Type Package

Version 1.26.0

Date 2012-04-17

Title FARMS - Factor Analysis for Robust Microarray Summarization

Author Djork-Arne Clevert <okko@clevert.de>

Maintainer Djork-Arne Clevert <okko@clevert.de>

Depends R (>= 2.8), affy (>= 1.20.0), MASS, methods

Imports affy, MASS, Biobase (>= 1.13.41), methods, graphics

Suggests affydata, Biobase, utils

biocViews GeneExpression, Microarray, Preprocessing, QualityControl

Description The package provides the summarization algorithm called Factor Analysis for Robust Microarray Summarization (FARMS) and a novel unsupervised feature selection criterion called "I/NI-calls"

License LGPL (>= 2.1)

  getNI_ProbeSets-methods.R getNI_Eset-methods.R
  farms.R zzz.R

URL http://www.bioinf.jku.at/software/farms/farms.html

LazyLoad yes

NeedsCompilation no

R topics documented:

dummy .................. 2
expFarms .................. 2
generateExprVal.method.farms ............... 3
getI_Eset-methods .......... 5
getI_ProbeSets ............. 6
getNI_Eset-methods ........... 6
getNI_ProbeSets ............ 7
INIcalls-methods ........... 8
INI_Calls-class ............. 9
lFarms .................... 10
Description

Example cdfenv (environment containing the probe locations).

Usage

data(testAffyBatch)

Format

Containing an environment dummy containing the probe locations

Description

This function converts an instance of AffyBatch into an instance of exprSet-class using a factor analysis model for which a Bayesian Maximum a Posteriori method optimizes the model parameters under the assumption of Gaussian measurement noise.

Usage

expFarms(object, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "quantiles", weight, mu, weighted.mean, laplacian, robust, correction, ...)

Arguments

object An instance of AffyBatch.
weight Hyperparameter value in the range of [0,1] which determines the influence of the prior. The default value is 0.5.
bgcorrect.method the name of the background adjustment method
pmcorrect.method the name of the PM adjustment method
normalize.method the normalization method to use
### mu
Hyper-parameter value which allows to quantify different aspects of potential prior knowledge. Values near zero assumes that most genes do not contain a signal, and introduces a bias for loading matrix elements near zero. Default value is 0.

### weighted.mean
Boolean flag, that indicates whether a weighted mean or a least square fit is used to summarize the loading matrix. The default value is set to FALSE.

### laplacian
Boolean flag, indicates whether a Laplacian prior for the factor is employed or not. Default value is FALSE.

### robust
Boolean flag, that ensures non-constant results. Default value is TRUE.

### correction
Value that indicates whether the covariance matrix should be corrected for negative eigenvalues which might emerge from the non-negative correlation constraints or not. Default = 0 (means that no correction is done), 1 (minimal noise (0.0001) is added to the diagonal elements of the covariance matrix to force positive definiteness), 2 (Maximum Likelihood solution to compute the nearest positive definite matrix under the given non-negative correlation constraints of the covariance matrix).

### centering
Indicates whether the data is "median" or "mean" centered. Default value is "median".

### spuriousCorrelation
Numeric value in the range of [0,1] that quantifies the suppression of spurious correlation when using the Laplacian prior. Default value is 0 (no suppression). Note, that this parameter is only active when the laplacian parameter is set to TRUE.

... other arguments to be passed to `expresso`.

### Details
This function is a wrapper for `expresso`.

### Value
`exprSet-class`

### See Also
`expresso`, `qFarms`, `lFarms`.

### Examples
```r
data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant", weight=0.5)
```

---

**generateExprVal.method.farms**

*Generate an expression value from the probes informations*

### Description
Generate an expression from the probe
Usage

generateExprVal.method.farms(probes, weight, mu, cyc, tol, weighted.mean, robust, minNoise, ...

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>probes</td>
<td>a matrix of probe intensities with rows representing probes and columns representing samples. Usually pm(probeset) where probeset is a of class ProbeSet.</td>
</tr>
<tr>
<td>weight</td>
<td>Hyperparameter value in the range of [0,1] which determines the influence of the prior. The default value is 0.5.</td>
</tr>
<tr>
<td>mu</td>
<td>Hyperparameter value which allows to quantify different aspects of potential prior knowledge. A value near zero assumes that most genes do not contain a signal, and introduces a bias for loading matrix elements near zero. Default value is 0.</td>
</tr>
<tr>
<td>cyc</td>
<td>Value which determines the maximum numbers of EM-Steps. Default value is set to 30.</td>
</tr>
<tr>
<td>tol</td>
<td>Value which determines the termination tolerance. Convergence threshold is set to 1E-05.</td>
</tr>
<tr>
<td>weighted.mean</td>
<td>Boolean flag, that indicates whether a weighted mean or a least square fit is used to summarize the loading matrix. The default value is set to FALSE.</td>
</tr>
<tr>
<td>robust</td>
<td>Boolean flag, that ensures non-constant results. Default value is TRUE.</td>
</tr>
<tr>
<td>minNoise</td>
<td>Value, minimal noise assumption. Default value is 0.0001.</td>
</tr>
<tr>
<td>correction</td>
<td>Value that indicates whether the covariance matrix should be corrected for negative eigenvalues which might emerge from the non-negative correlation constraints or not. Default = 0 (means that no correction is done), 1 (minimal noise (0.0001) is added to the diagonal elements of the covariance matrix to force positive definiteness), 2 (Maximum Likelihood solution to compute the nearest positive definite matrix under the given non-negative correlation constraints of the covariance matrix).</td>
</tr>
<tr>
<td>laplacian</td>
<td>Boolean flag, indicates whether a Laplacian prior for the factor is employed or not. Default value is FALSE.</td>
</tr>
<tr>
<td>centering</td>
<td>Indicates whether the data is &quot;median&quot; or &quot;mean&quot; centered. Default value is &quot;median&quot;.</td>
</tr>
<tr>
<td>spuriousCorrelation</td>
<td>Numeric value in the range of [0,1] that quantifies the suppression of spurious correlation when using the Laplacian prior. Default value is 0 (no suppression). Note, that this parameter is only active when the laplacian parameter is set to TRUE.</td>
</tr>
<tr>
<td>...</td>
<td>extra arguments to pass to the respective function</td>
</tr>
</tbody>
</table>

Value

A list containing entries:

<table>
<thead>
<tr>
<th>Entry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>exprs</td>
<td>The expression values.</td>
</tr>
<tr>
<td>se.exprs</td>
<td>Estimate of the hidden variable.</td>
</tr>
</tbody>
</table>

See Also

generateExprSet-methods,generateExprVal.method.playerout,li.wong,medianpolish
**getI_Eset-methods**

**Method to generate an ExpressionSet of informative genes**

### Description

This function generates an instance of `exprSet-class`, that contains only informative probe sets.

### Usage

```r
## S4 method for signature 'INI_Calls'
getI_Eset(object)
```

### Arguments

- **object**: An instance of `INI_Calls-class`.

### Value

`exprSet-class`

### Methods

- `signature(object = "INI_Calls")` An instance of `INI_Calls-class`.

### See Also

- `expFarms`, `qFarms`, `lFarms`, `INIcalls`, `summary`

### Examples

```r
data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant")
INIs <- INIcalls(eset) # apply I/NI calls
summary(INIs)
plot(INIs) # draws a density plot of I/NI-calls
I_data <- getI_Eset(INIs) # affybatch containing only informative probe sets
NI_data <- getNI_Eset(INIs) # affybatch containing only non-informative probe sets
I_probes <- getI_ProbeSets(INIs) # vector containing only informative probe sets names
NI_probes <- getNI_ProbeSets(INIs) # vector containing only non-informative probe sets names
```
Description

This function generates an instance of vector-class, that return a vector of informative probe set names.

Usage

```r
## S4 method for signature 'INI_Calls'
getI_ProbeSets(object)
```

Arguments

- `object`: An instance of INI_Calls-class.

Value

vector

Methods

signature(object = "INI_Calls") An instance of INI_Calls-class.

See Also

expFarms, qFarms, lFarms, INIcalls, summary

Examples

```r
data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant")
INIs <- INIcalls(eset) # apply I/NI calls
summary(INIs)
plot(INIs) # draws a density plot of I/NI-calls
I_data <- getI_Eset(INIs) # affybatch containing only informative probe sets
NI_data <- getNI_Eset(INIs) # affybatch containing only non-informative probe sets
I_probes <- getI_ProbeSets(INIs) # vector containing only informative probe sets names
NI_probes <- getNI_ProbeSets(INIs) # vector containing only non-informative probe sets names
```

description of getNI_Eset-methods

Method to generate an ExpressionSet of non-informative genes

Description

This function generates an instance of exprSet-class, that contains only non-informative probe sets.
getNI_ProbeSets

Usage

## S4 method for signature 'INI_Calls'
getNI_Eset(object)

Arguments

object An instance of INI_Calls-class.

Value

exprSet-class

Methods

signature(object = "INI_Calls") An instance of INI_Calls-class.

See Also

expFarms, qFarms, lFarms, INIcalls, summary

Examples

data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant")
INIs <- INIcalls(eset) # apply I/NI calls
summary(INIs)
plot(INIs) # draws a density plot of I/NI-calls
I_data <- getI_Eset(INIs) # affybatch containing only informative probe sets
NI_data <- getNI_Eset(INIs) # affybatch containing only non-informative probe sets
I_probes <- getI_ProbeSets(INIs) # vector containing only informative probe sets names
NI_probes <- getNI_ProbeSets(INIs) # vector containing only non-informative probe sets names

getNI_ProbeSets

Method to generate a vector of non-informative probe set names

Description

This function generates an instance of vector, that return a vector of non-informative probe set names.

Usage

## S4 method for signature 'INI_Calls'
getNI_ProbeSets(object)

Arguments

object An instance of INI_Calls-class.

Value

vector
INICalls-methods

Methods

signature(object = "INI_Calls") An instance of INI_Calls-class.

See Also

expFarms, qFarms, lFarms, INICalls, summary

Examples

data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant")
INIs <- INICalls(eset) # apply I/NI calls
summary(INIs)
plot(INIs) # draws a density plot of I/NI-calls
I_data <- getI_Eset(INIs) # affybatch containing only informative probe sets
Nl_data <- getNI_Eset(INIs) # affybatch containing only non-informative probe sets
I_probes <- getI_ProbeSets(INIs) # vector containing only informative probe sets names
Nl_probes <- getNI_ProbeSets(INIs) # vector containing only non-informative probe sets names

INICalls-methods  Dimension reduction based on informative genes

Description

This function generates an instance of INI_Calls-class of given which has been summarized by expFarms, qFarms or lFarms before, based on the informative genes.

Usage

## S4 method for signature 'ExpressionSet'
INICalls(object)

Arguments

  object  An instance of exprSet-class.

Value

exprSet-class

Methods

signature(object = "ExpressionSet") An instance of exprSet-class.

See Also

expFarms, qFarms, lFarms, INICalls
Examples

```r
data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant")
INIs <- INIcalls(eset) # apply I/NI calls
summary(INIs)
plot(INIs) # draws a density plot of I/NI-calls
I_data <- getI_Eset(INIs) # affybatch containing only informative probe sets
NI_data <- getNI_Eset(INIs) # affybatch containing only non-informative probe sets
I_probes <- getI_ProbeSets(INIs) # vector containing only informative probe sets names
NI_probes <- getNI_ProbeSets(INIs) # vector containing only non-informative probe sets names
```

INI_Calls-class

Class INI_Calls

Description

This is a class representation for an INI_calls-class object. The INI_calls-class consists of two instances of exprSet-class, containing an informative exprSet and a non-informative exprSet.

Objects from the Class

Objects can be created using the function INIcalls.

Slots

- `I_Calls`: Object of class "vector" containing informative probe set names.
- `NI_Calls`: Object of class "vector" containing non-informative probe set names.
- `I_Exprs`: Object of class exprSet-class representing the informative exprSet.
- `NI_Exprs`: Object of class exprSet-class representing the non-informative exprSet.
- `varZX`: Object of class "vector" containing the INI-call value.

Author(s)

Djork Clevert

See Also

expFarms, qFarms, lFarms, INIcalls

Examples

```r
data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant")
INIs <- INIcalls(eset) # apply I/NI calls
summary(INIs)
plot(INIs) # draws a density plot of I/NI-calls
I_data <- getI_Eset(INIs) # affybatch containing only informative probe sets
NI_data <- getNI_Eset(INIs) # affybatch containing only non-informative probe sets
I_probes <- getI_ProbeSets(INIs) # vector containing only informative probe sets names
NI_probes <- getNI_ProbeSets(INIs) # vector containing only non-informative probe sets names
```
1Farms 1Farms expression measure

Description
This function converts an instance of AffyBatch into an instance of exprSet-class using a factor analysis model for which a Bayesian Maximum a Posteriori method optimizes the model parameters under the assumption of Gaussian measurement noise. This function is a wrapper for expresso and uses the function normalize.loess for array normalization.

Usage
1Farms(object, weight, mu, weighted.mean, laplacian, robust, correction, centering, spuriousCorrelation, ...)

Arguments
object An instance of AffyBatch.
weight Hyperparameter value in the range of [0,1] which determines the influence of the prior. The default value is 0.5
mu Hyperparameter value which allows to quantify different aspects of potential prior knowledge. Values near zero assumes that most genes do not contain a signal, and introduces a bias for loading matrix elements near zero. Default value is 0
weighted.mean Boolean flag, that indicates whether a weighted mean or a least square fit is used to summarize the loading matrix. The default value is set to FALSE.
laplacian Boolean flag, indicates whether a Laplacian prior for the factor is employed or not. Default value is FALSE.
robust Boolean flag, that ensures non-constant results. Default value is TRUE.
correction Value that indicates whether the covariance matrix should be corrected for negative eigenvalues which might emerge from the non-negative correlation constraints or not. Default = 0 (means that no correction is done), 1 (minimal noise (0.0001) is added to the diagonal elements of the covariance matrix to force positive definiteness), 2 (Maximum Likelihood solution to compute the nearest positive definite matrix under the given non-negative correlation constraints of the covariance matrix)
centering Indicates whether the data is "median" or "mean" centered. Default value is "median".
spuriousCorrelation Numeric value in the range of [0,1] that quantifies the suppression of spurious correlation when using the Laplacian prior. Default value is 0 (no suppression). Note, that this parameter is only active when the laplacian parameter is set to TRUE.
...
other arguments to be passed to expresso.

Details
This function is a wrapper for expresso.
Value

\texttt{exprSet-class}

See Also

\texttt{expresso, expFarms, qFarms, normalize.loess}

Examples

data(testAffyBatch)
eset <- qFarms(testAffyBatch)

\begin{verbatim}
plot-methods  Visualizes the distribution of informative and non-informatives genes

Description

This function visualizes the distribution of informative and non-informative genes of a given instance of \texttt{INI_Calls-class}.

Usage

\begin{verbatim}
## S4 method for signature 'INI_Calls,missing'
plot(x)
\end{verbatim}

Arguments

\begin{verbatim}
x  An instance of \texttt{INI_Calls-class}.
\end{verbatim}

Value

\texttt{exprSet-class}

Methods

signature(x = "INI_Calls", y = "missing") An instance of \texttt{INI_Calls-class}.

See Also

\texttt{expFarms, qFarms, I_Farms, INIcalls, summary}

Examples

data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant")
INIs <- INIcalls(eset) # apply I/NI calls
summary(INIs)
plot(INIs) # draws a density plot of I/NI-calls
I_data <- getI_Eset(INIs) # affybatch containing only informative probe sets
NI_data <- getNI_Eset(INIs) # affybatch containing only non-informative probe sets
I_probes <- getI_ProbeSets(INIs) # vector containing only informative probe sets names
NI_probes <- getNI_ProbeSets(INIs) # vector containing only non-informative probe sets names
Description

This function converts an instance of `AffyBatch` into an instance of `exprSet-class` using a factor analysis model for which a Bayesian Maximum a Posteriori method optimizes the model parameters under the assumption of Gaussian measurement noise. This function is a wrapper for `expresso` and uses the function `normalize.quantiles` for array normalization.

Usage

```r
qFarms(object, weight, mu, weighted.mean, laplacian, robust, correction, centering, spuriousCorrelation, ...)
```

Arguments

- `object`: An instance of `AffyBatch`.
- `weight`: Hyperparameter value in the range of [0,1] which determines the influence of the prior. The default value is 0.5.
- `mu`: Hyperparameter value which allows to quantify different aspects of potential prior knowledge. Values near zero assumes that most genes do not contain a signal, and introduces a bias for loading matrix elements near zero. Default value is 0.
- `weighted.mean`: Boolean flag, that indicates whether a weighted mean or a least square fit is used to summarize the loading matrix. The default value is set to FALSE.
- `laplacian`: Boolean flag, indicates whether a Laplacian prior for the factor is employed or not. Default value is FALSE.
- `robust`: Boolean flag, that ensures non-constant results. Default value is TRUE.
- `correction`: Value that indicates whether the covariance matrix should be corrected for negative eigenvalues which might emerge from the non-negative correlation constraints or not. Default = 0 (means that no correction is done), 1 (minimal noise (0.0001) is added to the diagonal elements of the covariance matrix to force positive definiteness), 2 (Maximum Likelihood solution to compute the nearest positive definite matrix under the given non-negative correlation constraints of the covariance matrix).
- `centering`: Indicates whether the data is "median" or "mean" centered. Default value is "median".
- `spuriousCorrelation`: Numeric value in the range of [0,1] that quantifies the suppression of spurious correlation when using the Laplacian prior. Default value is 0 (no suppression). Note, that this parameter is only active when the laplacian parameter is set to TRUE.
- `...`: other arguments to be passed to `expresso`.

Details

This function is a wrapper for `expresso`. 
summary-methods

Value

exprSet-class

See Also

expresso, expFarms, lFarms, normalize.quantiles

Examples

data(testAffyBatch)
eset <- qFarms(testAffyBatch)

summary-methods

Summary of I/NI-calls

Description

This function determinates the percentage of informative genes of a given instance of INI_Calls-class which has been summarized by expFarms, qFarms or lFarms before.

Usage

## S4 method for signature 'INI_Calls'
summary(object,...)

Arguments

object An instance of INI_Calls-class.
... extra arguments to pass to the respective function

Value

exprSet-class

Methods

signature(object = "INI_Calls") An instance of INI_Calls-class.

See Also

expFarms, qFarms,lFarms,plot,INIcalls

Examples

data(testAffyBatch)
eset <- expFarms(testAffyBatch, bgcorrect.method = "none", pmcorrect.method = "pmonly", normalize.method = "constant")
INIs <- INIcalls(eset) # apply I/NI calls
summary(INIs)
plot(INIs) # draws a density plot of I/NI-calls
I_data <- getI_Eset(INIs) # affybatch containing only informative probe sets
NI_data <- getNI_Eset(INIs) # affybatch containing only non-informative probe sets
I_probes <- getI_ProbeSets(INIs) # vector containing only informative probe sets names
NI_probes <- getNI_ProbeSets(INIs) # vector containing only non-informative probe sets names
Description

This is an artificial data set. It contains a 2 genes x 2 samples examples (testAffyBatch) and is suitable for testing the rd-examples in farms.

Format

An AffyBatch of 2 samples.

See Also

Dilution
Index

*Topic classes
INI_Calls-class, 9

*Topic datasets
dummy, 2
testAffyBatch, 14

*Topic manip
expFarms, 2
generateExprVal.method.farms, 3
getI_Eset-methods, 5
getI_ProbeSets, 6
getNI_Eset-methods, 6
INIcalls-methods, 8
lFarms, 10
plot-methods, 11
qFarms, 12
summary-methods, 13

*Topic methods
getI_Eset-methods, 5
INIcalls-methods, 8
plot-methods, 11
summary-methods, 13

AffyBatch, 2, 10, 12, 14
Dilution, 14
dummy, 2

environment, 2
expFarms, 2, 5–9, 11, 13
expresso, 3, 10–13

generateExprVal.method.farms, 3
generateExprVal.method.playerout, 4
getI_Eset (getI_Eset-methods), 5
getI_Eset,INI_Calls-method (getI_Eset-methods), 5
getI_Eset-methods, 5
getI_ProbeSets, 6
getI_ProbeSets,INI_Calls-method (getI_ProbeSets), 6
getI_ProbeSets-methods (getI_ProbeSets), 6
getNI_Eset (getNI_Eset-methods), 6
getNI_Eset,INI_Calls-method (getNI_Eset-methods), 6
getNI_Eset-methods, 6
getNI_ProbeSets,INI_Calls-method (getNI_ProbeSets), 7
getNI_ProbeSets-methods (getNI_ProbeSets), 7
INI_Calls (INI_Calls-class), 9
INI_Calls-class, 9
INIcalls, 5–9, 11, 13
INIcalls (INIcalls-methods), 8
INIcalls,ExpressionSet-method (INIcalls-methods), 8
INIcalls-methods, 8

lFarms, 3, 5–9, 10, 11, 13
li.wong, 4

medianpolish, 4

normalize.loess, 10, 11
normalize.quantiles, 12, 13

plot, 13
plot (plot-methods), 11
plot,INI_Calls,missing-method (plot-methods), 11
plot-methods, 11

ProbeSet, 4

qFarms, 3, 5–9, 11, 12, 13

summary, 5–8, 11
summary (summary-methods), 13
summary,INI_Calls-method (summary-methods), 13
summary-methods, 13

testAffyBatch, 14