

# Package ‘target’

July 28, 2025

**Type** Package

**Title** Predict Combined Function of Transcription Factors

**Version** 1.22.0

**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

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|                  |                                 |
|------------------|---------------------------------|
| 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 | <i>Plot the ECDF of ranks by groups</i> |
|------------------|-----------------------------------------|

---

**Description**

Plot the cumulative distribution function of choosen 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 | <i>Calculate peak scores</i> |
|-------------|------------------------------|

---

**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`*Simulated peaks*

---

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

---

**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'))
```

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