

# Package ‘tomoseqr’

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**Title** R Package for Analyzing Tomo-seq Data

**Version** 1.13.0

**Description** `tomoseqr` is an R package for analyzing Tomo-seq data.

Tomo-seq is a genome-wide RNA tomography method that combines combining high-throughput RNA sequencing with cryosectioning for spatially resolved transcriptomics. `tomoseqr` reconstructs 3D expression patterns from tomo-seq data and visualizes the reconstructed 3D expression patterns.

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**Encoding** UTF-8

**LazyData** FALSE

**Roxygen** list(markdown = TRUE)

**RoxygenNote** 7.2.2

**VignetteBuilder** knitr

**Depends** R (>= 4.2)

**biocViews** GeneExpression, Sequencing, RNASeq, Transcriptomics, Spatial, Visualization, Software

**Imports** grDevices, graphics, animation, tibble, dplyr, stringr, purrr, methods, shiny, BiocFileCache, readr, tools, plotly, ggplot2

**Suggests** rmarkdown, knitr, BiocStyle, testthat (>= 3.0.0)

**Config/testthat/edition** 3

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---

animate2d

*Animate 2D expressions along one axis and generate GIF file.*


---

## Description

Animate 2D expressions along one axis and generate GIF file.

## Usage

```
animate2d(
  tomoObj,
  geneID,
  along = "x",
  main = geneID,
  xlab = "x",
  ylab = "y",
  file = str_c(geneID, "_", along, ".gif"),
  zlim = NA,
  interval = 0.1,
  aspectX = 1,
  aspectY = 1
)
```

## Arguments

|         |                                                                            |
|---------|----------------------------------------------------------------------------|
| tomoObj | tomoSeq object                                                             |
| geneID  | single gene ID (string)                                                    |
| along   | Parameter specifying along which axis the cross section should be plotted. |

|          |                                                                                                                                                          |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| main     | A string used for the title of the plot. Default is geneID.                                                                                              |
| xlab     | Label of x axis. Default is xaxis.                                                                                                                       |
| ylab     | Label of y axis. Default is yaxis.                                                                                                                       |
| file     | Path of GIF file.                                                                                                                                        |
| zlim     | Limit of value of heatmap. If target="mask", it is ignored.                                                                                              |
| interval | interval of GIF animation.                                                                                                                               |
| aspectX  | Width of figure. If you don't specify the value of this parameter, It is calculated based on the number of sections Corresponding to the horizontal axis |
| aspectY  | Height of figure. If you don't specify the value of this parameter, It is calculated based on the number of sections Corresponding to the vertical axis  |

**Value**

It generate GIF file.

**Examples**

```
if(interactive()) {
  data(tomoObj)
  animate2d(tomoObj, "gene2", target = "expression", file = "example.gif")
}
```

---

|                |                                            |
|----------------|--------------------------------------------|
| doadJunker2014 | <i>Load data of Junker2014 from cache.</i> |
|----------------|--------------------------------------------|

---

**Description**

Load data of Junker2014 from cache.

**Usage**

```
doadJunker2014(tomoseqrCache)
```

**Arguments**

tomoseqrCache    Cache of tomoseqr. You can get it using downloadJunker2014.

**Value**

List of tomo-seq data in cache.

---

|                    |                                                                      |
|--------------------|----------------------------------------------------------------------|
| downloadJunker2014 | <i>Download part of the Tomo-seq data published by Junker et al.</i> |
|--------------------|----------------------------------------------------------------------|

---

**Description**

Download part of the Tomo-seq data published by Junker et al.

**Usage**

```
downloadJunker2014(verbose = FALSE)
```

**Arguments**

|         |                                                                         |
|---------|-------------------------------------------------------------------------|
| verbose | If you want to force downloads with or without cache, set this to TRUE. |
|---------|-------------------------------------------------------------------------|

**Value**

BiocFileCache object.

---

|                       |                                |
|-----------------------|--------------------------------|
| estimate3dExpressions | <i>Estimate 3d expressions</i> |
|-----------------------|--------------------------------|

---

**Description**

Estimate 3d expressions

**Usage**

```
estimate3dExpressions(x, y, z, mask, query, numIter = 100, normalize = TRUE)
```

**Arguments**

|           |                                                                                                                                                                                                                              |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| x         | A data.frame object containing a simulated Tomo-seq data for x-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections. |
| y         | A data.frame object containing a simulated Tomo-seq data for y-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections. |
| z         | A data.frame object containing a simulated Tomo-seq data for z-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections. |
| mask      | A 3D array that represents if each boxel is included to sample. You can make a mask using masker.                                                                                                                            |
| query     | Vector of gene IDs                                                                                                                                                                                                           |
| numIter   | How many times iterate                                                                                                                                                                                                       |
| normalize | Whether to normalize so that total expression per sample volume is equal between sections.                                                                                                                                   |

**Value**

tomoSeq object

**Examples**

```
data("testx", "testy", "testz", "mask")
estimate3dExpressions(
  testx,
  testy,
  testz,
  mask = mask,
  query = c("gene1"),
  normalize = TRUE
)
```

---

extractGeneList

*Extract geneIDs to which hoge can be applied.*

---

**Description**

Extract geneIDs to which hoge can be applied.

**Usage**

```
extractGeneList(x, y, z)
```

**Arguments**

- |   |                                                                                                                                                                                                                    |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| x | A data.frame object containing a Tomo-seq data for x-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections. |
| y | A data.frame object containing a Tomo-seq data for y-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections. |
| z | A data.frame object containing a Tomo-seq data for z-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections. |

**Value**

A vector that contains genes which can be used for estimate3dExpressions.

**Examples**

```
data("testx", "testy", "testz")
extractGeneList(testx, testy, testz)
```

---

|                |                                 |
|----------------|---------------------------------|
| findAxialGenes | <i>Find peak genes on axial</i> |
|----------------|---------------------------------|

---

### Description

Find peak genes on axial

### Usage

```
findAxialGenes(tomoSeqData, genes = "all")
```

### Arguments

|             |                           |
|-------------|---------------------------|
| tomoSeqData | tomo-seq data of any axis |
| genes       | If run for all genes      |

### Value

A data frame consisting of gene ID, max of expression levels of the gene, mean of expression levels calculated by excluding the maximum value and section number showing the maximum expression level (0 means that there is no such section).

### Examples

```
data(testx)
findAxialGenes(testx)
```

---

|                        |                                 |
|------------------------|---------------------------------|
| getReconstructedResult | <i>Get reconstructed matrix</i> |
|------------------------|---------------------------------|

---

### Description

Get reconstructed matrix

### Usage

```
getReconstructedResult(tomoObj, geneID)
```

### Arguments

|         |                |
|---------|----------------|
| tomoObj | tomoSeq object |
| geneID  | single gene ID |

### Value

Reconstruction result as matrix

### Examples

```
data(tomoObj)
getReconstructedResult(tomoObj, "gene2")
```

---

|             |                                                                 |
|-------------|-----------------------------------------------------------------|
| imageViewer | <i>Output the reconstructed expression pattern as an image.</i> |
|-------------|-----------------------------------------------------------------|

---

**Description**

Output the reconstructed expression pattern as an image.

**Usage**

```
imageViewer(tomoObj)
```

**Arguments**

|         |                |
|---------|----------------|
| tomoObj | tomoSeq object |
|---------|----------------|

**Value**

NA

**Examples**

```
if (interactive()) {  
  data(tomoObj)  
  imageViewer(tomoObj, "gene2")  
}
```

---

|      |                                       |
|------|---------------------------------------|
| mask | <i>A matrix containing mask data.</i> |
|------|---------------------------------------|

---

**Description**

It is a matrix representing the mask. Each element of the matrix corresponds to a voxel, and has the value 1 if the voxel is included in the mask, 0 if it is not.

---

|        |                  |
|--------|------------------|
| masker | <i>Make mask</i> |
|--------|------------------|

---

**Description**

Make mask

**Usage**

```
masker()
```

**Value**

NA

**Examples**

```
if (interactive()) {
  masker()
}
```

---

`plot1dAllExpression`      *Plot expressions of all genes along an axis*

---

**Description**

Plot expressions of all genes along an axis

**Usage**

```
plot1dAllExpression(tomoSeqData, ...)
```

**Arguments**

|                          |                                                                                                                                                                                                                 |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>tomoSeqData</code> | A data.frame object containing a Tomo-seq data for any sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections. |
| <code>...</code>         | Arguments which are related to plot parameters. Please refer to <a href="#">plot</a> .                                                                                                                          |

**Value**

NA

**Examples**

```
data("testx")
plot1dAllExpression(testx)
```

---

`plot1dExpression`      *Plot expression of single gene along an axis*

---

**Description**

Plot expression of single gene along an axis

**Usage**

```
plot1dExpression(tomoObj, geneID, axes)
```

**Arguments**

|                      |                         |
|----------------------|-------------------------|
| <code>tomoObj</code> | tomoSeq object          |
| <code>geneID</code>  | single gene ID (string) |
| <code>axes</code>    | axis ("x", "y" or "z")  |

**Value**

NA

**Examples**

```
data(tomoObj)
plot1dExpression(tomoObj, "gene2", "x")
```

---

|                  |                                                          |
|------------------|----------------------------------------------------------|
| plotLossFunction | <i>Plot the trend of the value of the loss function.</i> |
|------------------|----------------------------------------------------------|

---

**Description**

Plot the trend of the value of the loss function.

**Usage**

```
plotLossFunction(tomoObj, geneID)
```

**Arguments**

|         |                         |
|---------|-------------------------|
| tomoObj | tomoSeq object          |
| geneID  | single gene ID (string) |

**Value**

NA

**Examples**

```
data(tomoObj)
plotLossFunction(tomoObj, "gene2")
```

---

|       |                                                                                      |
|-------|--------------------------------------------------------------------------------------|
| testx | <i>A data.frame object containing a simulated Tomo-seq data for x-axis sections.</i> |
|-------|--------------------------------------------------------------------------------------|

---

**Description**

A data.frame object containing a simulated Tomo-seq data for x-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections.

---

|       |                                                                                      |
|-------|--------------------------------------------------------------------------------------|
| testy | <i>A data.frame object containing a simulated Tomo-seq data for y-axis sections.</i> |
|-------|--------------------------------------------------------------------------------------|

---

### Description

A data.frame object containing a simulated Tomo-seq data for y-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections.

---

|       |                                                                                      |
|-------|--------------------------------------------------------------------------------------|
| testz | <i>A data.frame object containing a simulated Tomo-seq data for z-axis sections.</i> |
|-------|--------------------------------------------------------------------------------------|

---

### Description

A data.frame object containing a simulated Tomo-seq data for z-axis sections. The rows represent genes. The first column contains gene IDs and the second and subsequent columns contain gene expression levels in sections.

---

|             |                                                    |
|-------------|----------------------------------------------------|
| toDataFrame | <i>Convert reconstructed matrix to data.frame.</i> |
|-------------|----------------------------------------------------|

---

### Description

Convert reconstructed matrix to data.frame.

### Usage

```
toDataFrame(tomoObj, geneID)
```

### Arguments

|         |                |
|---------|----------------|
| tomoObj | tomoSeq object |
| geneID  | single gene ID |

### Value

Reconstruction result converted to dataframe.

### Examples

```
data(tomoObj)
toDataFrame(tomoObj, "gene2")
```

---

|         |                          |
|---------|--------------------------|
| tomoObj | <i>A tomoSeq object.</i> |
|---------|--------------------------|

---

### Description

It is a tomoSeq object generated from [testx](#), [testy](#), [testz](#) and [mask](#).

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