)
- cacheXenProstLite, [5](#)
- clipRect, [6](#)
  
- demoapp, [6](#)
  
- e2sym, [7](#)
- e79sym, [7](#)
  
- getCellBoundaries, [8](#)
- getCellBoundaries, XenSPEP-method, [8](#)
- getNucleusBoundaries, [9](#)
- getNucleusBoundaries, XenSPEP-method, [9](#)
- getTranscripts, [10](#)
- getTranscripts, XenSPEP-method, [10](#)
- ggprepSeg, [11](#)
  
- ingest\_xen, [11](#)
  
- loadGeometry, [12](#)
- loadGeometry, XenSPEP-method, [13](#)
  
- plotXenGgprep, [13](#)
- printXenGgprep, [14](#)
  
- resetParqPaths, [14](#)
- restoreZipXenSPEP, [15](#)
  
- show, XenSPEP-method, [15](#)
  
- viewSeg, [16](#)
- viewSegG2, [16](#)
  
- XenSPEP, [17](#)
- XenSPEP-class, [18](#)
  
- zipXenSPEP, [18](#)