

# Package ‘fCI’

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**Type** Package

**Title** f-divergence Cutoff Index for Differential Expression Analysis  
in Transcriptomics and Proteomics

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**Description** (f-divergence Cutoff Index), is to find DEGs in the transcriptomic & proteomic data, and identify DEGs by computing the difference between the distribution of fold-changes for the control-control and remaining (non-differential) case-control gene expression ratio data. fCI provides several advantages compared to existing methods.

**License** GPL (>= 2)

**Depends** R (>= 3.1),FNN, psych, gtools, zoo, rgl, grid, VennDiagram

**Suggests** knitr, rmarkdown, BiocStyle

**VignetteBuilder** knitr

**NeedsCompilation** no

**biocViews** Proteomics

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---

call.npci                    *the s4 class function*

---

**Description**

the s4 class function

**Usage**

```
call.npci(.Object)
```

**Arguments**

.Object                    the fCI object

**Details**

The S4 method will compute DEGs and save the results to the original s4 object .Object

**Value**

NA                         No values will be returned

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("See README")
```

---

call.npci-methods            *~~ Methods for Function call.npci ~~*

---

**Description**

*~~ Methods for function call.npci ~~*

**Methods:**

```
signature(.Object = "NPCI")
```

---

compute	<i>the generic function 'compute' for s4 class</i>
---------	--

---

**Description**

the generic function 'compute' for s4 class

**Usage**

```
compute(.Object)
```

**Arguments**

.Object

**Details**

TBD

**Value**

NA                      No values will be returned

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("See README")
```

---

compute-methods	<i>~~ Methods for Function compute ~~</i>
-----------------	---

---

**Description**

*~~ Methods for function compute ~~*

**Methods:**

signature(.Object = "NPC1")

---

deg.pairwise.fold.change

*find targets that have a consistent fold change in the same direction  
(either up- or down-regulation)*

---

### Description

find targets that have a consistent fold change in the same direction

### Usage

```
deg.pairwise.fold.change(pairwise.wt.up.down.fold, pairwise.df.up.down.fold,  
d = 1, min.fold = 1.2)
```

### Arguments

`pairwise.wt.up.down.fold`  
a list of numeric values representing the fold changes between control replicates for every gene

`pairwise.df.up.down.fold`  
a list of numeric values representing the fold changes between case and control replicates for every gene

`d`  
the dimensionality of the database, if the dataset is from proteogenomics, then `d=2`

`min.fold`  
minimum fold change to declare a gene to be dysregulated, by default, `min.fold=2`

### Details

TBD

### Value

expression ratio  
a dataframe of fCI gene expression ratios (folds) with none zero values defined by given control-control index (i.e. 1 & 2) and control-case index (i.e. 3&4)

### Note

TBD

### Author(s)

Shaojun Tang

### References

<http://software.steenlab.org/fCI/>

### See Also

TBD

## Examples

```
wt.fold.changes=list(c(1.2,1.3,1.5,1.6))
df.fold.changes=list(c(1.1,1.3,1.4,1.6))
deg.pairwise.fold.change(wt.fold.changes,df.fold.changes)
```

---

deg.up.down.info      *find targets and their detailed expression changes*

---

## Description

given expression matrix, find targets and their detailed expression changes

## Usage

```
deg.up.down.info(wt.index.in.list, df.index.in.list, npc,
use.normalization = FALSE, target.ratio = 0.5)
```

## Arguments

`wt.index.in.list`      a list of numeric values representing the column indexes for control samples

`df.index.in.list`      a list of numeric values representing the column indexes for experimental samples

`npc`                  the object `npc`

`use.normalization`      a boolean value indicating if the normalization will be applied or not

`target.ratio`          a numeric value indicating the expected fold changes, i.e. 1.5

## Details

TBD

## Value

`expression ratio`      a dataframe of fCI gene expression ratios (folds) defined by control-control index and control-case index

## Note

TBD

## Author(s)

Shaojun Tang

## References

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("TBC")
```

---

deseq.median.ratio.normalization  
*data matrix normalization method*

---

**Description**

normalize expression matrix by first replicate's median gene expression values

**Usage**

```
deseq.median.ratio.normalization(npci.data)
```

**Arguments**

npci.data      a data frame containing non-zero numeric values (the data frame must contain more than one row and one column)

**Details**

TBD

**Value**

data.frame      a new dataframe with each column having the same median value

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
udata=data.frame(matrix(sample(3:100, 6*4), 6,4))
normalized.udata=deseq.median.ratio.normalization(udata)
```

---

divergence.multivariate.distributions  
*estimate fCI divergence for given samples of arbitrary dimensions*

---

**Description**

estimate fCI divergence for given samples of arbitrary dimensions

**Usage**

```
divergence.multivariate.distributions(null.data, diff.data, choice = 2)
```

**Arguments**

null.data	the empirical null dataset (a dataframe of none-zero ratio values)
diff.data	the case-control dataset (a dataframe of none-zero ratio values)
choice	choice=1 => cross entropy choice=2 => Helligan distance choice=3 => KL distance

**Details**

TBD

**Value**

divergences	The estimated divergence given control-control and case-control expression ratios
-------------	---

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
null.data=data.frame(matrix(sample(seq(from=0.1,to=10, by=0.01), 100), 100,1))
diff.data=data.frame(matrix(sample(seq(from=0.1,to=10, by=0.01), 100), 100,1))
divergence.multivariate.distributions(null.data, diff.data, choice = 2)
```



fCI-class

Class "fCI"

**Description**

The main Class that defines the slots values

**Objects from the Class**

Objects can be created by calls of the form `new("fCI", ...)`.

**Slots**

sample.data.file: Object of class "character" ~~  
 distance.matrix: Object of class "matrix" ~~  
 sample.data.normalized: Object of class "data.frame" ~~  
 attr.info: Object of class "data.frame" ~~  
 null.data.start: Object of class "matrix" ~~  
 diff.data.start: Object of class "matrix" ~~  
 expr.by.fold: Object of class "matrix" ~~  
 fold.cutoff.list: Object of class "list" ~~  
 rank.index.to.be.removed: Object of class "list" ~~  
 diff.gene.ids: Object of class "list" ~~  
 wt.index: Object of class "numeric" ~~  
 df.index: Object of class "numeric" ~~  
 ctr.indexes: Object of class "numeric" ~~  
 trt.indexes: Object of class "numeric" ~~  
 method.option: Object of class "numeric" ~~  
 use.ratio: Object of class "logical" ~~  
 percent.genes.to.scan: Object of class "numeric" ~~  
 num.genes.to.skip.each: Object of class "numeric" ~~  
 use.fold.change: Object of class "logical" ~~  
 wt.comb: Object of class "list" ~~  
 df.comb: Object of class "list" ~~  
 diff.ids: Object of class "list" ~~  
 result: Object of class "numeric" ~~  
 indexes.reconsidered: Object of class "numeric" ~~  
 center.by.gaussian.kernel: Object of class "logical" ~~  
 symmetric.fold: Object of class "logical" ~~  
 pairwise.diff.gene.ids: Object of class "list" ~~

**Methods**

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

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**<http://software.steenlab.org/fCI/>**See Also**

TBD

**Examples**

```
showClass("fCI")
```

---

fCI.call.by.index	<i>top level function call to find targets based on expression data and control &amp; case indexes</i>
-------------------	--

---

**Description**

top level function call to find targets based on expression data and control & case indexes

**Usage**

```
fCI.call.by.index(wt.indexes, df.indexes, data.file, use.normalization = FALSE,  
npci=NULL, short.report=TRUE)
```

**Arguments**

wt.indexes	The wild type sample column indexes in the matrix, i.e. 1,2
df.indexes	The diseases type sample column indexes in the matrix, i.e. 3,4
data.file	The expression matrix
use.normalization	boolean value whether you want the data to be normalized or not
npci	the fCI object
short.report	whether you want to have a report summary

**Details**

TBD

**Value**

rtable	A data frame of the detected targets
--------	--------------------------------------

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**<http://software.steenlab.org/fCI/>**See Also**

TBD

**Examples**

```
wt.indexes=1:2
df.indexes=3:4
data.file=data.frame(matrix(sample(3:100, 100*4, replace=TRUE), 100,4))
use.normalization=FALSE
npci=NULL
short.report=TRUE
fCI.call.by.index(wt.indexes, df.indexes, data.file, use.normalization,
  npci, short.report)
```

---

`fci.data`*data frame of gene expression*

---

**Description**

This data set gives the gene expression values for multiple control and case samples.

**Usage**`fci.data`**Format**

a matrix containing 1043 genes and 4 samples.

**Value**

dataframe      A data frame of expression values

**Source**[software.steenlab.org](http://software.steenlab.org)**References**<http://software.steenlab.org/fCI/>

---

figures	<i>generic function to draw figures of the current analysis</i>
---------	---

---

**Description**

generic function to draw figures of the current analysis

**Usage**

```
figures(.Object)
```

**Arguments**

.Object

**Details**

TBD

**Value**

NA                    No values will be returned

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("See README")
```

---

figures-methods	<i>generate figures for empirical null and case-control distributions</i>
-----------------	---

---

**Description**

~~ Methods for function figures ~~

**Methods:**

```
signature(.Object = "NPCI")
```

---

find.fci.targets	<i>identify differentially expressed genes</i>
------------------	--

---

**Description**

identify differentially expressed genes

**Usage**

```
find.fci.targets(.Object, wt.indexes, df.indexes, data.file, use.normalization)
```

**Arguments**

.Object	the fCI object
wt.indexes	The wild type sample column indexes in the matrix, i.e. 1,2
df.indexes	The diseases type sample column indexes in the matrix, i.e. 3,4
data.file	The expression matrix
use.normalization	boolean value whether you want the data to be normalized or not

**Details**

TBD

**Value**

NA No values will be returned

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
fci=new("NPC1")
fci.data=data.frame(matrix(sample(3:100, 1043*6, replace=TRUE), 1043,6))
targets=find.fci.targets(fci, c(1,2,3), c(4,5,6), fci.data)
head(show.targets(targets))
```

---

find.fci.targets-methods

~~ *Methods for Function find.fci.targets* ~~

---

### Description

~~ Methods for function find.fci ~~

### Methods:

signature(.Object = "NPCI") the built-in method to compute fCI DEGs.

---

find.mid.point

*find the middle value of the density distribution*

---

### Description

find the middle value of the density distribution

### Usage

find.mid.point(Y)

### Arguments

Y

### Details

TBD

### Value

position            The value the separates density into two halves

### Note

TBD

### Author(s)

Shaojun Tang

### References

<http://software.steenlab.org/fCI/>

### See Also

TBD

### Examples

```
Y=density(sample(1:100, 50), bw=0.5)
find.mid.point(Y)
```

---

`get.fold.large.step`     *generate fold change cutoff values for fCI divergence computation*

---

### Description

generate fold change cutoff with a large step of 0.5 fold

### Usage

```
get.fold.large.step()
```

### Details

TBD

### Value

`fold_values`     A vector of predefined fold changes for fCI computation

### Note

TBD

### Author(s)

Shaojun Tang

### References

<http://software.steenlab.org/fCI/>

### See Also

TBD

### Examples

```
get.fold.large.step()
```

---

get.npci.data                    *return a fCI object given the gene expression data*

---

**Description**

return a fCI object given the gene expression data

**Usage**

```
get.npci.data(sample.data.normalized, wt.index, df.index)
```

**Arguments**

sample.data.normalized

wt.index

df.index

**Details**

TBD

**Value**

expression ratio

a dataframe of fCI gene expression ratios (folds) defined by control-control index and control-case index

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
sample.data.normalized=data.frame(matrix(sample(3:100, 100*4, replace=TRUE),
  100,4))
wt.index=c(1,2)
df.index=c(1,3)
get.npci.data(sample.data.normalized, wt.index, df.index)
```



---

get.npci.distance.matrix

*generate the divergence estimation based of fold change cutoff values*

---

### **Description**

generate the divergence estimation based of fold change cutoff values

### **Usage**

```
get.npci.distance.matrix(npci.data, null.data.start, diff.data.start, choice = 2, rank.index.to.be
```

### **Arguments**

npci.data

null.data.start

diff.data.start

choice

rank.index.to.be.removed

expr.by.fold

ctr.indexes

trt.indexes

use.intersect

symmetric.fold

fold.cutoff.list

### **Details**

TBD

### **Value**

divergence      A matrix of computed divergences

### **Note**

TBD

### **Author(s)**

Shaojun Tang

### **References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
data.file=data.frame(matrix(sample(3:100, 100*4, replace=TRUE), 100,4))
wt.index=c(1,2)
df.index=c(1,3)
npci=new("NPCI")
npci@wt.index=wt.index
npci@df.index=df.index
npci@sample.data.normalized=data.file
npci=initialize(npci)
npci=normalization(npci)
npci=populate(npci)

null.data.start=npci@null.data.start
diff.data.start=npci@diff.data.start
choice=2
rank.index.to.be.removed=npci@rank.index.to.be.removed
expr.by.fold=npci@expr.by.fold
ctr.indexes=npci@wt.index
trt.indexes=npci@df.index
use.intersect=FALSE
symmetric.fold=TRUE
fold.cutoff.list=npci@fold.cutoff.list

get.npci.distance.matrix(npci.data, null.data.start, diff.data.start,
  choice = 2, rank.index.to.be.removed, expr.by.fold, ctr.indexes, trt.indexes,
  use.intersect, symmetric.fold, fold.cutoff.list)
```

---

get.outline.index      *find the outline genes of a given distribution*

---

**Description**

find the outline genes of a given distribution

**Usage**

```
get.outline.index(values)
```

**Arguments**

values

**Details**

TBD

**Value**

indexes            remove the index of values that are outliers based on the t-test with alpha=0.05

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
values=rnorm(100)
get.outline.index(values)
```

---

*get.protein.fold.step*    *generate fold-change cutoff on proteomics data (with large steps of 0.2-0.5 fold)*

---

**Description**

generate fold-change cutoff on proteomics data (with large steps of 0.2-0.5 fold)

**Usage**

```
get.protein.fold.step()
```

**Details**

TBD

**Value**

folds            returning a vector of recommended fold ratios for proteomic study

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
get.protein.fold.step()
```

---

get.rank.combinations *fold change values*

---

**Description**

identify the fold change value indexes beyond the fCI estimation

**Usage**

```
get.rank.combinations(rank.index.to.be.removed, symmetric.fold)
```

**Arguments**

rank.index.to.be.removed

a list of integers representing the genes to be removed because it exceeds the predefined fold change, i.e 1.2 fold

symmetric.fold a boolean value indicating the upregulation and downregulation are treated equally

**Details**

TBD

**Value**

combinations a data frame of gene indexes

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
rank.index.to.be.removed=list(sample(1:100, 20))
symmetric.fold=TRUE
get.rank.combinations(rank.index.to.be.removed, symmetric.fold)
```

---

*get.rna.fold.step*      *generate fCI fold-change cutoff values for typical RNA-Seq data*

---

**Description**

generate fCI fold-change cutoff values for typical RNA-Seq data

**Usage**

```
get.rna.fold.step()
```

**Details**

TBD

**Value**

folds                      a vector of fold changes fCI used for divergence computation

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
get.rna.fold.step()
```

---

```
initialize-methods    ~~ Methods for Function initialize ~~
```

---

**Description**

```
~~ Methods for function initialize ~~
```

**Methods:**

```
signature(.Object = "NPCI") this s4 class generic method initialize the fCI object once it is made
```

---

```
intersect.of.lists    find the common values of all vectors of a list
```

---

**Description**

```
find the common values of all vectors of a list
```

**Usage**

```
intersect.of.lists(vectorlist)
```

**Arguments**

```
vectorlist    a list of list values which we want to use to find common values
```

**Details**

```
TBD
```

**Value**

```
intersects    the common values of lists
```

**Note**

```
TBD
```

**Author(s)**

```
Shaojun Tang
```

**References**

```
http://software.steenlab.org/fCI/
```

**See Also**

```
TBD
```

**Examples**

```
print("this function will be disabled!")
```

---

<code>is.installed</code>	<i>package</i>
---------------------------	----------------

---

### **Description**

test if a package is installed in the R library

### **Usage**

```
is.installed(mypkg)
```

### **Arguments**

`mypkg` a R library name, such as FNN

### **Details**

TBD

### **Value**

`installation` boolean value indicating the installation

### **Note**

TBD

### **Author(s)**

Shaojun Tang

### **References**

<http://software.steenlab.org/fCI/>

### **See Also**

TBD

### **Examples**

```
is.installed('fCI')
```

---

`multi dimensional.fci.data`  
*data frame of gene expression*

---

**Description**

This data set gives the gene expression values for 14204 genes and the control and case samples were generated at two time points (bivariate data).

**Usage**

`fci.data`

**Format**

a matrix containing 14204 genes and 8 samples.

**Value**

dataframe      A data frame of expression values

**Source**

[software.steen.org](http://software.steen.org)

**References**

<http://software.steenlab.org/fCI/>

---

`normalization`      *generic function to normalize gene expression matrix*

---

**Description**

generic function to normalize gene expression matrix

**Usage**

`normalization(.Object)`

**Arguments**

`.Object`      the predefined class object (i.e `fCI=new("NPC1")`)

**Details**

TBD

**Value**

NA      No values will be returned



**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("See README")
```

---

normalization-methods    *~~ Methods for Function normalization ~~*

---

**Description**

*~~ Methods for function normalization ~~*

**Methods:**

`signature(.Object = "NPCI")` the built-in method for fCI data normalization, by default, the data is normalized according to mean excluding the top 5 and bottom 5 percent.

---

NPCI-class

*Class "NPCI"*

---

**Description**

The main Class that defines the slots values

**Objects from the Class**

Objects can be created by calls of the form `new("NPCI", ...)`.

**Slots**

sample.data.file: Object of class "character" ~~  
distance.matrix: Object of class "matrix" ~~  
sample.data.normalized: Object of class "data.frame" ~~  
attr.info: Object of class "data.frame" ~~  
null.data.start: Object of class "matrix" ~~  
diff.data.start: Object of class "matrix" ~~  
expr.by.fold: Object of class "matrix" ~~  
fold.cutoff.list: Object of class "list" ~~  
rank.index.to.be.removed: Object of class "list" ~~  
diff.gene.ids: Object of class "list" ~~  
wt.index: Object of class "numeric" ~~  
df.index: Object of class "numeric" ~~  
ctr.indexes: Object of class "numeric" ~~  
trt.indexes: Object of class "numeric" ~~  
method.option: Object of class "numeric" ~~  
use.ratio: Object of class "logical" ~~  
percent.genes.to.scan: Object of class "numeric" ~~  
num.genes.to.skip.each: Object of class "numeric" ~~  
use.fold.change: Object of class "logical" ~~  
wt.comb: Object of class "list" ~~  
df.comb: Object of class "list" ~~  
diff.ids: Object of class "list" ~~  
result: Object of class "numeric" ~~  
indexes.reconsidered: Object of class "numeric" ~~  
center.by.gaussian.kernel: Object of class "logical" ~~  
symmetric.fold: Object of class "logical" ~~  
pairwise.diff.gene.ids: Object of class "list" ~~

**Methods**

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

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/NPCI/>

**See Also**

TBD

**Examples**

```
showClass("NPCI")
```

---

```
npci.gene.by.pvalues find most significantly change fCI targets
```

---

**Description**

identify the genes that change most significantly using inverse of log ratio the smaller the results, the more significant the changes.

**Usage**

```
npci.gene.by.pvalues(npci.data, gene.indexes, ctr.indexes, trt.indexes)
```

**Arguments**

<code>npci.data</code>	a data frame containing non-zero numeric values (the data frame must contain more than one row and one column)
<code>gene.indexes</code>	the row ids of genes used for p-value calculation
<code>ctr.indexes</code>	The wild type sample column indexes in the matrix, i.e. 1,2
<code>trt.indexes</code>	The experimental sample column indexes in the matrix, i.e. 1,2

**Details**

TBD

**Value**

`pvalues` a vector of pvalues

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
npci.data=data.frame(matrix(sample(3:100, 100*4, replace=TRUE), 100,4))
gene.indexes=sample(1:97, 25)
ctr.indexes=c(1,2)
trt.indexes=c(3,4)
npci.gene.by.pvalues(npci.data, gene.indexes, ctr.indexes, trt.indexes)
```

---

npci.index.reconsidered

*find targets that have little evidence to be differentially expressed*

---

**Description**

the function will be depreciated

**Usage**

```
npci.index.reconsidered(npci.data, expr.by.fold, null.data.start, diff.data.start, gene.indexes, c
```

**Arguments**

npci.data	a data frame containing non-zero numeric values (the data frame must contain more than one row and one column)
expr.by.fold	a 1xN matrix of case-control fold changes for every gene of the total N genes
null.data.start	a Nx1 matrix of control-control fold changes
diff.data.start	a Nx1 matrix of case-control fold changes
gene.indexes	the genes used for differential expression analysis.
ctr.indexes	the control sample column indexes
trt.indexes	the case sample column indexes
left.fold	the minimum fold changes for downregulation
right.fold	the minimum fold changes for upregulation

**Details**

TBD

**Value**

values            genes wrongly considered as differentially expressed

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**<http://software.steenlab.org/fCI/>**See Also**

TBD

**Examples**

```
data.file=data.frame(matrix(sample(3:100, 100*4, replace=TRUE), 100,4))
wt.index=c(1,2)
df.index=c(1,3)
npci=new("NPCI")
npci@wt.index=wt.index
npci@df.index=df.index
npci@sample.data.normalized=data.file
npci=initialize(npci)
npci=normalization(npci)
npci=populate(npci)
npci=compute(npci)
npci=summarize(npci)
```

```
npci.data=npci@sample.data.normalized
null.data.start=npci@null.data.start
diff.data.start=npci@diff.data.start
choice=2
rank.index.to.be.removed=npci@rank.index.to.be.removed
expr.by.fold=npci@expr.by.fold
```

```
ctr.indexes=1:2
trt.indexes=3:4
use.intersect=FALSE
symmetric.fold=TRUE
fold.cutoff.list=npci@fold.cutoff.list
gene.indexes=npci@diff.gene.ids
left.fold=2
right.fold=2
```

---

npci.index.to.be.removed

*gene indexes that will be considered as targets*

---

**Description**

This function will be deprecated.

**Usage**

```
npci.index.to.be.removed(expr.by.fold, d, symmetric.fold, max.rank,  
l.max.rank, r.max.rank)
```

**Arguments**

<code>expr.by.fold</code>	a 1xN matrix of fold change between case and control for every genes in N genes
<code>d</code>	the dimension of the data, if RNA-Seq or LC-MS/MS data, d=1
<code>symmetric.fold</code>	a booleam valuable indicating whether to use the same fold change cutoff for upregulation and downregulation
<code>max.rank</code>	the maximum fold change, i.e 3 fold
<code>l.max.rank</code>	the maximum fold change for downregulation, i.e 1.5 fold
<code>r.max.rank</code>	the maximum fold change for upregulation, i.e 1.5 fold

**Details**

TBD

**Value**

`indexes` gene (indexes) considered as differentially expressed

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("Function to be discarded!")
```

---

npci.venn.diagram      *generate venn diagram for multiple fCI analysis*

---

**Description**

plot the overlap differentially expressed genes by pairwise fCI analysis

**Usage**

```
npci.venn.diagram(diff.gene.ids, i = 1, k = 1)
```

**Arguments**

diff.gene.ids	gene ids for genes that are differentially expressed
i	number of comparisons for fCI analysis, i.e 1 or 2
k	number of genes for fCI analysis

**Details**

TBD

**Value**

figure      the venn diagram plot

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
targets.run1=c(2:10)
targets.run2=c(1:8)
targets.run3=c(6:12)
diff.gene.ids=list(targets.run1, targets.run2, targets.run3)
npci.venn.diagram(diff.gene.ids)
```

---

pairwise.change.occupancy

*find the targets whose fold changes occur consistently (upregulated or downregulated) in all fCI analysis*

---

### Description

find the targets whose fold changes occur consistently (upregulated or downregulated) in all fCI analysis

### Usage

```
pairwise.change.occupancy(common.ids, pairwise.index,  
pairwise.up.down, target.ratio)
```

### Arguments

common.ids        the gene ids that are differentially expressed  
pairwise.index    a list of the genes ids that differentially expressed in each of the fCI analysis  
pairwise.up.down        a list of up regulatio (+1) or downregulation (-1) for each gene in fCI analysis  
target.ratio        the expected fold changes

### Details

TBD

### Value

consistent.targets        Gene (indexes) that are consistently changed in fCI pairwise analysis  
direction                Gene (indexes) that are consistently upregulated (if < 0) or upregulated (if > 0)

### Note

TBD

### Author(s)

Shaojun Tang

### References

<http://software.steenlab.org/fCI/>

### See Also

TBD



**Examples**

```
common.ids=6:13
pairwise.index=list(c(4:13), c(6:15))
pairwise.up.down=list(c(sample(c(-1,1), 10, replace=TRUE)),
                     c(sample(c(-1,1), 10, replace=TRUE)))
target.ratio=0.5
pairwise.change.occupancy(common.ids, pairwise.index,
                           pairwise.up.down, target.ratio)
```

---

populate

*generic function to populate the fCI object based on provided data*

---

**Description**

generic function to populate the fCI object based on provided data

**Usage**

```
populate(.Object)
```

**Arguments**

.Object

**Details**

TBD

**Value**

NA No values will be returned

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("See README")
```

---

populate-methods      *~~ Methods for Function populate ~~*

---

**Description**

*~~ Methods for function populate ~~*

**Methods:**

signature(.Object = "NPCI") after fCI object is initialized, popular the slot values for the object

---

report.target.summary *generate the results (gene ids) in the data frame*

---

**Description**

generate the results (gene ids) in the data frame

**Usage**

```
report.target.summary(pairwise.diff.gene.ids)
```

**Arguments**

pairwise.diff.gene.ids  
a list of the the differentially expression genes (its index) for each pairwise fCI analysis.

**Details**

TBD

**Value**

NA                      No values will be returned

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("See README")
```

---

setfCI	<i>the generic function 'setfCI' for s4 class</i>
--------	---

---

**Description**

the generic function 'setfCI' for s4 class

**Usage**

```
setfCI(.Object, wt.index, df.index, fold.cutoff.list,
       center.distribution)
```

**Arguments**

.Object	the fCI object
wt.index	the control sample column ids, such as c(1,2)
df.index	the case sample column ids, such as c(1,2)
fold.cutoff.list	the predefined fold change cut-off such as list(seq(from=1.1, to=3.0, by=0.1))
center.distribution	a boolean value showing that if the users want to center the distribution or not

**Details**

TBD

**Value**

NA	No values will be returned
----	----------------------------

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
fci=new("NPCI")
fci=setfCI(fci, 7:8, 11:12, seq(from=1.1,to=3,by=0.1), TRUE)
```

---

```
setfCI-methods      ~~ Methods for Function setfCI ~~
```

---

**Description**

~~ Methods for function setfCI ~~

**Methods:**

```
signature(.Object = "NPCI")
```

---

```
show.targets      display the gene ids that are identified to be differentially regulated
```

---

**Description**

display the gene ids that are identified to be differentially regulated

**Usage**

```
show.targets(.Object)
```

**Arguments**

.Object            the class object, for example, fCI=new("NPCI")

**Details**

TBD

**Value**

NA                No values will be returned

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("See README")
```

---

show.targets-methods    *~~ Methods for Function show.targets ~~*

---

**Description**

~~ Methods for function show.targets ~~

**Methods:**

signature(.Object = "NPCI") the built-in method to show the fCI final DEGs.

---

summarize                      *result summerization*

---

**Description**

summerize the result after fCI computation is done

**Usage**

summarize(.Object)

**Arguments**

.Object                      the class object, for exaple, fci = new("NPCI")

**Details**

TBD

**Value**

NA                              No values will be returned

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```

data.file=data.frame(matrix(sample(3:100, 100*4, replace=TRUE), 100,4))
wt.index=c(1,2)
df.index=c(1,3)
npci=new("NPCI")
npci@wt.index=wt.index
npci@df.index=df.index
npci@sample.data.normalized=data.file
npci=initialize(npci)
npci=normalization(npci)
npci=populate(npci)
npci=summarize(npci)

```

---

summarize-methods	<i>result summerization</i>
-------------------	-----------------------------

---

**Description**

summerize the result after fCI computation is done

**Methods:**

signature(.Object = "NPCI")

---

total.library.size.normalization	<i>normalize the gene expression based on the library size (summation) of the first sample replicate</i>
----------------------------------	--

---

**Description**

normalize the gene expression based on the library size (summation) of the first sample replicate

**Usage**

```
total.library.size.normalization(sample.data)
```

**Arguments**

sample.data	a data frame of gene expression (noen-zero) with columns being the sample and rows being genes
-------------	--

**Details**

TBD

**Value**

dataframe	a data frame where column values were normalized by total library size
-----------	--

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**<http://software.steenlab.org/fCI/>**See Also**

TBD

**Examples**

```
sample.data=data.frame(matrix(sample(3:100, 100*4, replace=TRUE), 100,4))
total.library.size.normalization(sample.data)
```

---

`trim.size.normalization`*normalize gene expression by excluding genes on the top 5 and bottom 5 percentage*

---

**Description**

normalize gene expression by excluding genes on the top 5 and bottom 5 percentage

**Usage**`trim.size.normalization(sample.data)`**Arguments**

<code>sample.data</code>	a data frame of gene expression (noen-zero) with columns being the sample and rows being genes
--------------------------	--

**Details**

TBD

**Value**

<code>dataframe</code>	a data frame where column values were normalized by all genes except the top 5 percent and bottom 5 percent genes
------------------------	---

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
sample.data=data.frame(matrix(sample(3:100, 100*4, replace=TRUE), 100,4))
trim.size.normalization(sample.data)
```

---

two.sample.log.ratio *compute the log ratios of two vectors*

---

**Description**

compute the log ratios of two vectors

**Usage**

```
two.sample.log.ratio(a, b)
```

**Arguments**

a a vector of numeric values (value must be greater than 0)  
b a vector of numeric values (value must be greater than 0)

**Details**

TBD

**Value**

ratios the log ratios of two vectors

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>



**See Also**

TBD

**Examples**

```
a=10
b=2
two.sample.log.ratio(a, b)
```

---

```
two.sample.permutation.test
    perform permutation test on two vectors
```

---

**Description**

perform permutation test on two vectors

**Usage**

```
two.sample.permutation.test(a, b)
```

**Arguments**

a	a vector of numeric values (value must be greater than 0)
b	a vector of numeric values (value must be greater than 0)

**Details**

TBD

**Value**

pvalue            the pvalue of permutation test

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
two.sample.permutation.test(sample(1:100, 20), sample(5:104, 20))
```

---

venndiagram	<i>generate a venn diagram to show the differentially expression summaries accross pairwise fCI analysis</i>
-------------	--

---

**Description**

generate a venn diagram to show the differentially expression summaries accross pairwise fCI analysis

**Usage**

```
venndiagram(.Object)
```

**Arguments**

.Object	the class object, i.e, fci=new("NPC1")
---------	--

**Details**

TBD

**Value**

NA	No values will be returned
----	----------------------------

**Note**

TBD

**Author(s)**

Shaojun Tang

**References**

<http://software.steenlab.org/fCI/>

**See Also**

TBD

**Examples**

```
print("See README")
```

---

venndiagram-methods    *~~ Methods for Function venndiagram ~~*

---

**Description**

~~ Methods for function venndiagram ~~

**Methods:**

signature(.Object = "NPCI") generate the venn diagram to show the targets that shared among different fCI analysis

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