

# Package ‘PAST’

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**Type** Package

**Title** Pathway Association Study Tool (PAST)

**Version** 1.25.0

**Description** PAST takes GWAS output and assigns SNPs to genes, uses those genes to find pathways associated with the genes, and plots pathways based on significance. Implements methods for reading GWAS input data, finding genes associated with SNPs, calculating enrichment score and significance of pathways, and plotting pathways.

**License** GPL (>=3) + file LICENSE

**Encoding** UTF-8

**Depends** R (>= 4.0)

**Imports** stats, utils, dplyr, rlang, iterators, parallel, foreach,  
doParallel, qvalue, rtracklayer, ggplot2, GenomicRanges,  
S4Vectors

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

**RoxygenNote** 7.1.0

**URL** <https://github.com/IGBB/past>

**BugReports** <https://github.com/IGBB/past/issues>

**biocViews** Pathways, GeneSetEnrichment

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|              |                                        |
|--------------|----------------------------------------|
| assign_chunk | <i>Assign SNPs in a chunk to genes</i> |
|--------------|----------------------------------------|

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### Description

Assign SNPs in a chunk to genes

### Usage

```
assign_chunk(gff, chunk, window)
```

### Arguments

|        |                                              |
|--------|----------------------------------------------|
| gff    | The GFF data for the chromosome being parsed |
| chunk  | The dataframe containing SNP data            |
| window | The search window around the SNPs            |

### Value

tagSNPs labeled with gene names

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|                      |                             |
|----------------------|-----------------------------|
| assign_SNPs_to_genes | <i>Assign SNPs to genes</i> |
|----------------------|-----------------------------|

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### Description

Assign SNPs to genes

### Usage

```
assign_SNPs_to_genes(
  gwas_data,
  LD,
  gff_file,
  filter_type,
  window,
  r_squared_cutoff,
  num_cores
)
```

**Arguments**

|                  |                                                             |
|------------------|-------------------------------------------------------------|
| gwas_data        | Merged association and effects data from merge_data()       |
| LD               | Linkage disequilibrium data from parse_LD()                 |
| gff_file         | The path to a GFF file                                      |
| window           | The search window for genes around the SNP                  |
| r_squared_cutoff | The R <sup>2</sup> value used to determine SNP significance |
| num_cores        | The number of cores to use in parallelizing PAST            |

**Value**

A dataframe of genes from the SNP data

**Examples**

```
example("load_GWAS_data")
example("load_LD")
demo_genes_file = system.file("extdata", "genes.gff",
  package = "PAST", mustWork = TRUE)
filter_type = c("gene")
genes <- assign_SNPs_to_genes(gwas_data, LD, demo_genes_file, filter_type, 1000, 0.8, 2)
```

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|                   |                          |
|-------------------|--------------------------|
| determine_linkage | <i>Determine Linkage</i> |
|-------------------|--------------------------|

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**Description**

Determine Linkage

**Usage**

```
determine_linkage(chunk, r_squared_cutoff)
```

**Arguments**

|                  |                                           |
|------------------|-------------------------------------------|
| chunk            | A chunk of data to be processed           |
| r_squared_cutoff | The R <sup>2</sup> value to check against |

**Value**

Either the first unlinked SNP or a set of linked SNPs

---

find\_pathway\_significance  
*Find Pathway Significance*

---

## Description

Find Pathway Significance

## Usage

```
find_pathway_significance(  
  genes,  
  pathways_file,  
  gene_number_cutoff = 5,  
  mode,  
  sample_size = 1000,  
  num_cores  
)
```

## Arguments

|                    |                                                                              |
|--------------------|------------------------------------------------------------------------------|
| genes              | Genes from assign_SNPs_to_genes()                                            |
| pathways_file      | A file containing the pathway IDs, their names, and the genes in the pathway |
| gene_number_cutoff | A cut-off for the minimum number of genes in a pathway                       |
| mode               | increasing/decreasing                                                        |
| sample_size        | How many times to sample the effects data during random sampling             |
| num_cores          | The number of cores to use in parallelizing PAST                             |

## Value

Rugplots data

## Examples

```
example("assign_SNPs_to_genes")  
demo_pathways_file = system.file("extdata", "pathways.txt.xz",  
  package = "PAST", mustWork = TRUE)  
rugplots_data <- find_pathway_significance(genes, demo_pathways_file, 5,  
  "increasing", 1000, 2)
```

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`find_representative_SNP`*Find representative SNP for a chunk of SNPs*

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**Description**

Find representative SNP for a chunk of SNPs

**Usage**

```
find_representative_SNP(chunk, r_squared_cutoff)
```

**Arguments**

|                               |                                                     |
|-------------------------------|-----------------------------------------------------|
| <code>chunk</code>            | A chunk of data to parse                            |
| <code>r_squared_cutoff</code> | The $R^2$ value to check against when counting SNPs |

**Value**

A single SNP representing the whole chunk

---

`find_representative_SNP_gene_pairing`*Find the SNP-gene assignment that represents SNPs assigned to a gene*

---

**Description**

Find the SNP-gene assignment that represents SNPs assigned to a gene

**Usage**

```
find_representative_SNP_gene_pairing(chunk)
```

**Arguments**

|                    |                             |
|--------------------|-----------------------------|
| <code>chunk</code> | A chunk of gene assignments |
|--------------------|-----------------------------|

**Value**

A single SNP-gene assignment representing all SNPs assigned to the same gene to a gene

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|----------------|-----------------------|
| load_GWAS_data | <i>Load GWAS data</i> |
|----------------|-----------------------|

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### Description

Load GWAS data

### Usage

```
load_GWAS_data(
  association_file,
  effects_file,
  association_columns = c("Trait", "Marker", "Locus", "Site", "p", "marker_R2"),
  effects_columns = c("Trait", "Marker", "Locus", "Site", "Effect")
)
```

### Arguments

|                     |                                                                                                                  |
|---------------------|------------------------------------------------------------------------------------------------------------------|
| association_file    | The association file                                                                                             |
| effects_file        | The effects file                                                                                                 |
| association_columns | The names of the columns in your association data for Trait, Marker, Chromosome, Site, F, p, and marker_Rsquared |
| effects_columns     | The names of the columns in your effects data for Trait, Marker, Chromosome, Site, and effect                    |

### Value

The association data and the effects data merged into a dataframe with one row for each SNP

### Examples

```
demo_association_file = system.file("extdata", "association.txt.xz",
  package = "PAST", mustWork = TRUE)
demo_effects_file = system.file("extdata", "effects.txt.xz",
  package = "PAST", mustWork = TRUE)
gwas_data <- load_GWAS_data(demo_association_file, demo_effects_file)
```

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|         |                                    |
|---------|------------------------------------|
| load_LD | <i>Load Linkage Disequilibrium</i> |
|---------|------------------------------------|

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### Description

Load Linkage Disequilibrium

**Usage**

```
load_LD(
  LD_file,
  LD_columns = c("Locus1", "Position1", "Site1", "Position2", "Site2", "Dist_bp",
    "R.2")
)
```

**Arguments**

|            |                                                                                                                                                                                                                                                                                                          |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LD_file    | The file containing linkage disequilibrium data                                                                                                                                                                                                                                                          |
| LD_columns | The names of the columns in your linkage disequilibrium data for the chromosome of the first SNP, the position of the first SNP, the site of the first SNP, the chromosome of the second SNP, the position of the second SNP, the site of the second SNP, the distance between the two SNPs, and the R.2 |

**Value**

The linkage disequilibrium data in a list containing dataframes for each chromosome.

**Examples**

```
demo_LD_file = system.file("extdata","LD.txt.xz",
  package = "PAST", mustWork = TRUE)
LD <- load_LD(demo_LD_file)
```

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plot\_pathways

---

*Plot Rugplots for Selected Pathways*


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**Description**

Plot Rugplots for Selected Pathways

**Usage**

```
plot_pathways(
  rugplots_data,
  filter_type,
  filter_parameter,
  mode,
  output_directory
)
```

**Arguments**

|                  |                                                                    |
|------------------|--------------------------------------------------------------------|
| rugplots_data    | The data to be plotted (returned from find_pathway_significance()) |
| filter_type      | The parameter to be used for filtering                             |
| filter_parameter | The cut-off value of the filtering parameter                       |
| mode             | The mode used to create the data (increasing/decreasing)           |
| output_directory | An existing directory to save results in                           |

**Value**

Does not return a value

**Examples**

```
example("find_pathway_significance")  
plot_pathways(rugplots_data, "pvalue", "0.03", "decreasing", tempdir())
```



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