

# Package ‘StarBioTrek’

March 30, 2021

**Type** Package

**Title** StarBioTrek

**Version** 1.16.0

**Date** 04-16-2019

**Author** Claudia Cava,  
Isabella Castiglioni

**Maintainer** Claudia Cava <claudia.cava@ibfm.cnr.it>

**Depends** R (>= 3.3)

**Imports** SpidermiR, graphite, AnnotationDbi, e1071, ROCR, MLmetrics,  
grDevices, igraph, reshape2, ggplot2

## Description

This tool StarBioTrek presents some methodologies to measure pathway activity and cross-talk among pathways integrating also the information of network data.

**License** GPL (>= 3)

**biocViews** GeneRegulation, Network, Pathways, KEGG

**Suggests** BiocStyle, knitr, rmarkdown, testthat, devtools, roxygen2,  
qgraph, png, grid

**VignetteBuilder** knitr

**LazyData** true

**URL** <https://github.com/claudiacava/StarBioTrek>

**BugReports** <https://github.com/claudiacava/StarBioTrek/issues>

**RoxygenNote** 6.1.1

**git\_url** <https://git.bioconductor.org/packages/StarBioTrek>

**git\_branch** RELEASE\_3\_12

**git\_last\_commit** 50f1212

**git\_last\_commit\_date** 2020-10-27

**Date/Publication** 2021-03-29

**R topics documented:**

average . . . . .	2
circleplot . . . . .	3
ConvertedIDgenes . . . . .	3
dsscorectlk . . . . .	4
euclidctlk . . . . .	4
GetData . . . . .	5
getNETdata . . . . .	5
GetPathData . . . . .	6
GetPathNet . . . . .	6
GE_matrix . . . . .	7
GE_matrix_mean . . . . .	7
GOChord . . . . .	8
IPPI . . . . .	9
listpathnet . . . . .	9
pathnet . . . . .	10
plotcrosstalk . . . . .	10
SelectedSample . . . . .	11
select_class . . . . .	11
StarBioTrek . . . . .	12
stdv . . . . .	12
svm_classification . . . . .	13

<b>Index</b>	<b>14</b>
--------------	-----------

---

average	<i>For TCGA data get human pathway data and creates a matrix with the average of genes for each pathway.</i>
---------	--

---

**Description**

average creates a matrix with a summarized value for each pathway

**Usage**

```
average(pathwayexpsubset)
```

**Arguments**

```
pathwayexpsubset
    list of pathway data
```

**Value**

a matrix value for each pathway

**Examples**

```
list_path_gene<-GE_matrix(DataMatrix=Data_CANCER_normUQ_fil,genes.by.pathway=pathway[1:50])
score_mean<-average(pathwayexpsubset=list_path_gene)
```

---

circleplot	<i>Preparation for circle plot</i>
------------	------------------------------------

---

**Description**

circleplot function takes as input data derived by the function plotcrosstalk and pLOt a circle plot.

**Usage**

```
circleplot(preplot, scoregene)
```

**Arguments**

preplot	a list as obtained from the function plotcrosstalk
scoregene	a score for each gene with values included between -10 e +10

**Value**

a list with correlation matrix and gene set for each gene

**Examples**

```
formatplot<-plotcrosstalk(pathway_plot=pathway[1:6],gs_expre=tumo)
score<-runif(length(formatplot[[2]]), min=-10, max=+10)
circleplot(preplot=formatplot,scoregene=score)
```

---

ConvertedIDgenes	<i>Get interacting genes inside pathways.</i>
------------------	---

---

**Description**

GetPathNet creates a list of genes inside the pathways.

**Usage**

```
ConvertedIDgenes(path_ALL)
```

**Arguments**

path_ALL	variable. The user can select the variable as obtained by GetData function
----------	--

**Value**

a list of pathways

**Examples**

```
pathway<-ConvertedIDgenes(path_ALL=path[1:3])
```

---

dsscorecrtlk	<i>For TCGA data get human pathway data and creates a measure of discriminating score among pathways</i>
--------------	--

---

**Description**

dsscorecrtlk creates a matrix with discriminating score for pathways

**Usage**

```
dsscorecrtlk(dataFilt, pathway_exp)
```

**Arguments**

dataFilt	TCGA matrix
pathway_exp	a list of pathway data

**Value**

a matrix value for each pathway

**Examples**

```
cross_talk_st_dv<-dsscorecrtlk(dataFilt=tumo[,1:2],pathway_exp=pathway[1:5])
```

---

eucdistcrtlk	<i>For TCGA data get human pathway data and creates a measure of cross-talk among pathways</i>
--------------	--

---

**Description**

eucdistcrtlk creates a matrix with euclidean distance for pairwise pathways

**Usage**

```
eucdistcrtlk(dataFilt, pathway_exp)
```

**Arguments**

dataFilt	TCGA matrix
pathway_exp	list of pathway data

**Value**

a matrix value for each pathway

**Examples**

```
score_euc_dista_t<-eucdistcrtlk(dataFilt=tumo[,1:2],pathway_exp=pathway[1:5])
```

---

GetData	<i>Get general information inside pathways.</i>
---------	---

---

**Description**

GetData creates a list with genes inside the pathways.

**Usage**

```
GetData(species, pathwaydb)
```

**Arguments**

species	variable. The user can select the species of interest from SELECT_path_species(path_spec)
pathwaydb	variable. The user can select the pathway database of interest from SELECT_path_graphite(path_spec)

**Value**

a list of pathways

**Examples**

```
## Not run:
species="hsapiens"
pathwaydb="pharmgkb"
path<-GetData(species,pathwaydb)
## End(Not run)
```

---

getNETdata	<i>Get network data from GeneMania.</i>
------------	---

---

**Description**

getNETdata creates a data frame with network data. Network category can be filtered among: physical interactions, co-localization, genetic interactions and shared protein domain.

**Usage**

```
getNETdata(network, organismID = NULL)
```

**Arguments**

network	variable. The user can use the following parameters based on the network types to be used. PHint for Physical_interactions, COloc for Co-localization, GENint for Genetic_interactions and SHpd for Shared_protein_domains
organismID	organism==NULL default value is homo sapiens.

**Value**

list with gene-gene (or protein-protein interactions)

**Examples**

```
## Not run:
organismID="Saccharomyces_cerevisiae"
netw<-getNETdata(network="SHpd",organismID)
## End(Not run)
```

---

GetPathData	<i>Get genes inside pathways.</i>
-------------	-----------------------------------

---

**Description**

GetPathData creates a list of genes inside the pathways.

**Usage**

```
GetPathData(path_ALL)
```

**Arguments**

path\_ALL            variable. The user can select the variable as obtained by GetData function

**Value**

a list of pathways

**Examples**

```
pathway_ALL_GENE<-GetPathData(path_ALL=path[1:3])
```

---

GetPathNet	<i>Get interacting genes inside pathways.</i>
------------	---

---

**Description**

GetPathNet creates a list of genes inside the pathways.

**Usage**

```
GetPathNet(path_ALL)
```

**Arguments**

path\_ALL            variable. The user can select the variable as obtained by GetData function

**Value**

a list of pathways

**Examples**

```
pathway_net<-GetPathNet(path_ALL=path[1:3])
```

---

GE_matrix	<i>Get human KEGG pathway data and a gene expression matrix in order to obtain a list with the gene expression for only pathways given in input .</i>
-----------	---

---

**Description**

GE\_matrix creates a list of gene expression for pathways given by the user.

**Usage**

```
GE_matrix(DataMatrix, genes.by.pathway)
```

**Arguments**

DataMatrix      gene expression matrix (eg.TCGA data)  
genes.by.pathway      a list of pathway data as provided by GetData and ConvertedID\_genes

**Value**

a list for each pathway ( gene expression level belong to that pathway)

**Examples**

```
list_path_gene<-GE_matrix(DataMatrix=tumo[,1:2],genes.by.pathway=pathway[1:5])
```

---

GE_matrix_mean	<i>Get human KEGG pathway data and a gene expression matrix in order to obtain a matrix with the mean gene expression for only pathways given in input .</i>
----------------	--

---

**Description**

GE\_matrix creates a matrix of mean gene expression levels for pathways given by the user.

**Usage**

```
GE_matrix_mean(DataMatrix, genes.by.pathway)
```

**Arguments**

DataMatrix      gene expression matrix (eg.TCGA data)  
genes.by.pathway      list of pathway data as provided by getKEGGdata

**Value**

a matrix for each pathway (mean gene expression level belong to that pathway)

**Examples**

```
list_path_plot<-GE_matrix_mean(DataMatrix=tumo[,1:2],genes.by.pathway=pathway[1:5])
```

---

GOChord

*Displays the relationship between genes and terms.*


---

**Description**

The GOChord function generates a circularly composited overview of selected/specific genes and their assigned processes or terms. More generally, it joins genes and processes via ribbons in an intersection-like graph.

**Usage**

```
GOChord(data, title, space, gene.order, gene.size, gene.space, nlfsc = 1,
        lfc.col, lfc.min, lfc.max, ribbon.col, border.size, process.label, limit)
```

**Arguments**

data	The matrix represents the binary relation (1= is related to, 0= is not related to) between a set of genes (rows) and processes (columns); a column for the logFC of the genes is optional
title	The title (on top) of the plot
space	The space between the chord segments of the plot
gene.order	A character vector defining the order of the displayed gene labels
gene.size	The size of the gene labels
gene.space	The space between the gene labels and the segment of the logFC
nlfsc	Defines the number of logFC columns (default=1)
lfc.col	The fill color for the logFC specified in the following form: c(color for low values, color for the mid point, color for the high values)
lfc.min	Specifies the minimum value of the logFC scale (default = -3)
lfc.max	Specifies the maximum value of the logFC scale (default = 3)
ribbon.col	The background color of the ribbons
border.size	Defines the size of the ribbon borders
process.label	The size of the legend entries
limit	A vector with two cutoff values (default= c(0,0)).



---

 IPPI

*Multilayer analysis Cava et al. BMC Genomics 2017*


---

**Description**

IPPI function takes as input pathway and network data in order to select genes with central role in that pathway. Please see Cava et al. 2017 BMC Genomics

**Usage**

```
IPPI(pathax, netwa)
```

**Arguments**

pathax	pathway matrix Please see example path for format
netwa	a dataframe Please see example path for format netw

**Value**

a list with driver genes for each pathway

**Examples**

```
## Not run:
DRIVER_SP<-IPPI(pathax=pathway_matrix[,1:3],netwa=netw_IPPI[1:50000,])
## End(Not run)
```

---

 listpathnet

*Get human KEGG pathway data and the output of list\_path\_net define the common genes.*


---

**Description**

listpathnet creates a list of interacting genes for each human pathway.

**Usage**

```
listpathnet(lista_net, pathway_exp)
```

**Arguments**

lista_net	output of path_net
pathway_exp	pathway data as provided by getKEGGdata

**Value**

a list of genes for each pathway (interacting genes belong to that pathway)

**Examples**

```
lista_network<-pathnet(genes.by.pathway=pathway[1:5],data=netw)
list_path<-listpathnet(lista_net=lista_network,pathway=pathway[1:5])
```

---

pathnet *Get human KEGG pathway data and creates a network data.*

---

### Description

pathnet creates a list of network data for each human pathway. The network data will be generated when interacting genes belong to that pathway.

### Usage

```
pathnet(genes.by.pathway, data)
```

### Arguments

genes.by.pathway  
a list of pathway data as provided by `ConvertedIDgenes`

data  
a list of network data as provided by `getNETdata`

### Value

a list of network data for each pathway (interacting genes belong to that pathway)

### Examples

```
lista_net<-pathnet(genes.by.pathway=pathway[1:5],data=netw)
```

---

plotcrosstalk *Preparation for plotting cross-talk*

---

### Description

plot\_cross\_talk function takes as input pathway data and prepares the data to visualize (e.g. `ggplot2`, `qqgraph`, `igraph`)

### Usage

```
plotcrosstalk(pathway_plot, gs_expre)
```

### Arguments

pathway\_plot pathway

gs\_expre a gene expression matrix

### Value

a list with correlation matrix and gene set for each gene

### Examples

```
formatplot<-plotcrosstalk(pathway_plot=pathway[1:6],gs_expre=tumo)
```

---

SelectedSample	<i>Select the class of TCGA data</i>
----------------	--------------------------------------

---

**Description**

select two labels from ID barcode

**Usage**

```
SelectedSample(Dataset, typesample)
```

**Arguments**

Dataset	gene expression matrix
typesample	the labels of the samples (e.g. tumor,normal)

**Value**

a gene expression matrix of the samples with specified label

**Examples**

```
tumo<-SelectedSample(Dataset=Data_CANCER_normUQ_fil,typesample="tumour")[,2]
```

---

select_class	<i>Select the class of TCGA data</i>
--------------	--------------------------------------

---

**Description**

select best performance

**Usage**

```
select_class(performance_matrix, cutoff)
```

**Arguments**

performance_matrix	list of AUC value
cutoff	cut-off for AUC value

**Value**

a gene expression matrix with only pairwise pathway with a particular cut-off

---

StarBioTrek	<i>Download data</i>
-------------	----------------------

---

### Description

StarBioTrek allows you to Download data of samples from StarBioTrek

### Details

The functions you're likely to need from **StarBioTrek** is `path_star` Otherwise refer to the vignettes to see how to format the documentation.

---

stdv	<i>For TCGA data get human pathway data and creates a measure of standard deviations among pathways</i>
------	---

---

### Description

stdv creates a matrix with standard deviation for pathways

### Usage

```
stdv(gslist)
```

### Arguments

`gslist`            pathway data

### Value

a matrix value for each pathway

### Examples

```
list_path_gene<-GE_matrix(DataMatrix=tumo[,1:2],genes.by.pathway=pathway[1:5])  
score_stdev<-stdv(gslist=list_path_gene)
```

---

svm\_classification      *SVM classification for each feature*

---

**Description**

svm class creates a list with AUC, Accuracy, Sensitivity, Specificity values

**Usage**

```
svm_classification(TCGA_matrix, tumour, normal, nfs)
```

**Arguments**

TCGA_matrix	gene expression matrix where the first two columns represent the interacting pathways.
tumour	barcode samples for a class
normal	barcode samples for another class
nfs	nfs split data into a training and test set
Target	label for the classes

**Value**

a list with AUC value for pairwise pathway

**Examples**

```
## Not run:  
nf <- 60  
res_class<-svm_classification(TCGA_matrix=score_euc_dista[1:30,],nfs=nf,  
normal=colnames(norm[,1:10]),tumour=colnames(tumo[,1:10]))  
## End(Not run)
```

# Index

average, [2](#)

circleplot, [3](#)  
ConvertedIDgenes, [3](#)

dsscorecrtlk, [4](#)

euclidcrtlk, [4](#)

GE\_matrix, [7](#)  
GE\_matrix\_mean, [7](#)  
GetData, [5](#)  
getNETdata, [5](#)  
GetPathData, [6](#)  
GetPathNet, [6](#)  
GOChord, [8](#)

IPPI, [9](#)

listpathnet, [9](#)

pathnet, [10](#)  
plotcrosstalk, [10](#)

select\_class, [11](#)  
SelectedSample, [11](#)  
StarBioTrek, [12](#)  
StarBioTrek-package (StarBioTrek), [12](#)  
stdv, [12](#)  
svm\_classification, [13](#)