

# Package ‘target’

April 16, 2024

**Type** Package

**Title** Predict Combined Function of Transcription Factors

**Version** 1.16.0

**Description** Implement the BETA algorithm for inferring direct target genes from DNA-binding and perturbation expression data Wang et al. (2013) <[doi:10.1038/nprot.2013.150](https://doi.org/10.1038/nprot.2013.150)>. Extend the algorithm to predict the combined function of two DNA-binding elements from comparable binding and expression data.

**URL** <https://github.com/MahShaaban/target>

**BugReports** <https://github.com/MahShaaban/target/issues>

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**Depends** R (>= 3.6)

**Imports** BiocGenerics, GenomicRanges, IRanges, matrixStats, methods, stats, graphics, shiny

**Suggests** testthat (>= 2.1.0), knitr, rmarkdown, shinytest, shinyBS, covr

**VignetteBuilder** knitr

**RoxygenNote** 6.1.1

**biocViews** Software, StatisticalMethod, Transcription

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

**git\_branch** RELEASE\_3\_18

**git\_last\_commit** 8bae527

**git\_last\_commit\_date** 2023-10-24

**Repository** Bioconductor 3.18

**Date/Publication** 2024-04-15

**Author** Mahmoud Ahmed [aut, cre]

**Maintainer** Mahmoud Ahmed <[mahmoud.s.fahmy@students.kasralainy.edu.eg](mailto:mahmoud.s.fahmy@students.kasralainy.edu.eg)>

## R topics documented:

associated_peaks . . . . .	2
direct_targets . . . . .	3
find_distance . . . . .	4
merge_ranges . . . . .	4
plot_predictions . . . . .	5
rank_product . . . . .	6
real_peaks . . . . .	7
real_transcripts . . . . .	7
score_peaks . . . . .	8
score_regions . . . . .	9
sim_peaks . . . . .	10
sim_transcripts . . . . .	10
target . . . . .	11
target_app . . . . .	11
test_predictions . . . . .	12
<b>Index</b>	<b>13</b>

---

associated_peaks	<i>Predict associated peaks</i>
------------------	---------------------------------

---

### Description

This function selects overlapping peaks and regions, calculates the distance between them and score each peak.

### Usage

```
associated_peaks(peaks, regions, regions_col, base = 1e+05)
```

### Arguments

peaks	A GRanges object
regions	A GRanges object
regions_col	A character string
base	An integer to calculate distances relative to.

### Value

A GRanges object. A similar object to peaks with three added metadata columns.

**Examples**

```
# load peaks and transcripts data
data("real_peaks")
data("real_transcripts")

# associated peaks
ap <- associated_peaks(real_peaks, real_transcripts, 'name2')
```

---

direct_targets	<i>Predict direct targets</i>
----------------	-------------------------------

---

**Description**

This function selects overlapping peaks and regions, calculates the distance between them, score each peak and region and calculate rank products of the regions.

**Usage**

```
direct_targets(peaks, regions, regions_col, stats_col, base = 1e+05)
```

**Arguments**

peaks	A GRanges object
regions	A GRanges object
regions_col	A character string
stats_col	A character string
base	An integer to calculate distances relative to.

**Value**

A GRanges object. A similar object to regions with several added metadata columns.

**Examples**

```
# load peaks and transcripts data
data("real_peaks")
data("real_transcripts")

# direct targets
dt <- direct_targets(real_peaks, real_transcripts, 'name2', 't')
```

---

find_distance	<i>Find the distance between peaks and regions</i>
---------------	--

---

**Description**

Calculate the distance between the elements of two GRanges objects.

**Usage**

```
find_distance(peaks, regions, how = "center")
```

**Arguments**

peaks	A GRanges object
regions	A GRanges object
how	A character string, default 'center'

**Value**

A vector of integers

**Examples**

```
library(IRanges)

query <- IRanges(c(1, 4, 9), c(5, 7, 10))
subject <- IRanges(c(2, 2, 10), c(2, 3, 12))
find_distance(query, subject)
```

---

merge_ranges	<i>Merge peaks and regions GRanges</i>
--------------	--

---

**Description**

Merge two GRanges objects by overlaps

**Usage**

```
merge_ranges(peaks, regions)
```

**Arguments**

peaks	A GRanges object
regions	A GRanges object

**Value**

A DataFrame

**Examples**

```
library(IRanges)

query <- IRanges(c(1, 4, 9), c(5, 7, 10))
subject <- IRanges(c(2, 2, 10), c(2, 3, 12))
mergeByOverlaps(query, subject)
```

---

plot\_predictions      *Plot the ECDF of ranks by groups*

---

**Description**

Plot the cumulative distribution function of chosen value (e.g. ranks) by a factor of the same length, group. Each group is given a color and a label.

**Usage**

```
plot_predictions(rank, group, colors, labels, ...)
```

**Arguments**

rank	A numeric vector
group	A factor of length equal that of rank
colors	A character vector of colors for each group
labels	A character vector of length equal the unique values in groups
...	Other arguments passed to points

**Value**

NULL.

**Examples**

```
# generate random values
rn1 <- rnorm(100)
rn2 <- rnorm(100, 2)
e <- c(rn1, rn2)

# generate grouping variable
g <- rep(c('up', 'down'), times = c(length(rn1), length(rn2)))

plot_predictions(e,
```

```
group = g,  
colors = c('red', 'green'),  
labels = c('up', 'down'))
```

---

rank_product	<i>Calculate the regions rank products</i>
--------------	--

---

### Description

Calculate the rank products of the rank of the distances and the statistics.

### Usage

```
rank_product(region_score, region_stat, region_id)
```

### Arguments

region_score	A vector of numerics
region_stat	A vector of numerics
region_id	A vector of characters

### Value

A vector of numerics

### Examples

```
library(IRanges)  
  
query <- IRanges(c(1, 4, 9), c(5, 7, 10))  
subject <- IRanges(c(2, 2, 10), c(2, 3, 12))  
distance <- find_distance(query, subject)  
peak_score <- score_peaks(distance, 100000)  
region_id <- c('region1', 'region1', 'region2')  
region_score <- score_regions(peak_score, region_id)  
region_stat <- c(30, 30, -40)  
rank_product(region_score, region_stat, region_id)
```

---

real_peaks	<i>AR peaks in LNCaP cell line</i>
------------	------------------------------------

---

**Description**

Androgen receptor peaks from CHIP-Seq experiment in the LNCaP cell line.

**Usage**

```
real_peaks
```

**Format**

A GRanges

**Source**

[https://github.com/suwangbio/BETA/blob/master/BETA\\_test\\_data/3656\\_peaks.bed](https://github.com/suwangbio/BETA/blob/master/BETA_test_data/3656_peaks.bed)

**See Also**

[real\\_transcripts](#)

[sim\\_peaks](#)

**Examples**

```
# load data
data('real_peaks')

# locate the raw data
system.file('extdata', '3656_peaks.bed.gz', package = 'target')

# locate the source code for preparing the data
system.file('extdata', 'make-data.R', package = 'target')
```

---

real_transcripts	<i>Differential expression of DHT treated LNCaP cell line</i>
------------------	---

---

**Description**

The differential expression analysis output of LNCaP cell line treated with DHT for 16 hours compared to non-treated cells. The REFSEQ transcript identifiers were used to merge the data.frame with the transcript coordinates from the hg19 reference genome.

**Usage**

```
real_transcripts
```

**Format**

A GRanges

**Source**

[https://github.com/suwangbio/BETA/blob/master/BETA\\_test\\_data/AR\\_diff\\_expr.xls](https://github.com/suwangbio/BETA/blob/master/BETA_test_data/AR_diff_expr.xls)

[https://github.com/suwangbio/BETA/blob/master/BETA\\_1.0.7/BETA/references/hg19.refseq](https://github.com/suwangbio/BETA/blob/master/BETA_1.0.7/BETA/references/hg19.refseq)

**See Also**

[real\\_peaks](#)

[sim\\_transcripts](#)

**Examples**

```
# load data
data('real_transcripts')

# locate the raw data
system.file('extdata', 'AR_diff_expr.tsv.gz', package = 'target')
system.file('extdata', 'hg19.refseq', package = 'target')

# locate the source code for preparing the data
system.file('extdata', 'make-data.R', package = 'target')
```

---

score\_peaks

*Calculate peak scores*

---

**Description**

Calculate the peak score based on the distance to a region of interest.

**Usage**

```
score_peaks(distance, base)
```

**Arguments**

distance      A vector of integers

base          An integer to calculate distances relative to.

**Value**

A vector of integers



**Examples**

```
library(IRanges)

query <- IRanges(c(1, 4, 9), c(5, 7, 10))
subject <- IRanges(c(2, 2, 10), c(2, 3, 12))
distance <- find_distance(query, subject)
score_peaks(distance, 100000)
```

---

score_regions	<i>Calculate region scores</i>
---------------	--------------------------------

---

**Description**

Calculate the region score based on the distance to their assigned peaks.

**Usage**

```
score_regions(peak_score, region_id)
```

**Arguments**

peak_score	A vector of integers
region_id	A vector of character

**Value**

A vector of numerics

**Examples**

```
library(IRanges)

query <- IRanges(c(1, 4, 9), c(5, 7, 10))
subject <- IRanges(c(2, 2, 10), c(2, 3, 12))
distance <- find_distance(query, subject)
peak_score <- score_peaks(distance, 100000)
region_id <- c('region1', 'region1', 'region2')
region_score <- score_regions(peak_score, region_id)
```

---

sim_peaks	<i>Simulated peaks</i>
-----------	------------------------

---

**Description**

is randomly generated peaks with random distances from the transcripts start sites (TSS) of chromosome 1 of the mm10 mouse genome.

**Usage**

```
sim_peaks
```

**Format**

A GRanges

**See Also**

[real\\_peaks](#)

[sim\\_transcripts](#)

**Examples**

```
# load data
data('sim_peaks')

# locate the source code for preparing the data
system.file('extdata', 'make-data.R', package = 'target')
```

---

sim_transcripts	<i>Simulated transcripts The transcripts chromosome 1 of the mm10 mouse genome with randomly singed statistics assigned to each.</i>
-----------------	--

---

**Description**

Simulated transcripts The transcripts chromosome 1 of the mm10 mouse genome with randomly singed statistics assigned to each.

**Usage**

```
sim_transcripts
```

**Format**

A GRanges

**See Also**[real\\_transcripts](#)[sim\\_transcripts](#)**Examples**

```
# load data
data('sim_transcripts')

# locate the source code for preparing the data
system.file('extdata', 'make-data.R', package = 'target')
```

---

target	target: <i>Predict Combined Function of Transcription Factors.</i>
--------	--

---

**Description**

Implement the BETA algorithm for inferring direct target genes from DNA-binding and perturbation expression data Wang et al. (2013) <doi: 10.1038/nprot.2013.150>. Extend the algorithm to predict the combined effect of two DNA-binding elements from comparable binding and expression data.

**Details**

Predicting associated peaks and direct targets

[associated\\_peaks](#) [direct\\_targets](#)

Plotting and testing predictions [plot\\_predictions](#) [test\\_predictions](#)

Internal target functions: [merge\\_ranges](#) [find\\_distance](#) [score\\_peaks](#) [score\\_regions](#) [rank\\_product](#)

---

target_app	<i>Run the shiny App</i>
------------	--------------------------

---

**Description**

Run the shiny App

**Usage**

```
target_app()
```

**Value**

Runs the shiny app

---

test_predictions	<i>Test the ECDF ranks of groups are from same distribution</i>
------------------	---

---

**Description**

Test whether the cumulative distribution function of two groups are drawn from the same distribution.

**Usage**

```
test_predictions(rank, group, compare, ...)
```

**Arguments**

rank	A numeric vector
group	A factor of length equal that of rank
compare	A character vector of length two
...	Other arguments passed to ks.test

**Value**

An htest object

**Examples**

```
# generate random values
rn1 <- rnorm(100)
rn2 <- rnorm(100, 2)
e <- c(rn1, rn2)

# generate grouping variable
g <- rep(c('up', 'down'), times = c(length(rn1), length(rn2)))

# test
test_predictions(e,
                 group = g,
                 compare = c('up', 'down'))
```

# Index

## \* datasets

- real\_peaks, [7](#)
- real\_transcripts, [7](#)
- sim\_peaks, [10](#)
- sim\_transcripts, [10](#)

associated\_peaks, [2](#), [11](#)

direct\_targets, [3](#), [11](#)

find\_distance, [4](#), [11](#)

merge\_ranges, [4](#), [11](#)

plot\_predictions, [5](#), [11](#)

rank\_product, [6](#), [11](#)

real\_peaks, [7](#), [8](#), [10](#)

real\_transcripts, [7](#), [7](#), [11](#)

score\_peaks, [8](#), [11](#)

score\_regions, [9](#), [11](#)

sim\_peaks, [7](#), [10](#)

sim\_transcripts, [8](#), [10](#), [10](#), [11](#)

target, [11](#)

target-package (target), [11](#)

target\_app, [11](#)

test\_predictions, [11](#), [12](#)