Package ‘EGRNi’

November 18, 2022

Type Package

Title Ensemble Gene Regulatory Network Inference

Version 0.1.6

Author Chiranjib Sarkar [aut, cre, ctb]
(<https://orcid.org/0000-0003-1536-7449>),
Dipayan Sarkar [aut] (<https://orcid.org/0000-0002-0765-5689>),
Rajender Parsad [aut],
Dwijesh Mishra [aut] (<https://orcid.org/0000-0002-3327-6156>)

Maintainer Chiranjib Sarkar <cschiranjib9@gmail.com>

Description Gene regulatory network constructed using combined score obtained from individual network inference method. The combined score measures the significance of edges in the ensemble network. Fisher's weighted method has been implemented to combine the outcomes of different methods based on the probability values. The combined score follows chi-square distribution with 2n degrees of freedom. <doi:10.22271/09746315.2020.v16.i3.1358>.

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.2.1

Imports fdrtool, gdata, MASS, readr, stats

Depends R (>= 3.5.0)

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

NeedsCompilation no

Repository CRAN

Date/Publication 2022-11-18 10:00:09 UTC

R topics documented:

CRN .......................................................... 2
CRN

Description
Correlation based network

Usage

CRN(x)

Arguments

x microarray dataset with genes in columns and samples in rows.

Value
s matrix containing connectivity scores

Examples

library(EGRNi)
data(gene_exp)
t_geneexp<-t(gene_exp)
CRN(t_geneexp)
Edg2Fw

To compute F score from edge scores

Description

Edg2Fw computes the F-score from edge score using Fisher’s weighted method. One pair of genes with k numbers of edge scores obtained from k numbers of independent method are combined using the probability value. The weight matrix w contains the weight for k number of methods.

Usage

Edg2Fw(s, w, k)

Arguments

s       Matrix containing edge scores obtained from k numbers of methods with gene pairs in row and edge scores in column
w       Matrix containing weight for all individual methods
k       Numbers of independent methods considered for computing edge scores

Details

Edg2Fw function generates mixture distribution based on edge score for each method given column wise in s matrix. The probability value for each pair of gene obtained from mixture distribution are combined using Fisher’s weighted method. The combined score Fw follows chi-square distribution with 2k degrees of freedom.

Value

Fw_sum matrix containing F score for significant gene pairs

Author(s)

Chiranjib Sarkar(cschiranjib9@gmail.com)

References


Examples

#load "EGRNi" library and Edge score data
library(EGRNi)
data(Edgescore)
data(weight)
Edg2Fw(Edgescore, weight, 4)
## Edgescore

*Edge score obtained from 4 different methods for Ensemble Gene Regulatory Network Inference*

**Description**

Edge score obtained from 4 different methods for Ensemble Gene Regulatory Network Inference

**Usage**

```r
Edgescore(path)
```

**Arguments**

- `path` - path to file name

**Value**

- a tibble

**Author(s)**

Chiranjib Sarkar(cschiranjib9@gmail.com)

**References**


## EGRN

*Ensemble Gene Regulatory Network Inference*

**Description**

EGRN computes F-score from probability values obtained individual method for each edge. The F-score follows ch-square distribution with 2k degrees of freedom, where k is the number of individual methods consider for ensemble study. The EGRN combines the outcomes obtained from four methods i.e. correlation, principal component regression, partial least square regression and ridge regression. The function EGRN has been implemented using Fisher’s weighted method.

**Usage**

```r
EGRN(x, n, w)
```
**F_score**

**Arguments**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>Matrix containing gene expression data with genes in row and samples in column</td>
</tr>
<tr>
<td>n</td>
<td>Number of Bootstrap samples to obtain estimate of mean connectivity score and mean square error</td>
</tr>
<tr>
<td>w</td>
<td>Matrix containing weight for all individual methods</td>
</tr>
</tbody>
</table>

**Details**

The function works step-by-step as follows: The input gene expression data is considered for withdrawing n number of bootstrap samples to obtain the estimate of pairwise connectivity score for all possible pairs of genes in the dataset. The t-test statistic is calculated for each pair of genes and performed probability value and false discovery rate calculation from mixture distribution. The p-values for each edge are further used for computing F-score using fisher’s weighted method. The fisher’s weighted method provides the F-score which follows chi-square distribution with degrees of freedom twice the number of individual methods considered for ensemble study. The EGRN provides the network file as output containing the interacting pair of genes in row with final score.

**Value**

Fw_sum matrix containing F score for significant gene pairs

**Author(s)**

Chiranjib Sarkar(cschiranjib9@gmail.com)

**References**


**Examples**

```r
#load "EGRNi" library and gene expression data
library(EGRNi)
data(gene_exp)
data(weight)
EGRN(gene_exp[1:50,], 2, weight)
```

**Description**

F_score computes the combined edge score from multiple probability values of edges obtained from independent methods. The probability score follows uniform distribution [0,1]. The F score follows chi-square distribution with 2k degrees of freedom.
Usage

F_score(p, w, k)

Arguments

p: Matrix containing probability values of edges for each method column wise having gene pairs in row
w: Matrix containing weight for all individual methods
k: Numbers of independent methods considered for computing edge scores

Details

F_score function generates mixture distribution based on probability value for each method given column wise in p matrix. The probability value for each pair of gene are combined using Fisher's weighted method. The combined score Fw follows chi-square distribution with 2k degrees of freedom. The F_score provides the network file as output containing the interacting pair of genes in row with final score.

Value

Fw_sum matrix containing F score for significant gene pairs

Author(s)

Chiranjib Sarkar(cschiranjib9@gmail.com)

References


Examples

#load "EGRNi" library and probability value data
library(EGRNi)
data(pvalue)
data(weight)
F_score(pvalue, weight, 4)
gene_exp

| gene_exp | Gene expression data for Ensemble Gene Regulatory Network Inference |

**Description**

Gene expression data for Ensemble Gene Regulatory Network Inference

**Usage**

gene_exp(path)

**Arguments**

- **path**  
  path to file name

**Value**

- a tibble

**Author(s)**

Chiranjib Sarkar(cshiranjib9@gmail.com)

**References**


IntsctEdg2Fw

**To compute F score for significant edges from individual methods**

**Description**

IntsctEdg2Fw computes the Fw score using Fisher’s weighted method for the significant edges obtained in k numbers of individual methods. The probability values are combined to compute the Fw score which follows chi-square distribution. The significant edges (>fdr) are selected using intersection.

**Usage**

IntsctEdg2Fw(s, w, k, fdr)
Arguments

- **s**: Matrix containing edge scores obtained from k numbers of methods with gene pairs in row and edge scores in column
- **w**: Matrix containing weight for all individual methods
- **k**: Numbers of independent methods considered for computing edge scores
- **fdr**: Cut-off for selecting significant edges

Details

IntsectEdg2Fw function generates mixture distribution based on edge score for each method given column wise in s matrix. The probability value for each pair of gene obtained from mixture distribution are combined using Fisher’s weighted method. The combined score Fw follows chi-square distribution with 2k degrees of freedom.

Value

Fw matrix containing F score for significant gene pairs

Author(s)

Chiranjib Sarkar(cschiranjib9@gmail.com)

References


Examples

```r
# load "EGRNi" library and Edge score data
library(EGRNi)
data(Edgescore)
data(weight)
IntsctEdg2Fw(Edgescore, weight, k=4, fdr=0.1)
```

---

**Description**

Principal component regression based network

**Usage**

```r
PCN(x)
```
Partial least square based network

Usage

PLSN(x)

Arguments

x microarray dataset with genes in columns and samples in rows.

Value

s matrix containing connectivity scores

Examples

library(EGRNi)
data(gene_exp)
t_geneexp<-t(gene_exp)
PCN(t_geneexp)

PLSN(x)

Partial least square based network

Usage

PLSN(x)

Arguments

x microarray dataset with genes in columns and samples in rows.

Value

s matrix containing connectivity scores

Examples

library(EGRNi)
data(gene_exp)
t_geneexp<-t(gene_exp)
PCN(t_geneexp)
### pvalue

*Probability values for Ensemble Gene Regulatory Network Inference*

**Description**

Probability values for Ensemble Gene Regulatory Network Inference

**Usage**

```r
pvalue(path)
```

**Arguments**

- `path` path to file name

**Value**

a tibble

**Author(s)**

Chiranjib Sarkar(cschiranjib9@gmail.com)

**References**


### RidgN

*Ridge regression based network*

**Description**

Ridge regression based network

**Usage**

```r
RidgN(x)
```

**Arguments**

- `x` microarray dataset with genes in columns and samples in rows.

**Value**

s matrix containing connectivity scores
Examples

```r
library(EGRNi)
data(gene_exp)
t_geneexp<-t(gene_exp)
RidgN(t_geneexp)
```

Description

Weights for Ensemble Gene Regulatory Network Inference

Usage

```
weight(path)
```

Arguments

- `path` path to file name

Value

a tibble

Author(s)

Chiranjib Sarkar(cschiranjib9@gmail.com)

References

Index

CRN, 2
Edg2Fw, 3
Edgescore, 4
EGRN, 4
F_score, 5
gene_exp, 7
IntsctEdg2Fw, 7
PCN, 8
PLSN, 9
pvalue, 10
RidgN, 10
weight, 11