

# Package ‘NoRCE’

October 16, 2022

**Type** Package

**Title** NoRCE: Noncoding RNA Sets Cis Annotation and Enrichment

**Version** 1.8.0

**Description** While some non-coding RNAs (ncRNAs) are assigned critical regulatory roles, most remain functionally uncharacterized. This presents a challenge whenever an interesting set of ncRNAs needs to be analyzed in a functional context. Transcripts located close-by on the genome are often regulated together. This genomic proximity on the sequence can hint to a functional association. We present a tool, NoRCE, that performs cis enrichment analysis for a given set of ncRNAs. Enrichment is carried out using the functional annotations of the coding genes located proximal to the input ncRNAs. Other biologically relevant information such as topologically associating domain (TAD) boundaries, co-expression patterns, and miRNA target prediction information can be incorporated to conduct a richer enrichment analysis. To this end, NoRCE includes several relevant datasets as part of its data repository, including cell-line specific TAD boundaries, functional gene sets, and expression data for coding & ncRNAs specific to cancer. Additionally, the users can utilize custom data files in their investigation. Enrichment results can be retrieved in a tabular format or visualized in several different ways. NoRCE is currently available for the following species: human, mouse, rat, zebrafish, fruit fly, worm, and yeast.

**License** MIT + file LICENSE

**Depends** R (>= 4.0)

**Imports** KEGGREST, png, dplyr, graphics, RSQLite, DBI, tidyr, grDevices, S4Vectors, SummarizedExperiment, reactome.db, rWikiPathways, RCurl, dbplyr, utils, ggplot2, igraph, stats, reshape2, readr, GO.db, zlibbioc, biomaRt, rtracklayer, IRanges, GenomicRanges, GenomicFeatures, AnnotationDbi

**Encoding** UTF-8

**RoxygenNote** 7.1.1

**Suggests** knitr,

TxDb.Hsapiens.UCSC.hg38.knownGene, TxDb.Drerio.UCSC.danRer10.refGene, TxDb.Mmusculus.UCSC.mm10.knownGene, TxDb.Dmelanogaster.UCSC.dm6.ensGene, testthat, TxDb.Celegans.UCSC.ce11.refGene, rmarkdown, TxDb.Rnorvegicus.UCSC.rn6.refGene, TxDb.Hsapiens.UCSC.hg19.knownGene, org.Mm.eg.db,

org.Rn.eg.db,org.Hs.eg.db,org.Dr.eg.db,BiocGenerics,  
org.Sc.sgd.db, org.Ce.eg.db,org.Dm.eg.db, methods,markdown

**VignetteBuilder** knitr

**biocViews** BiologicalQuestion, DifferentialExpression,  
GenomeAnnotation, GeneSetEnrichment, GeneTarget,  
GenomeAssembly, GO

**LazyData** true

**BugReports** <https://github.com/guldenolgun/NoRCE/issues>

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

**git\_branch** RELEASE\_3\_15

**git\_last\_commit** ffeef02

**git\_last\_commit\_date** 2022-04-26

**Date/Publication** 2022-10-16

**Author** Gulden Olgun [aut, cre]

**Maintainer** Gulden Olgun <gulden@cs.bilkent.edu.tr>

## R topics documented:

annGO . . . . .	3
assembly . . . . .	4
brain_disorder_ncRNA . . . . .	4
brain_mirna . . . . .	5
breastmRNA . . . . .	5
calculateCorr . . . . .	6
convertGeneID . . . . .	7
convertGMT . . . . .	8
corrbased . . . . .	8
corrbasedMrna . . . . .	9
createNetwork . . . . .	10
drawDotPlot . . . . .	11
extractBiotype . . . . .	11
filterBiotype . . . . .	12
geneGOEnricher . . . . .	12
genePathwayEnricher . . . . .	14
geneRegionGOEnricher . . . . .	16
geneRegionPathwayEnricher . . . . .	18
getGoDag . . . . .	20
getKeggDiagram . . . . .	21
getmiRNACount . . . . .	22
getNearToExon . . . . .	22
getNearToIntron . . . . .	23
getReactomeDiagram . . . . .	24
getTADOverlap . . . . .	25
getUCSC . . . . .	26

goEnrichment . . . . .	27
KeggEnrichment . . . . .	28
listTAD . . . . .	29
mirna . . . . .	30
mirnaGOEnricher . . . . .	30
mirnaPathwayEnricher . . . . .	32
mirnaRegionGOEnricher . . . . .	34
mirnaRegionPathwayEnricher . . . . .	36
mrna . . . . .	38
ncRegion . . . . .	38
NoRCE-class . . . . .	39
packageCheck . . . . .	39
pathwayEnrichment . . . . .	40
predictmiTargets . . . . .	41
reactomeEnrichment . . . . .	41
setParameters . . . . .	43
tad_dmel . . . . .	44
tad_hg19 . . . . .	44
tad_hg38 . . . . .	45
tad_mm10 . . . . .	45
topEnrichment . . . . .	46
WikiEnrichment . . . . .	46
writeEnrichment . . . . .	47

## Index 49

---

annGO	<i>Annotate the set of genes with the GO terms for a given species and assembly</i>
-------	---

---

### Description

Annotate the set of genes with the GO terms for a given species and assembly

### Usage

```
annGO(
  genes,
  GOtype = c("BP", "CC", "MF"),
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3")
)
```

### Arguments

genes	List of mRNA genes. Supported format for genes is Hugo.
GOtype	Hierarchical category of the GO ontology. Possible values are 'BP', 'CC', 'MF'.
org_assembly	Genome assembly of interest. Possible assemblies are 'mm10' for mouse, 'dre10' for zebrafish, 'rn6' for rat, 'dm6' for fruit fly, 'ce11' for worm, 'hg19' and 'hg38' for human

**Value**

data frame of the GO term annotation of the genes

---

assembly	<i>Get the required information for the given assembly</i>
----------	--

---

**Description**

Get the required information for the given assembly

**Usage**

```
assembly(
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3")
)
```

**Arguments**

`org_assembly` Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human

**Value**

setting required information

**Examples**

```
assembly('hg19')
```

---

brain_disorder_ncRNA	<i>Differentially expressed non-coding gene</i>
----------------------	---

---

**Description**

Differentially expressed non-coding gene

**Usage**

```
brain_disorder_ncRNA
```

**Format**

Not Available

**Source**

<http://resource.psychencode.org/>

**Examples**

```
data(brain_disorder_ncRNA)
```

---

brain_mirna	<i>Differentially expressed human brain data</i>
-------------	--

---

**Description**

Differentially expressed human brain data

**Usage**

```
brain_mirna
```

**Format**

Not Available

**Source**

<http://resource.psychencode.org/>

**Examples**

```
data(brain_mirna)
```

---

breastmRNA	<i>Protein coding genes that are differentially expressed in TCGA breast cancer RNAseq data.</i>
------------	--

---

**Description**

Protein coding genes that are differentially expressed in TCGA breast cancer RNAseq data.

**Usage**

```
breastmRNA
```

**Format**

Not Available

**Source**

<https://portal.gdc.cancer.gov/>

**Examples**

```
data(breastmRNA)
```

---

calculateCorr	<i>Calculates the correlation coefficient values between two custom expression data.</i>
---------------	--

---

**Description**

Calculates the correlation coefficient values between two custom expression data.

**Usage**

```
calculateCorr(
  exp1,
  exp2,
  label1 = "",
  label2 = "",
  corrMethod = "pearson",
  varCutoff = 0.0025,
  corCutoff = 0.3,
  pcut = 0.05,
  alternate = "greater",
  conf = 0.95
)
```

**Arguments**

exp1	Custom expression data matrix or SummarizedExperiment data. Columns must be genes and rows must be patients.
exp2	Custom expression data matrix or SummarizedExperiment data. Columns must be genes and rows must be patients.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.
label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
corrMethod	Correlation coefficient method that will be used for evaluation. Possible values are "pearson", "kendall", "spearman"
varCutoff	Variance cut off that genes have less variance than this value will be trimmed
corCutoff	Correlation cut off values for the given correlation method
pcut	P-value cut off for the correlation values

alternate	Holds the alternative hypothesis and "two.sided", "greater" or "less" are the possible values.
conf	Confidence level for the returned confidence interval. It is only used for the Pearson correlation coefficient if there are at least 4 complete pairs of observations.

**Value**

Pairwise relations between gene-gene with corresponding correlation value and pvalue

**Examples**

```
#Assume that mirnanorce and mrnanorce are custom patient by gene data
a<-calculateCorr(exp1 = mirna, exp2 = mrna )
```

---

convertGeneID	<i>Convert gene ids according to the gene type</i>
---------------	--

---

**Description**

Convert gene ids according to the gene type

**Usage**

```
convertGeneID(
  genotype = c("Entrez", "mirna", "Ensembl_gene", "Ensembl_trans", "NCBI"),
  genelist,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3")
)
```

**Arguments**

genotype	Type of the input gene list. Possible values are "Entrez", "mirna", "Ensembl_gene", "Ensembl_trans", "NCBI". For HUGO gene symbol "NCBI" value, for Entrez gene id "Entrez", for mirbase id "mirna" is used.
genelist	Input gene list
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human

**Value**

GRange object of the given input

**Examples**

```
convGene <-convertGeneID(genetype = "mirna",
                        genelist = brain_mirna[1:30,],
                        org_assembly = 'hg19')
```

---

convertGMT	<i>Convert gmt formatted pathway file to the Pathway ID, Entrez, symbol formatted data frame</i>
------------	--

---

**Description**

Convert gmt formatted pathway file to the Pathway ID, Entrez, symbol formatted data frame

**Usage**

```
convertGMT(gmtName, org_assembly, isSymbol = FALSE)
```

**Arguments**

gmtName	Custom pathway gmt file
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
isSymbol	Boolean variable that hold the gene format of the gmt file. If it is set as TRUE, gene format of the gmt file should be symbol. Otherwise, gene format should be ENTREZ ID. By default, it is FALSE.

**Value**

return data frame

---

corrbased	<i>Pearson correlation coefficient value of the miRNA genes between miRNA:mRNA for a given correlation cut-off and cancer.</i>
-----------	--

---

**Description**

Pearson correlation coefficient value of the miRNA genes between miRNA:mRNA for a given correlation cut-off and cancer.

**Usage**

```
corrbased(mirnagene, cancer, minAbsCor, databaseFile)
```

**Arguments**

mirnagene	Data frame of the miRNA genes in mature format
cancer	Name of the TCGA project code such as 'BRCA' that is analyzed for miRNA-mRNA correlation. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
minAbsCor	Cut-off value for the Pearson correlation coefficient of the miRNA-mRNA
databaseFile	Path of the miRcancer.db file

**Value**

Data frame of the miRNA-mRNA correlation result

---

corrbasedMrna	<i>Pearson correlation coefficient value of the mRNA genes between miRNA:mRNA for a given correlation cut-off and cancer.</i>
---------------	---

---

**Description**

Pearson correlation coefficient value of the mRNA genes between miRNA:mRNA for a given correlation cut-off and cancer.

**Usage**

```
corrbasedMrna(mRNAgene, cancer, minAbsCor, databaseFile)
```

**Arguments**

mRNAgene	Data frame of the mRNA genes
cancer	Name of the TCGA project code such as 'BRCA' that is analyzed for miRNA-mRNA correlation. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
minAbsCor	Cut-off value for the Pearson correlation coefficient of the miRNA-mRNA
databaseFile	Path of miRcancer.db file

**Value**

Data frame of the miRNA-mRNA correlation result

---

createNetwork	<i>Create interaction network for top n enriched GO term: coding RNA or GO-term: noncoding RNA interaction. Nodes are GO term and RNA, edges are interactions between them. Each GO-term is annotated and enriched with the mRNAs provided from the input list.</i>
---------------	---

---

### Description

Create interaction network for top n enriched GO term: coding RNA or GO-term: noncoding RNA interaction. Nodes are GO term and RNA, edges are interactions between them. Each GO-term is annotated and enriched with the mRNAs provided from the input list.

### Usage

```
createNetwork(
  mrnaObject,
  type = "pvalue",
  n,
  isNonCode = FALSE,
  takeID = FALSE
)
```

### Arguments

mrnaObject	Output of enrichment results
type	Sort in terms of p-values or FDR. Possible values "pvalue", "padjust"
n	Number of top enrichments
isNonCode	Boolean value that checks whether node of the network is GO-term& coding or GO-term& noncoding genes. By default, it is FALSE so node of the network is GO-term& coding gene. Otherwise, nodes are GO-term& noncoding genes.
takeID	Boolean value that checks the name decision of the GO/pathway node, GO-term/pathway-term or GO ID-pathway ID. If it is true, name of the GO/pathway node will be GO ID/pathway ID will be used, otherwise, name of the GO/pathway node is GO-term. By default, it is FALSE. It is suggested to used when the GO-term is too long or the GO-term is missing for the custom enrichment database.

### Value

Network

---

drawDotPlot	<i>Draw dot plot of the enrichment object</i>
-------------	---

---

**Description**

Draw dot plot of the enrichment object

**Usage**

```
drawDotPlot(mrnaObject, type = "pAdjust", n)
```

**Arguments**

mrnaObject	Object of the enrichment result
type	Draw the dot plot according to the p-value or adjusted p-value ("pvalue", "pAdjust")
n	Number of GO terms or pathways, that ordered by type and has least number of top p-value

**Value**

Dot plot of the top n enrichment results

---

extractBiotype	<i>Get the biotype of the non-coding genes. It is suitable for the GENCODE gtf files</i>
----------------	--

---

**Description**

Get the biotype of the non-coding genes. It is suitable for the GENCODE gtf files

**Usage**

```
extractBiotype(gtfFile)
```

**Arguments**

gtfFile	Path of the input gtf file which contains biotype information. The gtf file must be provided from the Ensembl or Gencode site. For space efficiency, gtf files should be in a zip format.
---------	---

**Value**

Tabular form of the gtf file with the required features such as gene id and biotypes

**Examples**

```
fileImport<-system.file("extdata", "temp.gtf", package = "NoRCE")
gtf <- extractBiotype(gtffile = fileImport)
```

---

filterBiotype	<i>Extract the genes that have user provided biotypes. This method is useful when input gene list is mixed or when research of the interest is only focused on specific group of genes.</i>
---------------	---

---

**Description**

Extract the genes that have user provided biotypes. This method is useful when input gene list is mixed or when research of the interest is only focused on specific group of genes.

**Usage**

```
filterBiotype(gtffile, biotypes)
```

**Arguments**

gtffile	Input gtf file for the genes provided by the extractBiotype function
biotypes	Selected biotypes for the genes

**Value**

Table format of genes with a given biotypes

**Examples**

```
biotypes <- c('unprocessed_pseudogene', 'transcribed_unprocessed_pseudogene')
fileImport<-system.file("extdata", "temp.gtf", package = "NoRCE")
extrResult <- filterBiotype(fileImport, biotypes)
```

---

geneGOEnricher	<i>Given genes that fall in a given upstream and downstream region of mRNAs of interest, GO term enrichment analysis is carried out</i>
----------------	---

---

**Description**

Given genes that fall in a given upstream and downstream region of mRNAs of interest, GO term enrichment analysis is carried out

**Usage**

```

geneGOEnricher(
  gene,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  genotype = c("Entrez", "mirna", "Ensembl_gene", "Ensembl_trans", "NCBI"),
  backG = "",
  backGType = "pc_gene",
  near = FALSE,
  isTADSearch = FALSE,
  TAD = c(tad_hg19, tad_dmel, tad_hg38, tad_mm10),
  express = FALSE,
  isCustomExp = FALSE,
  cancer,
  exp1,
  exp2,
  label1 = "",
  label2 = "",
  isUnionCorGene = FALSE,
  databaseFile
)

```

**Arguments**

gene	Input genes other than miRNA
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
genotype	Type of the input gene list. Possible values are "Entrez", "mirna", "Ensembl_gene", "Ensembl_trans", "NCBI". For HUGO gene symbol "NCBI" value, for Entrez gene id "Entrez" is used.
backG	The set of genes that tested against to the input (background gene)
backGType	Type of the background gene. If miRNA gene set is used for background gene, backGType should be set to the 'mirna'
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
isTADSearch	Boolean value that shows whether TAD analysis is performed. This value has to be TRUE for TAD analysis.
TAD	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dmel' for hg19, hg38, mm9 and dm6 assembly, respectively.
express	Boolean variable whether co-expression analysis is performed. If this option is set to TRUE, co-expression analysis will be performed.
isCustomExp	Boolean variable whether co-expression analysis with custom data will be performed. When this option is set, exp1 and exp2 parameters must be defined.

cancer	Defines the name of the TCGA project code such as 'BRCA' for correlation analysis. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
exp1	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
exp2	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.
label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
isUnionCorGene	Boolean value that shows whether union of the output of the co-expression analysis and the other analysis should be considered
databaseFile	Path of miRcancer.db file

**Value**

GO term enrichment object for the given input

**Examples**

```
ncGO<-geneGOEnricher(gene = brain_disorder_ncRNA, org_assembly='hg19',
near=TRUE, genetype = 'Ensembl_gene')
```

---

genePathwayEnricher     *Given genes that fall in the given upstream and downstream region of mRNAs of interest, pathway enrichment analysis is carried out*

---

**Description**

Given genes that fall in the given upstream and downstream region of mRNAs of interest, pathway enrichment analysis is carried out

**Usage**

```
genePathwayEnricher(
  gene,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  genetype = c("Entrez", "mirna", "Ensembl_gene", "Ensembl_trans", "NCBI"),
  near = TRUE,
  isTADSearch = FALSE,
```

```

TAD = tad_hg19,
gmtName = "",
express = FALSE,
isCustomExp = FALSE,
cancer,
exp1,
exp2,
label1 = "",
label2 = "",
isUnionCorGene = FALSE,
databaseFile,
isGeneEnrich = FALSE
)

```

### Arguments

gene	Input noncoding genes other than miRNA
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
genetype	Type of the input gene list. Possible values are "Entrez", "mirna", "Ensembl_gene", "Ensembl_trans", "NCBI". For HUGO gene symbol "NCBI" value, for Entrez gene id "Entrez", for mirbase id "mirna" is used.
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
isTADSearch	Boolean value that shows whether TAD analysis is performed. This value has to be TRUE for TAD analysis.
TAD	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dmel' for hg19, hg38, mm9 and dm6 assembly, respectively.
gmtName	Custom pathway gmt file
express	Boolean variable whether co-expression analysis is performed. If this option is set to TRUE, co-expression analysis will be performed.
isCustomExp	Boolean variable whether co-expression analysis with custom data will be performed. When this option is set, exp1 and exp2 parameters must be defined.
cancer	Defines the name of the TCGA project code such as 'BRCA' for correlation analysis. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL,COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM, LGG
exp1	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.

exp2	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.
label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
isUnionCorGene	Boolean value that shows whether union of the output of the co-expression analysis and the other analysis should be considered
databaseFile	Path of miRcancer.db file
isGeneEnrich	Boolean value whether gene enrichment should be performed

**Value**

Pathway enrichment object for the given input

**Examples**

```
#Pathway enrichment based on the gen sets that falls into the TAD regions
ncRNAPathway<-genePathwayEnricher(gene = brain_disorder_ncRNA ,
                                   org_assembly='hg19',
                                   isTADSearch = TRUE,
                                   TAD = tad_hg19,
                                   genetype = 'Ensembl_gene')
```

---

geneRegionGOEnricher *Given gene regions that fall in the given upstream and downstream region of mRNAs of interest, GO term enrichment analysis is carried out*

---

**Description**

Given gene regions that fall in the given upstream and downstream region of mRNAs of interest, GO term enrichment analysis is carried out

**Usage**

```
geneRegionGOEnricher(
  region,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  near = TRUE,
  backG = "",
  backGType = "pc_gene",
  isTADSearch = FALSE,
  TAD = c(tad_hg19, tad_dmel, tad_hg38, tad_mm10),
```

```

express = FALSE,
isCustomExp = FALSE,
cancer,
exp1,
exp2,
label1 = "",
label2 = "",
isUnionCorGene = FALSE,
databaseFile
)

```

### Arguments

region	Bed format of the input gene regions other than miRNA
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
backG	The set of genes that tested against to the input (background gene)
backGType	Type of the background gene. If miRNA gene set is used for background gene, backGType should be set to the 'mirna'
isTADSearch	Boolean value that shows whether TAD analysis is performed. This value has to be TRUE for TAD analysis.
TAD	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dm6' for hg19, hg38, mm9 and dm6 assembly, respectively.
express	Boolean variable whether co-expression analysis is performed. If this option is set to TRUE, co-expression analysis will be performed.
isCustomExp	Boolean variable whether co-expression analysis with custom data will be performed. When this option is set, exp1 and exp2 parameters must be defined.
cancer	Defines the name of the TCGA project code such as 'BRCA' for correlation analysis. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
exp1	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
exp2	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.

label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
isUnionCorGene	Boolean value that shows whether union of the output of the co-expression analysis and the other analysis should be considered
databaseFile	Path of miRcancer.db file

**Value**

GO term enrichment object for the given input

**Examples**

```
regions<-system.file("extdata", "ncRegion.txt", package = "NoRCE")
regionNC <- rtracklayer::import(regions, format = "BED")
regionGO<-geneRegionGOEnricher(region = regionNC, org_assembly= 'hg19',
                               near = TRUE)
```

---

geneRegionPathwayEnricher

*Given gene regions that fall in the given upstream and downstream region of mRNAs of interest, pathway enrichment analysis is carried out*

---

**Description**

Given gene regions that fall in the given upstream and downstream region of mRNAs of interest, pathway enrichment analysis is carried out

**Usage**

```
geneRegionPathwayEnricher(
  region,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  near = FALSE,
  isTADSearch = FALSE,
  TAD = tad_hg19,
  gmtName = "",
  express = FALSE,
  isCustomExp = FALSE,
  cancer,
  exp1,
  exp2,
  label1 = "",
  label2 = "",
  isUnionCorGene = FALSE,
  databaseFile,
  isGeneEnrich = FALSE
)
```

**Arguments**

region	Bed format of input gene regions other than miRNA. Input must be Granges object.
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
isTADSearch	Boolean value that shows whether TAD analysis is performed. This value has to be TRUE for TAD analysis.
TAD	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dmel' for hg19, hg38, mm9 and dm6 assembly, respectively.
gmtName	Custom pathway gmt file
express	Boolean variable whether co-expression analysis is performed. If this option is set to TRUE, co-expression analysis will be performed.
isCustomExp	Boolean variable whether co-expression analysis with custom data will be performed. When this option is set, exp1 and exp2 parameters must be defined.
cancer	Defines the name of the TCGA project code such as 'BRCA' for correlation analysis. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
exp1	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
exp2	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.
label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
isUnionCorGene	Boolean value that shows whether union of the output of the co-expression analysis and the other analysis should be considered
databaseFile	Path of miRcancer.db file
isGeneEnrich	Boolean value whether gene enrichment should be performed

**Value**

Pathway enrichment object of the given input



---

getKeggDiagram	<i>Display the enriched KEGG diagram of the KEGG pathway. This function is specific to only one KEGG pathway id and identifies the enriched genes in the diagram.</i>
----------------	---

---

## Description

Display the enriched KEGG diagram of the KEGG pathway. This function is specific to only one KEGG pathway id and identifies the enriched genes in the diagram.

## Usage

```
getKeggDiagram(  
  mrnaObject,  
  pathway,  
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3")  
)
```

## Arguments

mrnaObject	Output of enrichment results
pathway	Kegg pathway term such as 'hsa04010'
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human

## Value

Shows kegg diagram marked with an enriched genes in a browser

## Examples

```
ncRNAPathway<-mirnaPathwayEnricher(gene = brain_mirna,  
                                   org_assembly = 'hg19',near = TRUE)  
  
getKeggDiagram(mrnaObject = ncRNAPathway, org_assembly = 'hg19',  
               pathway = ncRNAPathway@ID[1])
```

---

getmiRNAcount	<i>Get TCGA miRNAseq expression of miRNA genes for the given cancer</i>
---------------	---

---

**Description**

Get TCGA miRNAseq expression of miRNA genes for the given cancer

**Usage**

```
getmiRNAcount(mirnagene, cancer, databaseFile)
```

**Arguments**

mirnagene	Data frame of the mature format
cancer	Name of the TCGA project code such as 'BRCA' that is analyzed for miRNA-mRNA correlation
databaseFile	Path of miRcancer.db file

**Value**

Data frame of the raw read count of the given miRNA genes for different patients

---

getNearToExon	<i>Get only those neighbouring genes that fall within exon region</i>
---------------	---

---

**Description**

Get only those neighbouring genes that fall within exon region

**Usage**

```
getNearToExon(
  bedfile,
  upstream,
  downstream,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3")
)
```

**Arguments**

bedfile	Input bed formatted file
upstream	Maximum upstream distance from the TSS position
downstream	Maximum downstream distance from the TES position
org_assembly	genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human

**Value**

genes

**Examples**

```
regions <- system.file("extdata", "ncRegion.txt", package = "NoRCE")
regionNC <- rtracklayer::import(regions, format = "BED")

r<-getNearToExon.bedfile = regionNC,
  upstream = 1000,
  downstream = 2000,
  org_assembly = 'hg19')
```

---

getNearToIntron	<i>Get only those neighbouring genes that fall within intron region</i>
-----------------	---

---

**Description**

Get only those neighbouring genes that fall within intron region

**Usage**

```
getNearToIntron(
  bedfile,
  upstream,
  downstream,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3")
)
```

**Arguments**

bedfile	Bed file
upstream	upstream distance
downstream	downstream distance
org_assembly	genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human

**Value**

genes

## Examples

```
regions<-system.file("extdata", "ncRegion.txt", package = "NoRCE")
regionNC <- rtracklayer::import(regions, format = "BED")

r<-getNearToExon.bedfile = regionNC,
  upstream = 1000,
  downstream = 2000,
  org_assembly = 'hg19')
```

---

getReactomeDiagram	<i>Display the enriched Reactome diagram of the given Reactome pathway id. This function is specific to only one pathway id and identifies the enriched genes in the diagram.</i>
--------------------	---

---

## Description

Display the enriched Reactome diagram of the given Reactome pathway id. This function is specific to only one pathway id and identifies the enriched genes in the diagram.

## Usage

```
getReactomeDiagram(mrnaObject, pathway, imageFormat)
```

## Arguments

mrnaObject	Output of enrichment results
pathway	Reactome pathway term
imageFormat	Image format of the diagram. Possible image formats are 'png', 'svg'

## Value

Shows reactome diagram marked with an enriched genes in a browser

## Examples

```
br_enr<-reactomeEnrichment(genes = breastmRNA,org_assembly='hg19')

getReactomeDiagram(mrnaObject = br_enr,pathway = br_enr@ID[1],
  imageFormat = 'png')
```

---

getTADOverlap	<i>For given region of interest, overlapped genes in the TAD regions are found. Results can be filtered according to the available cell lines.</i>
---------------	--

---

### Description

For given region of interest, overlapped genes in the TAD regions are found. Results can be filtered according to the available cell lines.

### Usage

```
getTADOverlap(
  bedfile,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  tad = c(tad_hg19, tad_dmel, tad_hg38, tad_mm10),
  near = FALSE,
  upstream = 10000,
  downstream = 10000,
  cellline = "all"
)
```

### Arguments

bedfile	Region of interest
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
tad	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dmel' for hg19, hg38, mm9 and dm6 assembly, respectively.
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
upstream	Holds upstream distance from the transcription start position
downstream	Holds downstream distance from the transcription end position
cellline	Cell lines for TAD regions.

### Value

List of protein coding genes that falls into the TAD regions

**Examples**

```
regions<-system.file("extdata", "ncRegion.txt", package = "NoRCE")
regionNC <- rtracklayer::import(regions, format = "BED")

r<-getTADOverlap.bedfile = regionNC,
  tad = tad_hg19,
  org_assembly = 'hg19',
  cellline = 'HUVEC')
```

---

getUCSC

*Get nearest genes for the window of the upstream/downstream region.*


---

**Description**

When downstream = 0 / upstream = 0, function converts bed formatted regions to HUGO genes

**Usage**

```
getUCSC(
  bedfile,
  upstream,
  downstream,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3")
)
```

**Arguments**

bedfile	Bed formatted input gene regions
upstream	Maximum upstream distance from the transcription start region of the input gene
downstream	Maximum downstream distance from the transcription end region of the input gene
org_assembly	genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human

**Value**

genes

**Examples**

```
regions<-system.file("extdata", "ncRegion.txt", package = "NoRCE")
regionNC <- rtracklayer::import(regions, format = "BED")

neighbour <- getUCSC(bedfile = regionNC,
  upstream = 1000,
```

```

downstream = 1000,
org_assembly = 'hg19')

```

---

goEnrichment

*Perform enrichment analysis of the given genes*


---

## Description

Perform enrichment analysis of the given genes

## Usage

```

goEnrichment(
  genes,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  GOtype = c("BP", "CC", "MF"),
  pCut = 0.05,
  pAdjCut = 0.05,
  pAdjust = c("holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"),
  min = 5,
  backG = "",
  backGType = "pc_gene",
  enrichTest = c("hyper", "binom", "fisher", "chi")
)

```

## Arguments

genes	Set of input genes. Supported format HUGO.
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
GOtype	Hierarchical category of the GO ontology. Possible values are "BP"(default), "CC", "MF".
pCut	Threshold value for the pvalue. Default value is 0.05
pAdjCut	Cutoff value for the adjusted p-values using one of given method. Default value is 0.05.
pAdjust	Methods of the adjusted p-values. Possible methods are "bonferroni", "holm", "BH"(default)
min	Minimum number of gene that are required for enrichment. By default, it is set to 5
backG	The set of genes that tested against to the input (background gene)
backGType	Type of the background gene. If miRNA gene set is used for background gene, backGType should be set to the 'mirna'
enrichTest	Types of enrichment methods to perform enrichment analysis. Possible values are "hyper"(default), "binom", "fisher", "chi".

**Value**

GO enrichment results

**Examples**

```
subsetGene <- breastmRNA[1:30,]
breastEnr <- goEnrichment(genes = subsetGene,
                          org_assembly = 'hg19',
                          GOtype = 'MF',
                          min = 2)
```

---

KeggEnrichment	<i>KEGG pathway enrichment</i>
----------------	--------------------------------

---

**Description**

KEGG pathway enrichment

**Usage**

```
KeggEnrichment(
  genes,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  pCut = 0.05,
  pAdjCut = 0.05,
  pAdjust = c("holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"),
  min = 5,
  gmtFile = "",
  isSymbol = "",
  isGeneEnrich = ""
)
```

**Arguments**

genes	Input genes
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
pCut	Threshold value for the pvalue. Default value is 0.05
pAdjCut	Cutoff value for the adjusted p-values using one of given method. Default value is 0.05.
pAdjust	Methods of the adjusted p-values. Possible methods are "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
min	Minimum number of genes that are required for enrichment. By default, it is set to 5.

gmtFile	File path of the gmt file
isSymbol	Boolean value that controls the gene formats. If it is TRUE, gene format of the gmt file should be symbol. Otherwise, gene format must be ENTREZ ID.
isGeneEnrich	Boolean value whether gene enrichment should be performed

**Value**

KEGG pathway enrichment results

**Examples**

```
subsetGene <- breastmRNA[1:30,]  
br_enr<-KeggEnrichment(genes = subsetGene,  
                        org_assembly='hg19')
```

---

listTAD	<i>List cell line of the given topological domain regions</i>
---------	---

---

**Description**

List cell line of the given topological domain regions

**Usage**

```
listTAD(TADName)
```

**Arguments**

TADName	input TAD regions
---------	-------------------

**Value**

cell line of the input tad data

**Examples**

```
listTAD(TADName = tad_hg19)
```

---

 mirna
 

---

*Brain miRNA expression retrieved from the TCGA*


---

**Description**

Brain miRNA expression retrieved from the TCGA

**Usage**

```
mirna
```

**Format**

Not Available

**Source**

<https://www.encodegenes.org/>

**Examples**

```
data(mirna)
```

---

mirnaGOEnricher

*GO term enrichments of the microRNA genes with mRNAs that fall in the given upstream/downstream regions of the microRNA genes*


---

**Description**

GO term enrichments of the microRNA genes with mRNAs that fall in the given upstream/downstream regions of the microRNA genes

**Usage**

```
mirnaGOEnricher(
  gene,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  near = FALSE,
  target = FALSE,
  backGenes = "",
  backGType = "pc_gene",
  isTADSearch = FALSE,
  TAD = c(tad_hg19, tad_dmel, tad_hg38, tad_mm10),
  express = FALSE,
  isCustomExp = FALSE,
  cancer,
```

```

    exp1,
    exp2,
    label1 = "",
    label2 = "",
    isUnionCorGene = FALSE,
    databaseFile = ""
)

```

### Arguments

gene	Input microRNA gene. It supports both pre-miRNA and mature miRNA, however, when target prediction is performed (target= TRUE), miRNA genes should be mature.
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
target	Boolean value shows whether miRNA target prediction should be performed
backGenes	The set of genes that tested against to the input
backGType	Type of the background gene. If miRNA gene set is used for background gene, backGType should be set to the 'mirna'
isTADSearch	Boolean value that shows whether TAD analysis is performed. This value has to be TRUE for TAD analysis.
TAD	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dmel' for hg19, hg38, mm9 and dm6 assembly, respectively.
express	Boolean variable whether co-expression analysis is performed. If this option is set to TRUE, co-expression analysis will be performed.
isCustomExp	Boolean variable whether co-expression analysis with custom data will be performed. When this option is set, exp1 and exp2 parameters must be defined.
cancer	Defines the name of the TCGA project code such as 'BRCA' for correlation analysis. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
exp1	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
exp2	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.

label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
isUnionCorGene	Boolean value that shows whether union of the output of the co-expression analysis and the other analysis should be considered
databaseFile	Path of miRcancer.db file

**Value**

MiRNA GO term enrichment object for the given input

**Examples**

```
subsetGene <- brain_mirna[1:30,]

miGO <-mirnaGOEnricher(gene=subsetGene,
                       org_assembly='hg19',
                       near = TRUE,
                       target = FALSE)
```

---

mirnaPathwayEnricher *Pathway enrichments of the microRNA genes with mRNAs that fall in the given upstream/downstream regions of the microRNA genes*

---

**Description**

Pathway enrichments of the microRNA genes with mRNAs that fall in the given upstream/downstream regions of the microRNA genes

**Usage**

```
mirnaPathwayEnricher(
  gene,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  near = FALSE,
  target = FALSE,
  isTADSearch = FALSE,
  TAD = c(tad_hg19, tad_dme1, tad_hg38, tad_mm10),
  gmtName = "",
  express = FALSE,
  isCustomExp = FALSE,
  cancer,
  exp1,
  exp2,
  label1 = "",
  label2 = "",
  isUnionCorGene = FALSE,
  databaseFile,
  isGeneEnrich = FALSE
)
```

**Arguments**

gene	Input microRNA gene. It supports both pre-miRNA and mature miRNA, however, when target prediction is performed(target= TRUE), miRNA genes should be mature.
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
target	Boolean value shows whether miRNA target prediction should be performed
isTADSearch	Boolean value that shows whether TAD analysis is performed. This value has to be TRUE for TAD analysis.
TAD	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dm6l' for hg19, hg38, mm9 and dm6 assembly, respectively.
gmtName	Custom pathway gmt file
express	Boolean variable whether co-expression analysis is performed. If this option is set to TRUE, co-expression analysis will be performed.
isCustomExp	Boolean variable whether co-expression analysis with custom data will be performed. When this option is set, exp1 and exp2 parameters must be defined.
cancer	Defines the name of the TCGA project code such as 'BRCA' for correlation analysis. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
exp1	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
exp2	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.
label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
isUnionCorGene	Boolean value that shows whether union of the output of the co-expression analysis and the other analysis should be considered
databaseFile	Path of miRcancer.db file
isGeneEnrich	Boolean value whether gene enrichment should be performed

**Value**

MiRNA pathway enrichment object for the given input

**Examples**

```
miPath <- mirnaPathwayEnricher(gene = brain_mirna,
                              org_assembly = 'hg19',
                              near = TRUE)
```

---

mirnaRegionGOEnricher *GO enrichments of the microRNA regions with mRNAs that fall in the given upstream/downstream regions of the microRNA genes*

---

**Description**

GO enrichments of the microRNA regions with mRNAs that fall in the given upstream/downstream regions of the microRNA genes

**Usage**

```
mirnaRegionGOEnricher(
  region,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  near = FALSE,
  target = FALSE,
  backG = "",
  backGType = "pc-genes",
  isTADSearch = FALSE,
  TAD = c(tad_hg19, tad_dm6, tad_hg38, tad_mm10),
  express = FALSE,
  isCustomExp = FALSE,
  cancer,
  exp1,
  exp2,
  label1 = "",
  label2 = "",
  isUnionCorGene = FALSE,
  databaseFile
)
```

**Arguments**

region	MiRNA region in a bed format
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
target	Boolean value shows whether miRNA target prediction should be performed

backG	The set of genes that tested against to the input
backGType	Type of the background gene. If miRNA gene set is used for background gene, backGType should be set to the 'mirna'
isTADSearch	Boolean value that shows whether TAD analysis is performed. This value has to be TRUE for TAD analysis.
TAD	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dmel' for hg19, hg38, mm9 and dm6 assembly, respectively.
express	Boolean variable whether co-expression analysis is performed. If this option is set to TRUE, co-expression analysis will be performed.
isCustomExp	Boolean variable whether co-expression analysis with custom data will be performed. When this option is set, exp1 and exp2 parameters must be defined.
cancer	Defines the name of the TCGA project code such as 'BRCA' for correlation analysis. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
exp1	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
exp2	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.
label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
isUnionCorGene	Boolean value that shows whether union of the output of the co-expression analysis and the other analysis should be considered
databaseFile	Path of miRcancer.db file

### Value

MiRNA GO enrichment object for the given input

### Examples

```
regions<-system.file("extdata", "ncRegion.txt", package = "NoRCE")
regionNC <- rtracklayer::import(regions, format = "BED")

a<- mirnaRegionGOEnricher(region = regionNC,
                          org_assembly = 'hg19',
                          near = TRUE)
```

---

 mirnaRegionPathwayEnricher

*Pathway enrichments of the microRNA regions with mRNAs that fall in the given upstream/downstream regions of the microRNA genes*

---

## Description

Pathway enrichments of the microRNA regions with mRNAs that fall in the given upstream/downstream regions of the microRNA genes

## Usage

```
mirnaRegionPathwayEnricher(
  region,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  near = FALSE,
  target = FALSE,
  isTADSearch = FALSE,
  TAD = c(tad_hg19, tad_dmel, tad_hg38, tad_mm10),
  gmtName = "",
  express = FALSE,
  isCustomExp = FALSE,
  cancer,
  exp1,
  exp2,
  label1 = "",
  label2 = "",
  isUnionCorGene = FALSE,
  databaseFile,
  isGeneEnrich = FALSE
)
```

## Arguments

region	MiRNA region in a bed format
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
near	Boolean value presents whether cis-neighbourhood should be considered in the analysis
target	Boolean value shows whether miRNA target prediction should be performed
isTADSearch	Boolean value that shows whether TAD analysis is performed. This value has to be TRUE for TAD analysis.
TAD	TAD genomic regions for the species. Predefined TAD regions or any new TAD regions can be used for the analysis. TAD regions must be formatted as GRanges

	object. Predefined TAD regions are 'tad_hg19', 'tad_hg38', 'tad_mm10', 'tad_dmel' for hg19, hg38, mm9 and dm6 assembly, respectively.
gmtName	Custom pathway gmt file
express	Boolean variable whether co-expression analysis is performed. If this option is set to TRUE, co-expression analysis will be performed.
isCustomExp	Boolean variable whether co-expression analysis with custom data will be performed. When this option is set, exp1 and exp2 parameters must be defined.
cancer	Defines the name of the TCGA project code such as 'BRCA' for correlation analysis. Possible cancer types ACC, BLCA, BRCA, CESC, CHOL, COAD, COADREAD, DLBC, ESCA, GBMLGG, HNSC, KICH, KIPAN, KIRC, KIRP, LGG, LIHC, LUAD, LUSC, OV, PAAD, PCPG, PRAD, READ, SARC, SKCM, STAD, STES, TGCT, THCA, THYM, UCEC, UCS, UVM
exp1	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
exp2	Custom expression data matrix. Columns must be genes and rows must be patients. If gene names are provided as header, no need to redefine the headers(labels) of the expression data.
label1	Gene names of the custom exp1 expression data. If it is not provided, column name of the exp1 data will be taken.
label2	Gene names of the custom exp2 expression data. If it is not provided, column name of the exp2 data will be taken.
isUnionCorGene	Boolean value that shows whether union of the output of the co-expression analysis and the other analysis should be considered
databaseFile	Path of miRcancer.db file
isGeneEnrich	Boolean value whether gene enrichment should be performed

**Value**

miRNA pathway enrichment object for the given input

**Examples**

```
regions<-system.file("extdata", "ncRegion.txt", package = "NoRCE")
regionNC <- rtracklayer::import(regions, format = "BED")

a<- mirnaRegionPathwayEnricher(region = regionNC,
                               org_assembly = 'hg19')
```

---

mrna	<i>Brain mRNA expression retrieved from the TCGA</i>
------	--

---

**Description**

Brain mRNA expression retrieved from the TCGA

**Usage**

mrna

**Format**

Not Available

**Source**

<https://www.encodegenes.org/>

**Examples**

data(mrna)

---

ncRegion	<i>Differentially expressed non-coding gene regions</i>
----------	---

---

**Description**

Differentially expressed non-coding gene regions

**Usage**

ncRegion

**Format**

Not Available

**Source**

<http://resource.psychencode.org/>

**Examples**

data(ncRegion)

---

`NoRCE-class`*An S4 class to represent enrichment*

---

**Description**

An S4 class to represent enrichment

**Slots**

ID factor

Term factor

geneList factor

ncGeneList factor

pvalue factor

pAdj factor

GeneRatio factor

BckRatio factor

---

`packageCheck`*Check the package availability for the given assembly*

---

**Description**

Check the package availability for the given assembly

**Usage**

```
packageCheck(pkg)
```

**Arguments**

`pkg` Required packages

**Value**

return install packages

---

pathwayEnrichment      *For a given gmt file of a specific pathway database, pathway enrichment can be performed. Function supports Entrez ID and symbol based gmt file.*

---

### Description

For a given gmt file of a specific pathway database, pathway enrichment can be performed. Function supports Entrez ID and symbol based gmt file.

### Usage

```
pathwayEnrichment(
  genes,
  gmtFile,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  pCut = 0.05,
  pAdjCut = 0.05,
  pAdjust = c("holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"),
  isSymbol,
  min = 5,
  isGeneEnrich = FALSE
)
```

### Arguments

genes	Input genes
gmtFile	File path of the gmt file
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
pCut	Threshold value for the pvalue. Default value is 0.05
pAdjCut	Cutoff value for the adjusted p-values using one of given method. Default value is 0.05.
pAdjust	Methods of the adjusted p-values. Possible methods are "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
isSymbol	Boolean value that controls the gene formats. If it is TRUE, gene format of the gmt file should be symbol. Otherwise, gene format must be ENTREZ ID.
min	Minimum number of genes that are required for enrichment. By default, it is set to 5.
isGeneEnrich	Boolean value whether gene enrichment should be performed

### Value

Pathway Enrichment

---

predictmiTargets	<i>Predict the miRNA targets for the miRNA or mRNA genes, which is specified with type parameter</i>
------------------	--

---

### Description

Predict the miRNA targets for the miRNA or mRNA genes, which is specified with type parameter

### Usage

```
predictmiTargets(gene, type, org_assembly)
```

### Arguments

gene	Data frame of miRNA or mRNA gene. Formats should be NCBI gene name, ENSEMBL gene or transcript id, and mirna
type	Format of the gene, it should be "NCBI" for NCBI gene name, "Ensembl_gene" for ENSEMBL gene id, "Ensembl_trans" for Ensembl transcript id and "mirna" for miRNA gene
org_assembly	Analyzed genome assembly. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "hg19" and "hg38" for human

### Value

miRNA:mRNA target sets of the given genes

### Examples

```
a<- predictmiTargets(gene = brain_mirna[1:100,],
                    org_assembly = 'hg19',
                    type = "mirna")
```

---

reactomeEnrichment	<i>Reactome pathway enrichment</i>
--------------------	------------------------------------

---

### Description

Reactome pathway enrichment

**Usage**

```

reactomeEnrichment(
  genes,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  pCut = 0.05,
  pAdjCut = 0.05,
  pAdjust = c("holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"),
  min = 5,
  gmtFile = "",
  isSymbol = "",
  isGeneEnrich = ""
)

```

**Arguments**

genes	Input genes
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
pCut	Threshold value for the pvalue. Default value is 0.05
pAdjCut	Cutoff value for the adjusted p-values using one of given method. Default value is 0.05.
pAdjust	Methods of the adjusted p-values. Possible methods are "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
min	Minimum number of genes that are required for enrichment. By default, it is set to 5.
gmtFile	File path of the gmt file
isSymbol	Boolean value that controls the gene formats. If it is TRUE, gene format of the gmt file should be symbol. Otherwise, gene format must be ENTREZ ID.
isGeneEnrich	Boolean value whether gene enrichment should be performed

**Value**

Reactome pathway enrichment results

**Examples**

```
br_enr<-reactomeEnrichment(genes = breastmRNA,org_assembly='hg19')
```

---

setParameters	<i>Set the parameters</i>
---------------	---------------------------

---

### Description

Parameters: upstream: Upstream distance from the transcription start position downstream: Downstream distance from the transcription end position searchRegion: Search space of the cis-region. Possible values are "all", "exon", "intron" GOtype: Hierarchical category of the GO ontology. Possible values are "BP", "CC", "MF" pCut: Threshold value for the pvalue. Default value is 0.05 pAdjCut: Cutoff value for the adjusted p-values using one of given method. Default value is 0.05. pAdjust: Methods of the adjusted p-values. Possible methods are "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none" min: Minimum number of genes that are required for enrichment. By default, this value is set to 5. cellline: Cell lines for TAD regions. corrMethod Correlation coefficient method that will be used for evaluation. Possible values are "pearson", "kendall", "spearman" varCutoff: Variance cutt off that genes have less variance than this value will be trimmed pcut: P-value cut off for the correlation values alternate: Holds the alternative hypothesis and "two.sided", "greater" or "less" are the possible values. conf: Confidence level for the returned confidence interval. It is only used for the Pearson correlation coefficient if there are at least 4 complete pairs of observations. minAbsCor: Cut-off value for the Pearson correlation coefficient of the miRNA-mRNA pathwayType: Pathway database for enrichment. Possible values are 'reactome' for Reactome, 'kegg' for KEGG, 'wiki' for WikiPathways, 'other' for custom database enrichTest: Types of enrichment methods to perform enrichment analysis. Possible values are "hyper"(default), "binom", "fisher", "chi". isSymbol: Boolean variable that hold the gene format of the gmt file. If it is set as TRUE, gene format of the gmt file should be symbol. Otherwise, gene format should be ENTREZ ID. By default, it is FALSE.

### Usage

```
setParameters(type, value)
```

### Arguments

type	List of parameter names
value	New values for the parameters. Value and the parameter names must be in the same order.

### Value

changed parameters

### Examples

```
type <- c('downstream', 'upstream')
value <- c(2000, 30000)
setParameters(type, value)
```

---

tad_dmel	<i>TAD regions for the fly</i>
----------	--------------------------------

---

**Description**

TAD regions for the fly

**Usage**

```
tad_dmel
```

**Format**

Not Available

**Source**

[http://chorogenome.ie-freiburg.mpg.de/data\\_sources.html#hi-c\\_datasets](http://chorogenome.ie-freiburg.mpg.de/data_sources.html#hi-c_datasets)

**Examples**

```
data(tad_dmel)
```

---

tad_hg19	<i>TAD regions for human hg19 assembly</i>
----------	--

---

**Description**

TAD regions for human hg19 assembly

**Usage**

```
tad_hg19
```

**Format**

Not Available

**Source**

<http://promoter.bx.psu.edu/hi-c/publications.html>

**Examples**

```
data(tad_hg19)
```

---

tad_hg38	<i>TAD regions for human hg38 assembly</i>
----------	--

---

**Description**

TAD regions for human hg38 assembly

**Usage**

```
tad_hg38
```

**Format**

Not Available

**Source**

<http://promoter.bx.psu.edu/hi-c/publications.html>

**Examples**

```
data(tad_hg38)
```

---

tad_mm10	<i>TAD regions for mouse</i>
----------	------------------------------

---

**Description**

TAD regions for mouse

**Usage**

```
tad_mm10
```

**Format**

Not Available

**Source**

<http://promoter.bx.psu.edu/hi-c/publications.html>

**Examples**

```
data(tad_mm10)
```

---

topEnrichment	<i>Number of top enrichment results of the pathway or GO terms for the given object and the order type - p-value or adjusted p-value.</i>
---------------	---

---

**Description**

Number of top enrichment results of the pathway or GO terms for the given object and the order type - p-value or adjusted p-value.

**Usage**

```
topEnrichment(mrnaObject, type, n)
```

**Arguments**

mrnaObject	Object of the enrichment result
type	Draw the dot plot according to the p-value or adjusted p-value ("pvalue", "pAdjusted")
n	Number of GO terms or pathways, that ordered by type and has least number of top p-value

**Value**

Give top n enrichment results

---

WikiEnrichment	<i>WikiPathways Enrichment</i>
----------------	--------------------------------

---

**Description**

WikiPathways Enrichment

**Usage**

```
WikiEnrichment(
  genes,
  org_assembly = c("hg19", "hg38", "mm10", "dre10", "rn6", "dm6", "ce11", "sc3"),
  pCut = 0.05,
  pAdjCut = 0.05,
  pAdjust = c("holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"),
  min = 5,
  gmtFile = "",
  isSymbol = "",
  isGeneEnrich = ""
)
```

**Arguments**

genes	Input genes
org_assembly	Genome assembly of interest for the analysis. Possible assemblies are "mm10" for mouse, "dre10" for zebrafish, "rn6" for rat, "dm6" for fruit fly, "ce11" for worm, "sc3" for yeast, "hg19" and "hg38" for human
pCut	Threshold value for the pvalue. Default value is 0.05
pAdjCut	Cutoff value for the adjusted p-values using one of given method. Default value is 0.05.
pAdjust	Methods of the adjusted p-values. Possible methods are "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
min	Minimum number of genes that are required for enrichment. By default, it is set to 5.
gmtFile	File path of the gmt file
isSymbol	Boolean value that controls the gene formats. If it is TRUE, gene format of the gmt file should be symbol. Otherwise, gene format must be ENTREZ ID.
isGeneEnrich	Boolean value whether gene enrichment should be performed

**Value**

Wiki Pathway Enrichment

---

writeEnrichment	<i>Write the tabular form of the pathway or GO term enrichment results</i>
-----------------	--

---

**Description**

Write the tabular form of the pathway or GO term enrichment results

**Usage**

```
writeEnrichment(mrnaObject, fileName, sept = "\t", type = "pAdjust", n)
```

**Arguments**

mrnaObject	Object of the enrichment result
fileName	File name of the txt file
sept	File separator, by default, it is tab('\t')
type	Draw the dot plot according to the p-value or adjusted p-value ("pvalue", "pAdjust"). Default value is "pAdjust".
n	Number of GO terms or pathways, that ordered by type and has least number of top p-value

**Value**

Text file of the enrichment results in a tabular format

**Examples**

```
ncGO<-geneGOEnricher(gene = brain_disorder_ncRNA, org_assembly='hg19',  
  near=TRUE, genetype = 'Ensembl_gene')
```

```
writeEnrichment(mrnaObject = ncGO, fileName = "a.txt", sept = '\t')
```

# Index

## \* datasets

- brain\_disorder\_ncRNA, 4
  - brain\_mirna, 5
  - breastmRNA, 5
  - mirna, 30
  - mrna, 38
  - ncRegion, 38
  - tad\_dmel, 44
  - tad\_hg19, 44
  - tad\_hg38, 45
  - tad\_mm10, 45
- annGO, 3
- assembly, 4
- brain\_disorder\_ncRNA, 4
- brain\_mirna, 5
- breastmRNA, 5
- calculateCorr, 6
- convertGeneID, 7
- convertGMT, 8
- corrbased, 8
- corrbasedMrna, 9
- createNetwork, 10
- drawDotPlot, 11
- extractBiotype, 11
- filterBiotype, 12
- geneGOEnricher, 12
- genePathwayEnricher, 14
- geneRegionGOEnricher, 16
- geneRegionPathwayEnricher, 18
- getGoDag, 20
- getKeggDiagram, 21
- getmiRNACount, 22
- getNearToExon, 22
- getNearToIntron, 23
- getReactomeDiagram, 24
- getTADOverlap, 25
- getUCSC, 26
- goEnrichment, 27
- KeggEnrichment, 28
- listTAD, 29
- mirna, 30
- mirnaGOEnricher, 30
- mirnaPathwayEnricher, 32
- mirnaRegionGOEnricher, 34
- mirnaRegionPathwayEnricher, 36
- mrna, 38
- ncRegion, 38
- NoRCE-class, 39
- packageCheck, 39
- pathwayEnrichment, 40
- predictmiTargets, 41
- reactomeEnrichment, 41
- setParameters, 43
- tad\_dmel, 44
- tad\_hg19, 44
- tad\_hg38, 45
- tad\_mm10, 45
- topEnrichment, 46
- WikiEnrichment, 46
- writeEnrichment, 47