

Package ‘CNA2Subpathway’

August 19, 2020

Type Package

Title Identification of Dysregulated Subpathway Driven by Copy Number Alteration

Version 0.1.0

Author Junwei Han, Yuqi Sheng, Baotong Zheng

Maintainer Junwei Han <hanjunwei1981@163.com>

Description Identify dysfunctional subpathways driven by somatic copy number alterations (CNAs). we first construct a weighted subpathway crosstalk network. the weights of the network consider both the crosstalk relationship of the biological functions performed among those subpathways and the differential expression extent of genes influenced by the CNAs. Next, we calculate the centrality scores of subpathways by a random walk algorithm on the network, which reflect the extent of subpathways influenced by the somatic CNAs and subpathways crosstalk. Finally, a bootstrap-based randomization method is used to calculate the statistical significance of the scores.

License GPL (>= 2)

Encoding UTF-8

LazyData true

Depends R (>= 2.10)

RoxygenNote 7.0.2

Imports igraph,
discover,
graphics

Suggests knitr,
rmarkdown

VignetteBuilder knitr

R topics documented:

CNA2Subpathway-package	2
envData	2
getCNADEscore	3
getCNAlabel	3
GetExampleData	4
IDSubPath	4
plotDiscovermap	5
plotSubPathway	6
Index	8

CNA2Subpathway-package
The CNA2Subpathway package

Description

CNA2Subpathway is a R package for based on Copy Number Alterations(CNAs) to identify dys-regulated subpathway in cancer.

Details

CNA2Subpathway
The main goals of the CNA2Subpathway package is to provide main functions and some datas.
The main functions includes: 1) getCNADEscore 2) getCNAlabel 3) IDSubpath and two visual functions: 1) plotDiscovermap 2) plotSubPathway.
For more details, please see browseVignettes("CNA2Subpathway")

envData	<i>The variables in the environment include an copy number variation data, amplified genes,deleted genes, an example expression profile, A matrix of subpathway infomation, Biological functions data, Jac-card coefficient of the network point, Overlapping genes of the network point, A list of subpathway map infomation, A binary matrix of CNA profile, A matric of CNADEscore, Optimized subpathway, and the sta-tistical significance p value and FDR for these optimal subpathways</i>
---------	--

Description

Identification of dysregulated subpathways driven by Copy Number aberrations(CNA). We firstly calculate the CNADEscore by copy number aberration and gene expression. Secondly, we constructing subpathways network that implicitly links subpathways through their common function and weight of the network based on the CNADEscore. Finally, we calculate an eigenvector centrality and the statistical significance of these subpathways is assessed using a bootstrap-based ran-domization method.

Format

An environment variable

Details

The environment variable includes the variable ampGene, delGene,CNAlabelresult,GEP,CNAP,GoInfo,SubPathwayInfo

Author(s)

Junwei Han<hanjunwei1981@163.com>,Yuqi Sheng<sheng_yuqi@163.com>, Baotong Zheng<btzheng1116@163.com>

getCNADEscore	<i>getCNADEscore</i>
---------------	----------------------

Description

The function getCNADEscore used calculate the CNA-DEscore. The CNA-DEscore is defined as differentially expressed genes driven by CNA. We used the Student's t-test to calculate the t scores with the CNA label, and standardized them to a normal distribution with a mean of 0 and an SD of 1.

Usage

```
getCNADEscore(inexpData, CNALabel)
```

Arguments

inexpData	Gene Expression profile(GEP)
CNALabel	The CNA label (the result of function getCNAlabel)

Value

A matrix of the Student's t-test result and CNA-DEscore

Examples

```
# obtain GEP data
GEP<-GetExampleData("GEP")
# obtain the result of getCNAlabel function
CNALabelresult<-GetExampleData("CNALabelresult")
# Calculate the CNA-DEscore
CNADEscore<-getCNADEscore(GEP,CNALabelresult)
# view first the ten gene CNA-DEscore
head(CNADEscore[1:10,])
```

getCNAlabel	<i>getCNAlabel</i>
-------------	--------------------

Description

The function getCNAlabel used to discretize the CNA profile to a binary matrix.

Usage

```
getCNAlabel(CNAprofile, ampGene, delGene)
```

Arguments

CNAprofile	Copy Number Alteration profile
ampGene	A vector of strings, the gene symbol of amplified genes
delGene	A vector of strings, the gene symbol of deleted genes

Value

A binary matrix

Examples

```
# obtain Copy Number Alteration profile data
CNAP<-GetExampleData("CNAP")
head(CNAP[1:10,1:10])
# obtion amplified genes
ampGene<-GetExampleData("ampGene")
# obtion deleted genes
delGene<-GetExampleData("delGene")
# Obtin the CNA label.
CNAlabelresult<-getCNAlabel(CNAP,ampGene,delGene)
# get the result of the getCNAlabel function
CNAlabelresult<-GetExampleData("CNAlabelresult")
# view first ten genes and ten sample of the label
head(CNAlabelresult[1:10,1:10])
```

GetExampleData	<i>GetExampleData</i>
----------------	-----------------------

Description

Get the example data of test package for litte trials

Usage

```
GetExampleData(exampleData)
```

Arguments

exampleData A character,should be one of"ampGene","delGene","GEP","CNAP", "SubPathwayInfo", "GoInfo", "GoSubPconGene", "Jaccardscore", "SubPathwaymapdata", "CNAlabelresult", "CNA2Subpathwayresult".

Value

data

IDSubPath	<i>IDSubPath</i>
-----------	------------------

Description

The function IDSubPath used to find significant dysregulate subpathways by the IDSCNA method. According our method, in this function, the user need input 6 variable. Four of six variable can obtain from our example data, those data from KEGG and GO, and the user can change at will also. The "CNADEscore" variable is result of function getCNADEscore. And the last variable is nperm, that representative number of disturbances, usually nperm = 1000 or bigger as statistically significant.

Usage

```
IDSubPath(CNADEscore, nperm, Subpathway, Go, Jaccard, Go_SubPath_gene)
```

Arguments

CNADEscore	The CNA-DEscore of genes.
nperm	input Number of disturbance(≥ 1000).
Subpathway	Subpathway information from SuupathwayMiner.
Go	Biological functions data from Gene Ontology.
Jaccard	Jaccard score shared by a sub-pathway with biological function. Used to optimization.
Go_SubPath_gene	Genes symble shared by a sub-pathway with biological function. Used to optimization.

Value

Optimized subpathway, and the statistical significance p value and FDR for these optimal subpathways

Examples

```
# load depend package
require(igraph)
# obtain subpathway data
SubPathwayInfo<-GetExampleData("SubPathwayInfo")
# obtain biological functions data
GoInfo<-GetExampleData("GoInfo")
# obtain some genes shared by a sub-pathway with biological function
GoSubPconGene<-GetExampleData("GoSubPconGene")
# obtain Jaccardscore shared by a sub-pathway with biological function
Jaccardscore<-GetExampleData("Jaccardscore")
# obtain the result of getDEGscore function
CNADEscore<-GetExampleData("CNADEscore")
# run the IDSubPath function
#CNA2Subpathwayresult<-IDSubPath(CNADEscore,nperm=100,
#                               Subpathway=SubPathwayInfo,Go=GoInfo,
#                               Jaccard=Jaccardscore,Go_SubPath_gene=GoSubPconGene)
# get the result of the IDSCNA function #only show
CNA2Subpathwayresult<-GetExampleData("CNA2Subpathwayresult")
# View the result top 10 subpathways
head(CNA2Subpathwayresult[1:10,])
```

plotDiscovermap

plotDiscovermap

Description

we use Copy Number Alteration data to polt discover.

Usage

```
plotDiscovermap(genes, CNAmatrix)
```

Arguments

genes	A vector of strings. The user interesting and happened CNA genes symbol.
CNAmatrix	The copy number alteration matrix. It takes the from of a binary matrix. Only 0 and 1 are allowed as values.

Value

Groupwise test of the discover result

Examples

```
# load depend package
require(discover)
# input gene
genes <- c("AKT3", "AKT1", "CALML5", "PIK3CA", "PIK3R1", "CALM1", "CALM3", "CALML3")
# get the result of the getCNALabel function
CNALabelresult<-GetExampleData("CNALabelresult")
# plot discover
discover<-plotDiscovermap(genes,CNALabelresult)
plot(discover)
```

plotSubPathway

plotSubPathway

Description

The function plotsubpathway can visualization of a subpathway network map.

Usage

```
plotSubPathway(
  subpathwayID,
  subpathwaydata,
  layout = NULL,
  margin = 0,
  vertex.label.cex = 0.8,
  vertex.label.font = 0.8,
  vertex.label.dist = 1,
  vertex.size = 12,
  edge.arrow.width = 3,
  edge.label.cex = 0.6,
  vertex.label.color = "black",
  vertex.color = "#F08080",
  vertex.frame.color = "dimgray",
  edge.color = "grey70",
  edge.label.color = "dimgray",
  sub = NULL,
  main = NULL
)
```

Arguments

subpathwayID	subpathway id number
subpathwaydata	The subpathwaymap data
layout	A matrix of x-y coordinates with two dims. Determine the placement of the nodes for drawing a graph.
margin	A numeric. The value is usually between -0.5 and 0.5, which is able to zoom in or out a subpathway graph. The default is 0.
vertex.label.cex	A numeric vector of node label size.
vertex.label.font	A numeric vector of label font.
vertex.label.dist	A numeric vector of label dist.
vertex.size	A numeric vector of Node size. See plot.igraph.
edge.arrow.width	Edge arrow width. The default is 3.
edge.label.cex	Edge label size.
vertex.label.color	A vector of node label colors. The default is black.
vertex.color	A vector of node colors. The default is the KEGG node color.
vertex.frame.color	A vector of node frame color. The default is dimgray.
edge.color	A vector of edge color. The default is dimgray
edge.label.color	A vector of edge label color. The default is dimgray.
sub	A character string of subtitle.
main	A character string of main title.

Value

a subpathway map

Examples

```
# load depend package
require(igraph)
# obtain subpathwaymap data
SubPathwaymapdata<-GetExampleData("SubPathwaymapdata")
# plot network graph of the subpathway 04915_13
plotSubPathway("04915_13",SubPathwaymapdata)
```

Index

*Topic **data**

envData, [2](#)

ampGene (envData), [2](#)

CNA2Subpathway
(CNA2Subpathway-package), [2](#)

CNA2Subpathway-package, [2](#)

CNAEScore (envData), [2](#)

CNAlabelresult (envData), [2](#)

CNAP (envData), [2](#)

delGene (envData), [2](#)

envData, [2](#)

GEP (envData), [2](#)

getCNAEScore, [3](#)

getCNAlabel, [3](#)

GetExampleData, [4](#)

GoInfo (envData), [2](#)

GoSubPconGene (envData), [2](#)

IDSubPath, [4](#)

Jaccardscore (envData), [2](#)

plotDiscovermap, [5](#)

plotSubPathway, [6](#)

SubpathwayCNAresult (envData), [2](#)

SubPathwayInfo (envData), [2](#)

SubPathwaymapdata (envData), [2](#)