Package ‘EBS’

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Description This package performs an exact Bayesian segmentation on data and returns the probabilities of breakpoints, an ICL criteria, comparison of change-point location, etc
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EBS-package

Contains functions that run exact bayesian changepoint methods and return changepoint probabilities and ICL criteria for model selection

Description

Implements changepoint method in an exact bayesian framework for finding single and multiple changepoints within data. Retrieves each changepoint probabilities for segmentations in 1 to Kmax segments. Chooses the optimal number of segments according to the ICL criterion. Compares change-point location between profiles using credibility intervals or likelihood ratios.

Details

Package: EBS
Type: Package
Version: 2.0
Date: 2012-11-26
License: GPL
LazyLoad: yes

Author(s)

Alice Cleynen
Maintainer: Alice Cleynen <alice.cleynen@agroparistech.fr>

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems
Johnson, Kotz & Kemp: Univariate Discrete Distributions
Hall, Kay & Titterington: Asymptotically optimal difference-based estimation of variance in non-parametric regression

Examples

# changes for Poisson model
set.seed(1)
x<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
out <- EBSegmentation(x,Kmax=20)
bic <- EBSBIC(out)
print(bic$NbicBIC)
icl <- EBSICL(out)
print(icl$NbicICL)
plot(bic$NbicICL,type='b',pch=1,col='blue',ylim=c(0,1000))
lines(icl$NbicICL,type='b',pch=2,col='red')
EBSPlotProba(out,icl$NbicICL, data=TRUE, file="my-segmentation.pdf")

# changes for Negative Binomial model, comparison of two profiles
set.seed(1)
x1<-c(rnbinom(125,size=0.2,prob=0.8),rnbinom(100,size=0.2, prob=0.1),
rnbinom(50,size=0.2,prob=0.6),rnbinom(75,size=0.2, prob=0.95),
rnbinom(50,size=0.2,prob=0.25))
x2<-c(rnbinom(125,size=0.15,prob=0.75),rnbinom(75,size=0.15,prob=0.2),
rnbinom(75,size=0.15,prob=0.9),rnbinom(125,size=0.15,prob=0.1))
M<-rbind(x1,x2)
E <- EBSProfiles(M,model=3,K=10,homoscedastic=TRUE)

# Computes probabilities for both profile assuming independance but common #overdispersion
EBSPlotProbaProfiles(E,K=c(5,4))

# Plots posterior distribution of each change points of the two profiles, 
#the first into 5 segments, the second into 4. 
mass<-CompCredibility(E,Conditions=c(1,2),Tau=c(1,1),K=c(5,4))

# Computes the distribution and credibility interval of the difference of 
#location of the first change point of the two profiles, 
#the first being devided into 5 segments, the second into 4 
mass$massto0
DecisionStatistic<-EBSStatistic(E,Conditions=c(1,2),Tau=c(1,1))

# Computes the likelihood ratio of the profiles having same first 
#change-point versus complementary.

<table>
<thead>
<tr>
<th>CardE0</th>
<th>Prior probability of E0</th>
</tr>
</thead>
</table>

Description

Probability under uniform that profiles share same change-point location
Usage
CardE0(n,k,K,unif=TRUE)

Arguments
- **n**: Integer giving length of datasets.
- **k**: Vector of integers giving change-point number of datasets.
- **K**: Vector of integers giving number of segments in segmentation of each profile.
- **unif**: Boolean stating whether prior on segmentation is uniform given K. If false then prior favors segments of equal length.

Details
Returns the probability under the uniform that profiles of length n have their k[i]th change-point at same location when segmented into in K[i] segments.

Value
A numeric object giving the prior probability of E0.

Author(s)
Alice Cleynen

References
Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems [Arxiv:1004.4347](https://arxiv.org/abs/1004.4347)

See Also
- PriorDistrib

Examples
```r
# probability that two profiles of size 100 have their 1st and second change-point at same location
# when segmented into 5 segments:
n<-100
k<-c(1,3)
K<-c(5,5)
CardE0(n,k,K,TRUE)
```
**CardMK**

*Number of segmentations in K segments*

---

**Description**

Number of all possible segmentations in K segments

**Usage**

`cardmkHnLkI(n,K)`

**Arguments**

- `n` Integer giving length of dataset.
- `K` Integer giving number of segments in segmentation.

**Details**

Returns the number of possible segmentations of [1,n] in K segments

**Value**

A numeric object giving the number of possible segmentations of [1,n] in K segments.

**Author(s)**

Alice Cleynen

**References**

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Arxiv:1004.4347*

**See Also**

`priordistrib`

**Examples**

```r
# number of partitions of {1, 100} in 5 segments:
n<-100
K<-5
cardmkHnLkI(n,K)
```
Generic function

Description
Generic function

Usage
Col(object)

Arguments
object An object of class EBSProfiles

Details
Returns the slot Col of an object of class EBSProfiles

Value
A matrix of size (n+1)*Kmax

Author(s)
Alice Cleynen

References
Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also
Li

Examples
x=new("EBSProfiles") # new EBSProfiles object
Col(x) # retrieves the Col slot from x
### CompCredibility

#### Description

Comparison of two profiles with credibility intervals

#### Usage

```
CompCredibility(x, Conditions, Tau = numeric(), K = numeric())
```

#### Arguments

- **x**: An object of class EBSProfiles.
- **Conditions**: A vector of length 2 containing the index of the two conditions to compare.
- **Tau**: A vector of length 2 containing the index of the change-point of interest of the two conditions to compare.
- **K**: A vector of length 2 containing the maximum number of segments for the segmentation of each of the two profiles to compare.

#### Details

This function is used to compute the posterior credibility interval of the difference of change-point locations between two profiles assumed to be independant.

#### Value

- **Distribution**: Posterior distribution of the difference between the location of change-points of interest for the two conditions
- **masswith0**: Mass of the smallest credibility interval up to and including data-point 0
- **massto0**: Mass of the smallest credibility interval up to but excluding data-point 0
Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347
Johnson, Kotz & Kemp: Univariate Discrete Distributions
Hall, Kay & Titterington: Asymptotically optimal difference-based estimation of variance in non-parametric regression

See Also

EBSPProfiles, EBSStatistic

Examples

# changes for Poisson model
set.seed(1)
x1<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(50,5),rpois(50,1))
x2<-c(rpois(125,3),rpois(75,4),rpois(75,1),rpois(125,8))
M<-rbind(x1,x2)
E <- EBSProfiles(M,model=1,K=10)
out<-CompCredibility(E,Conditions=c(1,2),Tau=c(1,1),K=c(5,4))

<table>
<thead>
<tr>
<th>Data</th>
<th>Generic function</th>
</tr>
</thead>
</table>

Description

Generic function

Usage

Data(object)

Arguments

object An object of class EBSProfiles

Details

Returns the datasets used from an object of class EBSProfiles.

Value

A matrix where each row is the dataset of a profile analyzed.
Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Length, NbConditions

Examples

x=new("EBSProfiles") # new EBSProfiles object
Data(x) # retrieves the Data from x

Data-methods ~~ Methods for Function Data ~~

Description

~~ Methods for function Data ~~

Methods

signature(object = "EBSProfiles") Retreives Data from an object of class EBSProfiles

EBS-class Class "EBS"

Description

A class for Bayesian Segmentation objects.

Objects from the Class

Objects can be created by calls of the form new("EBS", ...).

new("EBS", ...): creates a new object with class EBS
**EBS-class**

**Slots**

model: Object of class "character", the assumed distribution of the data
data: Object of class "numeric", the data to be segmented
length: Object of class "numeric", the length of the profile
Kmax: Object of class "numeric", the maximum number of segments considered for the segmentation
HyperParameters: Object of class "numeric", the hyperparameters used for the prior distribution on the model parameters
Variance: Object of class "numeric", if model = Normal Homoscedastic, the variance used in the analysis
overdispersion: Object of class "numeric", if model = Negative Binomial, the overdispersion used in the analysis
Li: Object of class "numeric", matrix of size Kmax*(length+1) where element [i,j] is the log-probability of interval [1,j] being segmented in i segments
Col: Object of class "numeric", a matrix of size (length+1)*Kmax where element [i,j] is the log-probability of interval [i,n] being segmented in j segments
matProba: a matrix of size (length+1)*(length+1) where element [i,j] is the log-probability of interval [i,j]
unif: a boolean stating whether prior on segmentation is uniform given number of segments

**Methods**

`getModel` signature(object = "EBS"): retrieves model slot
`getData` signature(object = "EBS"): retrieves data slot
`getLength` signature(object = "EBS"): retrieves length slot
`getKmax` signature(object = "EBS"): retrieves Kmax slot
`getHyperParameters` signature(object = "EBS"): retrieves HyperParameters slot
`getVariance` signature(object = "EBS"): retrieves Variance slot
`getOverdispersion` signature(object = "EBS"): retrieves overdispersion slot
`getLi` signature(object = "EBS"): retrieves Li slot
`getCol` signature(object = "EBS"): retrieves Col slot
`getP` signature(object = "EBS"): retrieves matProba slot
`getPrior` signature(object = "EBS"): retrieves unif slot

**Author(s)**

Alice Cleynen

**See Also**

EBSSegmentation
Examples

showClass("EBS") # shows the structure of the cpt class

data<-c(rpois(100,2),rpois(100,5))
# creates a new EBS object containing the segmentation of x
E<-EBSegmentation(data)
class(E) # verifies the class of E
getModel(E) # retrieves model of the segmentation
getLength(E) # retrieves the length of the signal

---

**EBSBIC**

*Model Selection by BIC Criterion*

**Description**

Computes the exact BIC criterion: -Loglikelihood (data,K) and chooses the optimal number of segments as \( k = \text{argmin}(\text{BIC}) \)

**Usage**

```
EBSBIC(x, prior=numeric())
```

**Arguments**

- **x**: An object of class EBS returned by function EBSegmentation applied to data of interest.
- **prior**: A vector of size Kmax giving prior probabilities for segment numbers.

**Details**

This function is used to choose the optimal K according to the BIC criteria.

**Value**

- **nbbic**: An integer containing the choice of the optimal number of segments.
- **bic**: A vector of length Kmax returning -Loglikelihood (data,K).

**Author(s)**

Alice Cleynen

**References**

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Arxiv:1004.4347*
Description

Calculates the bayesian posterior probability of a changepoint of a segmentation in K segments.

Usage

EBSDistri(x, k, Kk)

Arguments

x An object of class EBS returned by function EBsegmentation applied to data of interest.

k The rank of the breakpoint for which the posterior distribution is wanted. Must have 0<k<Kk

Kk The number of segments for the segmentation of interest. Must have 2<Kk<=x$Kmax

Details

This function is used to compute the posterior distribution of kth changepoint for a segmentation in K segments.

Value

A vector containing distribution of kth changepoint in a segmentation in Kk segments.

Author(s)

Alice Cleynen
EBSegmentation

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems arxiv:1004.4347

See Also

EBSegmentation, EBSPlotProba

Examples

# changes for Poisson model
set.seed(1)
x<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
out <- EBSegmentation(x,model=1,Kmax=20)
y1=EBSDistrib(out,1,5)
plot(y1,type='l')

EBSegmentation  Exact Bayesian Segmentation for Poisson, Negative Binomial and Normal models

Description

Calculates the bayesian probability of each segmentation in 1 to Kmax segments (assuming the data is poisson, normal or negative binomial distributed) and returns object of class EBS.

Usage

EBSegmentation(data=numeric(), model=1, Kmax = 15, hyper = numeric(),
theta = numeric(), var = numeric(), unif= TRUE)

Arguments

data A vector containing the data within which you wish to find changepoints.
model Model under which data is assumed to be distributed. Possible values are 1 for Poisson, 2 for Normal Homoscedastic, 3 for Negative Binomial and 4 for Normal Heteroscedastic.
Kmax The maximum number of segments for the segmentation. Function will find explore the set of all possible segmentations in k segments for k in 1 to Kmax.
hyper The set of hyper-parameters for the prior on the data-distribution. If model is Poisson the conjugate law is Gamma and 2 parameters are needed. If model is Negative Binomial the conjugate is Beta and 2 parameters are needed. If model is Normal the prior on the mean is normal, and if it is heteroscedastic the prior on the inverse variance is Gamma, so that 4 parameters are needed. The first two are the mean hyperparameters, the last two are the variance's. If the user
does not give his own hyperparameters, the package uses the following default values:

For the Poisson model, Gamma(1,1) is used. For Negative Binomial model, Jeffreys’ prior, Beta(1/2,1/2) is used. For the Normal Homoscedastic, N(0,1) is used for a prior on the mean. Finally, for the Normal Heteroscedastic, the package computes the MAD on the data and fits an inverse-gamma distribution on the result. The parameters are used for the prior on the variance: IG(alpha,beta), and the prior on the mean is N(0,2*beta).

\[ \text{theta} \]

If model=3 (Negative binomial), the value of the inverse of the overdispersion parameter. If the user does not give his own hyperparameters, the package uses a modified version of Johnson and Kotz’s estimator where the mean is replaced by the median.

\[ \text{var} \]

If model=2 (Normal Homoscedastic), the value of the variance. If the user does not give his own hyperparameters, the package uses Hall’s estimator with \( d=4 \).

\[ \text{unif} \]

A boolean stating whether prior on segmentation is uniform given number of segments. If false, then the prior favors segmentation with segments of equal length, i.e. \( n_r \) is proportional to the inverse of segment length.

Details

This function is used to compute the matrix of segment probabilities assuming data is poisson, normal or negative binomial distributed. The probability of each interval being divided in \( k \) segments (\( k \) in \( 1 \) to \( K_{max} \)) is computed.

Value

An object of class "EBS".

\[ \text{model} \]

Emission distribution (Poisson, Normal Homoscedastic, Negative Binomial or Normal Heteroscedastic)

\[ \text{length} \]

the length of the data-set

\[ K_{max} \]

the maximum number of segments for the segmentation

\[ \text{HyperParameters} \]

The hyperparameters used for the prior on the data distribution

\[ \text{Li} \]

a matrix of size \( K_{max}*(\text{length}+1) \). Element \([i,j]\) is the log-probability of interval \([1,j]\) being segmented in \( i \) segments

\[ \text{Co1} \]

a matrix of size \((\text{length}+1)\times K_{max} \). Element \([i,j]\) is the log-probability of interval \([i,n]\) being segmented in \( j \) segments

\[ \text{matProba} \]

a matrix of size \((\text{length}+1)\times(\text{length}+1) \). Element \([i,j]\) is the log-probability of interval \([i,j]\)

Author(s)

Alice Cleynen
EBSICL

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems

Johnson, Kotz & Kemp: Univariate Discrete Distributions

Hall, Kay & Titterington: Asymptotically optimal difference-based estimation of variance in non-parametric regression

See Also

EBS-class, EBSDistrib, EBSProfiles

Examples

# changes for Poisson model
set.seed(1)
x <- c(rpois(125, 1), rpois(100, 5), rpois(50, 1), rpois(75, 5), rpois(50, 1))
out <- EBSegmentation(x, model=1, Kmax=20)

EBSICL

Model Selection by Integrated Completed Likelihood criterion

Description

Computes the exact ICL criterion: \(-\text{Loglikelihood (data,K)} + H(m|K)\) where \(H\) is the entropy of the segmentation, and chooses the optimal number of segments as \(k = \arg\min(I CL)\)

Usage

EBSICL(x, prior=numeric())

Arguments

x An object of class EBS returned by function EBSegmentation applied to data of interest.
prior A vector of length \(K\max\) giving prior probabilities on the value of \(K\). Default value is uniform on 1:Kmax.

Details

This function is used to compute the entropy of the segmentation in \(k\) segments (for \(k\) in 1 to \(K\max\)) and choose the optimal \(K\) according to the ICL criteria.

Value

NbICL An integer containing the choice of the optimal number of segments.
ICL Vector of length \(xK\max\) containing the ICL values.
EBSICLProfiles

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems

See Also

EBSegmentation, EBSBIC, EBSPostK

Examples

# changes for Poisson model
set.seed(1)
x<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
out <- EBSegmentation(x,model=1,Kmax=20)
bestK=EBSICL(out)$NbICL
print(bestK)

---

EBSICLProfiles  Model Selection by Integrated Completed Likelihood criterion

Description

For each profile, computes the exact ICL criterion: -Loglikelihood (data,K) + H(m|K) where H is the entropy of the segmentation, and chooses the optimal number of segments as k= argmin(ICL)

Usage

EBSICLProfiles(x, prior=numeric())

Arguments

x  An object of class EBSPofiles returned by function EBSProfiles applied to matrix of profiles of interest.

prior  A vector of length Kmax giving prior probabilities on the value of K. Default value is uniform on 1:Kmax.

Details

For each condition, this function is used to compute the entropy of the segmentation in k segments (for k in 1 to Kmax) and choose the optimal K according to the ICL criteria.
Value

- **NbICL**
  A vector containing the choice of the optimal number of segments for each profile.

- **ICL**
  A list of vector (one for each condition) of length getK(x)[l] containing the ICL values.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems

See Also

*EBSProfiles, EBSICL*

Examples

```r
# changes for Poisson model
set.seed(1)
x1<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
x2<-c(rpois(100,1),rpois(100,3),rpois(75,2),rpois(125,0.5))
M<-rbind(x1,x2)
E<-EBSProfiles(M, K=8)
out <- EBSICLProfiles(E)
print(out$NbICL)
```

---

**EBSPlotProba**  
*Plot distribution of changepoints of one profile*

Description

Given a profile and its number of segments, plots the posterior distribution of each of the change-points

Usage

`EBSPlotProba(x,K,data=FALSE, file=character(), type='pdf')`
Arguments

- **x** An object of class EBS returned by function EBSSegmentation applied to data of interest.
- **K** The number of segments of the segmentation for which the posterior distributions are wanted. Must have $2 < K < x$.
- **data** A logical vector. If TRUE, the data is plotted as well as the posterior distributions. By default, data=FALSE.
- **file** An object of type string. If filled, the plot is saved in a file which name is given by the file argument, and which type is given by argument type.
- **type** An object of type string. If file is filled, argument type determines the type of the file saved. Possible values are ‘pdf’, ‘png’ and ‘ps’. By default, ‘pdf’ is used.

Details

For a single profile, this function is used to plot the posterior distribution of all changepoints of a segmentation in K segments.

Value

A plot of the posterior distributions.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems

See Also

EBSSegmentation, EBSDistrib

Examples

```r
# changes for Poisson model
set.seed(1)
x <- c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
out <- EBSSegmentation(x,model=1,Kmax=20)
EBSPPlotProba(out,4)
EBSPPlotProba(out,4,data=TRUE,file="mysegmentation.png",type='png')
```
EBSPlotProbaProfiles  

Plot distribution of changepoints of each profile

Description

For the set of profiles and their number of segments, plots the posterior distribution of each of the change-points

Usage

EBSPlotProbaProfiles(x,K=numeric(),data=FALSE)

Arguments

x  
An object of class EBSProfiles returned by function EBSProfiles applied to the matrix of profiles of interest.

K  
The vector of number of segments of the segmentation for which the posterior distributions are wanted (one value for each profile). Must have 2<K[l]<getK(x)[l] for all profile l

data  
A logical vector. If TRUE, the data is plotted as well as the posterior distributions. By default, data=FALSE.

Details

This function is used to plot the posterior distribution of all changepoints of a segmentation in K[l] segments for all profiles l. Graph is subdivided into NbConditions plots, one for each profile.

Value

A plot of the posterior distributions, for each profile.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems

See Also

EBSegmentation, EBSPlotProba
Examples

# changes for Poisson model
set.seed(1)
x1<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
x2<-c(rpois(125,3),rpois(75,4),rpois(75,1),rpois(125,8))
M<-rbind(x1,x2)
E <- EBSProfiles(M,model=1,K=10)
EBSPlotProbaProfiles(E, K=c(5,4), data=TRUE)

Description

For a single profile, computes the posterior probabilities of the number of segments given its prior.

Usage

EBSPostK(x, prior=numeric())

Arguments

x
An object of class EBS returned by function EBSegmentation applied to data of interest.
prior
A vector of length Kmax giving prior probabilities on the value of K. Default value is uniform on 1:Kmax.

Details

This function computes the posterior probabilities of the number of segments, so that the user can use Bayesian Model Averaging.

Value

A vector of size Kmax containing the probability of each of the number of segments.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems

See Also

EBSegmentation, ESBIC, EBSICL
### Examples

```r
# changes for Poisson model
set.seed(1)
x <- c(rpois(125,1), rpois(100,5), rpois(50,1), rpois(75,5), rpois(50,1))
out <- EBSSegmentation(x, model=1, Kmax=20)
Posterior <- EBSPostK(out)
plot(Posterior, type='b')
```

### Description

Computes the matrix of indexes \( n_r \) (values associated to prior on segmentation) for each segment \( r \).

### Usage

```r
EBSPrior(n=numeric(), Kmax = 15, unif = TRUE)
```

### Arguments

- \( n \): The size of the series.
- \( Kmax \): The maximum number of segments that will be considered.
- \( unif \): A boolean stating whether the uniform prior will be used for the segmentation.

### Details

This function is used to compute the values associated with the prior on the segmentation to use in computations such as ICL.

### Value

An object of class EBS with values associated to prior on segmentation.

### Author(s)

Alice Cleynen

### References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems \textit{Arxiv:1004.4347}

### See Also

EBSSegmentation
**EBSPriorProfiles**

**Examples**

```r
ebspriorprofiles <- EBSPrior(1000, Kmax=20, unif=FALSE)
```

---

**Description**

Computes the matrix of indexes \(n_r\) (values associated to prior on segmentation) for each segment \(r\).

**Usage**

```r
EBSPriorProfiles(n=numeric(), K = 3, unif=TRUE)
```

**Arguments**

- `n` The size of the series.
- `K` A vector of size the number of series which elements are the maximum number of segments that will be considered for each profile.
- `unif` A boolean stating whether the uniform prior will be used for the segmentation.

**Details**

This function is used to compute the values associated with the prior on the segmentation to use in computations such as ICL.

**Value**

An object of class EBSProfiles with values associated to prior on segmentation.

**Author(s)**

Alice Cleynen

**References**

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Arxiv:1004.4347*

**See Also**

EBSProfiles, EBSPrior

**Examples**

```r
outPrior <- EBSPriorProfiles(1000, K=c(4,5), unif=FALSE)
```
**EBSProfiles**

**Exact Bayesian Segmentation for multiple profiles**

**Description**

For each profile i, calculates the bayesian probability of each segmentation in 1 to \( K[i] \) segments (assuming the data is poisson, normal or negative binomial distributed) and returns object of class EBSProfiles.

**Usage**

EBSProfiles(data=numeric(), model=1, \( K = 3 \), hyper = numeric(),

theta = numeric(), var = numeric(), homoscedastic = FALSE, unif= TRUE)

**Arguments**

data  
A matrix where each line contains the data of one profile within which you wish to find changepoints.

model  
Model under which each profile is assumed to be distributed. Possible values are 1 for Poisson, 2 for Normal Homoscedastic, 3 for Negative Binomial and 4 for Normal Heteroscedastic.

K  
A vector containing the maximum number of segments for the segmentation of each profile. Function will explore the set of all possible segmentations in \( k \) segments for \( k \) in 1 to \( K[i] \). If length(K)=1, the same value of \( K \) will be used for each profile.

hyper  
The set of hyper-parameters for the prior on the data-distribution. If model is Poisson the conjugate law is Gamma and 2 parameters are needed for each profile (ie vector of length 2*(number of profiles)). If model is Negative Binomial the conjugate is Beta and 2 parameters are needed for each profile (ie vector of length 2*(number of profiles)). If model is Normal the prior on the mean is normal, and if it is heteroscedastic the prior on the inverse variance is Gamma, so that 4 parameters are needed for each profile (ie vector of length 4*(number of profiles)). The first two are the mean hyperparameters, the last two are the variance’s. If the user does not give his own hyperparameters, the package uses the following default values:

For the Poisson model, Gamma(1,1) is used. For Negative Binomial model, Jeffreys’ prior, Beta(1/2,1/2) is used. For the Normal Homoscedastic, N(0,1) is used for a prior on the mean. Finally, for the Normal Heteroscedastic, the package computes the MAD on the data and fits an inverse-gamma distribution on the result. The parameters are used for the prior on the variance: IG(alpha,beta), and the prior on the mean is N(0,2*beta).

theta  
If model=3 (Negative binomial), the vector of values of the inverse of the overdispersion parameter for each profile. If the user does not give his own hyperparameters, the package uses a modified version of Johnson and Kotz’s estimator
where the mean is replaced by the median. If homoscedastic is TRUE, the median is taken over all profiles, else one value per profile is computed.

**var**

If model = 2 (Normal Homoscedastic), the vector of values of the variance. If the user does not give his own hyperparameters, the package uses Hall’s estimator with d=4. If homoscedastic is TRUE, the mean of the estimate over all profile is used, else one value per profile is computed.

**homoscedastic**

If model = 2 (Normal Homoscedastic) or model = 3, indicates whether the fixed parameter (variance or overdispersion) is common for all profiles or is profile-specific.

**unif**

A boolean stating whether prior on segmentation is uniform given number of segments. If false, then the prior favors segmentation with segments of equal length, i.e. \( n_r \) is proportional to the inverse of segment length.

### Details

This function is used to compute the matrix of segment probabilities assuming data is poisson, normal or negative binomial distributed. The probability of each interval being divided in \( k \) segments (\( k \) in 1 to \( K_{\text{max}} \)) is computed.

### Value

An object of class "EBSProfiles".

- **model**
  - Emission distribution (Poisson, Normal Homoscedastic, Negative Binomial or Normal Heteroscedastic)

- **length**
  - the length of each profile

- **nbconditions**
  - the number of profiles

- **K**
  - the maximum number of segments for the segmentation for each profile

- **HyperParameters**
  - The hyperparameters used for the prior on the data distribution for each profile

- **Variance**
  - the vector of variances if model is Normal Homoscedastic

- **overdispersion**
  - the vector of overdispersions if model is negative Binomial

- **Li**
  - a list (one element per profile) of matrix of size \( K_{\text{max}} \) \( *( \text{length}+1) \). Element \([i,j]\) is the log-probability of interval \([1,j] \) being segmented in \( j \) segments

- **Col**
  - a list (one element per profile) of matrix of size \( \text{length}+1 \) \( * K_{\text{max}} \). Element \([i,j]\) is the log-probability of interval \([i,n] \) being segmented in \( i \) segments

- **P**
  - a list (one element per profile) of matrix of size \( \text{length}+1 \) \( *( \text{length}+1) \). Element \([i,j]\) is the log-probability of interval \([i,j]\)

### Author(s)

Alice Cleynen
References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems \textit{Arxiv:1004.4347}

Johnson, Kotz & Kemp: Univariate Discrete Distributions

Hall, Kay & Titterington: Asymptotically optimal difference-based estimation of variance in non-parametric regression

See Also

\texttt{EBSegmentation}

Examples

```r
# changes for Poisson model
set.seed(1)
x1<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
x2<-c(rpois(125,3),rpois(75,4),rpois(75,1),rpois(125,8))
M<-rbind(x1,x2)
out <- EBSProfiles(M,model=1,K=10)
```

\textit{EBSProfiles-class} \hspace{1cm} \textit{Class "EBSProfiles"}

Description

A class for Bayesian Segmentation and comparison of multiple profiles.

Objects from the Class

Objects can be created by calls of the form \texttt{new("EBSProfiles", ...)}.

\texttt{new("EBSProfiles", ...)}: creates a new object with class \\
EBSProfiles

Slots

- \texttt{model}: Object of class "character", the assumed (identic) distribution class of each profile
- \texttt{data}: Object of class "numeric", the matrix of profiles (lines) to be segmented
- \texttt{length}: Object of class "numeric", the length of each profile
- \texttt{NbConditions}: Object of class "numeric", the number of profiles
- \texttt{K}: Object of class "numeric", the vector of maximum number of segments considered for each profile
- \texttt{HyperParameters}: Object of class "numeric", the vector of hyperparameters used for the prior distribution on the model parameters for each profile
- \texttt{Variance}: Object of class "numeric", if model = Normal Homoscedastic, the vector of variances used in the analysis
overdispersion: Object of class "numeric", if model = Negative Binomial, the vector of overdispersions used in the analysis.

Li: Object of class "numeric", a list of the matrix of each profile, of size \(K_{\text{max}} \times (\text{length}+1)\) where element \([i,j]\) is the log-probability of interval \([1,j]\) being segmented in \(j\) segments.

Col: Object of class "numeric", a list of the matrix of each profile, of size \((\text{length}+1) \times K_{\text{max}}\) where element \([i,j]\) is the log-probability of interval \([i,n]\) being segmented in \(i\) segments.

P: a list of the matrix of each profile, of size \((\text{length}+1) \times (\text{length}+1)\) where element \([i,j]\) is the log-probability of interval \([i,j]\).

unif: a boolean stating whether the prior on the segmentation is uniform given the number of segments.

Methods

Model signature(object = "EBSProfiles"): retrieves model slot.
Data signature(object = "EBSProfiles"): retrieves data slot.
Length signature(object = "EBSProfiles"): retrieves length slot.
NbConditions signature(object = "EBSProfiles"): retrieves NbConditions slot.
Kmax signature(object = "EBSProfiles"): retrieves K slot.
HyperParameters signature(object = "EBSProfiles"): retrieves HyperParameters slot.
Variance signature(object = "EBSProfiles"): retrieves Variance slot.
Overdispersion signature(object = "EBSProfiles"): retrieves overdispersion slot.
Li signature(object = "EBSProfiles"): retrieves Li slot.
Col signature(object = "EBSProfiles"): retrieves Col slot.
matProba signature(object = "EBSProfiles"): retrieves P slot.
Priorm signature(object = "EBSProfiles"): retrieves unif slot.

Author(s)

Alice Cleynen

See Also

EBSegmentation, EBSProfiles, Classes

Examples

```
showClass("EBS") # shows the structure of the cpt class

x1<-c(rpois(100,2),rpois(200,5))
x2<-c(rpois(100,3),rpois(150,8),rpois(50,2))
data<-rbind(x1,x2)
# creates a new EBSProfiles object containing the segmentation of
# profiles x1 and x2
E<-EBSProfiles(data,K=c(2,3))
class(E) # verifies the class of E
Model(E) # retrieves model of the segmentation
```
# retrieves the maximal number of segments considered for profile x1
Kmax(E[1])

<table>
<thead>
<tr>
<th>Statistic for Profile Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EBSStatistic</strong></td>
</tr>
</tbody>
</table>

## Description
Posterior probability of profiles having same change-point location

## Usage

\[
\text{EBSStatistic}(x, \text{Conditions} = \text{numeric}(), \text{Tau} = \text{numeric}(), \\
\text{K} = \text{numeric}(), p0=1/2)
\]

## Arguments

- **x**
  - An object of class EBSProfiles, outcome of function EBSProfiles applied to matrix of profiles of interest
- **Conditions**
  - A vector containing the set of index of profiles to compare using posterior probabilities.
- **Tau**
  - The vector of index of the change-point of interest for each profile. If field is left empty, default value is $1$ for all profiles. If only one value is entered, this value is used for all profiles.
- **K**
  - The vector of number of segments of the segmentation for each profile. If field is left empty, function calls EBSICLProfiles to choose value of K. If only one value is entered, this value is used for all profiles.
- **p0**
  - The prior probability of having same change-point. If field is left empty, default value is 1/2.

## Details
This function returns \(p(\mathcal{E}_0|Y, K)\) where:
- \(Y\) is the matrix of data: \(Y = (Y^1, \ldots, Y^I)\),
- \(m_l\) is the segmentation of profile \(l\),
- \(k_l\) is the index of the change-point of interest in profile \(l\), and \(\tau_{k_l}\) is the corresponding change-point,
- \(\mathcal{E}_0\) denotes the event \(\tau_{k_1} = \ldots = \tau_{k_I}\),
- \(q\) denotes the uniform prior on segmentation \(m\),
- \(p\) denotes a probability measure chosen by user for which:
- \(p_0 = p(\mathcal{E}_0|K)\)

Then the function returns

\[
S(Y) = \frac{p_0(1 - q_0)q(\mathcal{E}_0|Y, K))}{(1 - p_0)q_0q(Y|K) + (p_0 - q_0)q(\mathcal{E}_0|Y, K)}
\]
**Value**

The posterior probability of profiles having same change-point location (see details).

**Author(s)**

Alice Cleynen

**References**

- Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems
- Johnson, Kotz & Kemp: Univariate Discrete Distributions
- Hall, Kay & Titterington: Asymptotically optimal difference-based estimation of variance in non-parametric regression

**See Also**

- EBSProfiles-class, EBSProfiles, EBSSegmentation, EBSICLProfiles

**Examples**

```r
# Comparison of 3rd change-point of 2 profiles segmented in 5 and 4 segments with Poisson model
set.seed(1)
x1<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
x2<-c(rpois(100,1),rpois(100,3),rpois(75,2),rpois(125,0.5))
M<-rbind(x1,x2)
E<-EBSProfiles(M, K=8)
out <- EBSStatistic(E,Conditions=c(1,2),Tau=c(3,3),K=c(5,4))
```

---

**Description**

Generic function

**Usage**

```r
getCol(object)
```

**Arguments**

- `object` An object of class EBS

**Details**

Returns the slot Col of an object of class EBS
GetCondition

Value

A list where each element is a the Col matrix of size (n+1)*Kmax of a profile.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Col, getli

Examples

x = new("EBS") # new EBS object
getCol(x) # retrieves the Col slot from x

getCol-methods

Description

Retrieves the segmentation information of one particular profile out of the set given

Usage

GetCondition(x, Condition = numeric())

Arguments

x An object of class EBSProfiles
Condition the index of the profile of interest
getData

Details

This function is used to retrieve the segmentation information of a profile when a set of conditions have been analysed together.

Value

An object of class "EBS".

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems [Arxiv:1004.4347]
Johnson, Kotz & Kemp: Univariate Discrete Distributions
Hall, Kay & Titterington: Asymptotically optimal difference-based estimation of variance in non-parametric regression

See Also

EBS-class, EBSProfiles-class, EBSProfiles, EBSegmentation

Examples

# changes for Poisson model
set.seed(1)
x1<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
x2<-c(rpois(100,1),rpois(100,3),rpois(75,2),rpois(50,0.5),rpois(75,3))
M<-rbind(x1,x2)
E<-EBSProfiles(M)
C1 <- GetCondition(E,1)
Details

Returns the dataset used from an object of class EBS.

Value

A vector with the dataset of a profile analyzed.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Length

Examples

x=new("EBS") # new EBS object
getData(x) # retrieves the Data from x
getHyperParameters

Generic function

Description
Generic function

Usage
getHyperParameters(object)

Arguments
object An object of class EBS

Details
Returns the slot HyperParameters of an object of class EBSProfiles

Value
A vector of HyperParameters used for the analysis of the dataset.

Author(s)
Alice Cleynen

References
Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also
HyperParameters

Examples
x=new("EBS") # new EBS object
gETCHyperParameters(x) # retrieves the HyperParameters slot from x
getKmax

getHyperParameters-methods

~~ Methods for Function getHyperParameters ~~

Description

~~ Methods for function getHyperParameters ~~

Methods

signature(object = "EBS") Retrieves the hyperparameters used from an object of class EBS

getKmax

Generic function

Description

Generic function

Usage

getKmax(object)

Arguments

object An object of class EBS

Details

Returns the slot Kmax of an object of class EBS

Value

An integer of the maximum number of segments considered for the analysis of the dataset.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Kmax
**Examples**

```r
x = new("EBS")  # new EBS object
getKmax(x) # retrieves the Kmax slot from x
```

**Description**

Methods for function `getKmax`

**Methods**

- `signature(object = "EBS")` Retrieves maximum number of segments considered from an object of class EBS

**getLength**

Generic function

**Description**

Generic function

**Usage**

```r
getLength(object)
```

**Arguments**

- `object` An object of class EBS

**Details**

Returns the length of the dataset used from an object of class EBS

**Value**

An integer with size of a profile.

**Author(s)**

Alice Cleynen

**References**

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Arxiv:1004.4347*
**getLi**

**See Also**

Length

**Examples**

```r
x = new("EBS")  # new EBS object
getLength(x)  # retrieves the length of data from x
```

---

**Description**

```
Methods for function getLength ~~
```

**Methods**

```
signature(object = "EBS")  # Retreives length of data from an object of class EBS
```

---

**getLi**

**Generic function**

**Description**

Generic function

**Usage**

```
getLi(object)
```

**Arguments**

```
object  # An object of class EBS
```

**Details**

```
Returns the slot Li of an object of class EBS
```

**Value**

```
A list where each element is the Li matrix of size Kmax*(n+1) of a profile
```

**Author(s)**

Alice Cleynen
References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems arxiv:1004.4347

See Also

gCol, Li

Examples

x = new("EBS") # new EBS object
gLi(x) # retrieves the Li slot from x

getLi-methods

Description

Methods for function getLi

Methods

signature(object = "EBS") Retrieves slot Li from an object of class EBS

getModel

Generic function

Description

Generic function

Usage

gModel(object)

Arguments

object An object of class EBS

Details

Returns the slot Model of an object of class EBS

Value

An object of class string returning the model used for the analysis of the dataset.
Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Model

Examples

x=new("EBS") # new EBS object
getModel(x) # retrieves the Model slot from x

getModel-methods ~ Methods for Function getModel ~

Description

~ Methods for function getModel ~

Methods

signature(object = "EBS") Retrives model used from an object of class EBS

getOverdispersion Generic function

Description

Generic function

Usage

getOverdispersion(object)

Arguments

object An object of class EBS

Details

Returns the slot Overdispersion of an object of class EBS
Value
If model is Negative Binomial, the value of the overdispersion used for the analysis.

Author(s)
Alice Cleynen

References
Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also
Overdispersion

Examples
x$newHBebsBI C new ebs object
getOverdispersion(x) # retrieves the P slot from x

getoverdispersion-methods

Description
~~ Methods for function getOverdispersion ~~

Methods

signature(object = "EBS") Retrieves estimate value of overdispersion used from an object of class EBS

getP

Generic function

Description
Generic function

Usage
getP(object)
Arguments

object An object of class EBS

Details

Returns the slot P of an object of class EBS

Value

A list of the matrix P of each profiles.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

matProba

Examples

x=new("EBS") # new EBS object
gP(x) # retrieves the P slot from x
getPriorm

Generic function

Description

Generic function

Usage

getPriorm(object)

Arguments

object  An object of class EBS

Details

Returns the slot unif of an object of class EBS

Value

A boolean stating whether prior on segmentation is uniform.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Col.getLi

Examples

x=new("EBS") # new EBS object
getiorm(x) # retrieves the unif slot from x
getPriorm-methods

~~ Methods for Function getPriorm ~~

Description

~~ Methods for function getPriorm ~~

Methods

signature(object = "EBS") Retreives slot unif from an object of class EBS

getVariance

Generic function

Description

Generic function

Usage

getVariance(object)

Arguments

object An object of class EBS

Details

Returns the slot Variance of an object of class EBS

Value

If model is Gaussian homoscedastic, the value of the variance used for the analysis.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Variance
getVariance-methods

Examples

x = new("EBS")  # new EBS object
getVariance(x) # retrieves the Variance slot from x

Description

~ Methods for function getVariance ~~

Methods

signature(object = "EBS")  Retrieves estimate value of variance used from an object of class EBS

HyperParameters  Generic function

Description

Generic function

Usage

HyperParameters(object)

Arguments

object  An object of class EBSProfiles

Details

Returns the slot HyperParameters of an object of class EBSProfiles

Value

A vector of HyperParameters used for each profile

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347
See Also

getHyperParameters

Examples

x = new("EBSProfiles")  # new EBSProfiles object
HyperParameters(x)  # retrieves the HyperParameters slot from x

HyperParameters-methods

~ ~ Methods for Function HyperParameters ~ ~

Description

~~ Methods for function HyperParameters ~~

Methods

signature(object = "EBSProfiles")  # Retrieves hyperparameters used from an object of class EBSProfiles

Kmax  Generic function

Description

Generic function

Usage

Kmax(object)

Arguments

object  An object of class EBSProfiles

Details

Returns the slot K of an object of class EBSProfiles

Value

An integer of the maximum number of segments considered for the analysis of the dataset.
**Kmax-methods**

**Author(s)**
Alice Cleynen

**References**
Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Arxiv:1004.4347*

**See Also**
getKmax

**Examples**
```r
x = new("EBSProfiles") # new EBSProfiles object
Kmax(x) # retrieves the Kmax slot from x
```

---

**Description**
~~ Methods for function Kmax ~~

**Methods**

signature(object = "EBSProfiles") Retreives slot K from an object of class EBSProfiles

**Length**

*Generic function*

**Description**

Generic function

**Usage**

Length(object)

**Arguments**

object An object of class EBSProfiles

**Details**

Returns the length of the dataset used from an object of class EBSProfiles
Value
An integer with size of data used.

Author(s)
Alice Cleynen

References
Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also
gedata

Examples
x = new("EBSProfiles") # new EBSProfiles object
Length(x) # retrieves the length of data from x

~~ Methods for Function Length ~~

Description
~ Methods for function Length ~

Methods
signature(object = "EBSProfiles") Retrieves length of the signal from an object of class EBSProfiles

Li

Generic function

Description
Generic function

Usage
Li(object)

Arguments
object An object of class EBSProfiles
Details

Returns the slot Li of an object of class EBSProfiles

Value

A matrix of size Kmax*(n+1)

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Col

Examples

x=new("EBSProfiles") # new EBSProfiles object
Li(x) # retrieves the Li slot from x
**matProba**

*Generic function*

**Description**

Generic function

**Usage**

```r
matProba(object)
```

**Arguments**

- `object` An object of class `EBSProfiles`

**Details**

Returns the slot `P` of an object of class `EBSProfiles`

**Value**

A matrix of size `(n+1)*(n+1)` containing segment probabilities.

**Author(s)**

Alice Cleynen

**References**

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems [Arxiv:1004.4347](https://arxiv.org/abs/1004.4347)

**See Also**

`getP`

**Examples**

```r
x = new("EBSProfiles") # new EBSProfiles object
matProba(x) # retrieves the P slot from x
```
Description

~~ Methods for function matProba ~~

Methods

signature(object = "EBSProfiles") Retrieves the generic matrix of segment probabilities from an object of class EBSProfiles

Model

Generic function

Description

Generic function

Usage

Model(object)

Arguments

object An object of class EBSProfiles

Details

Returns the slot Model of an object of class EBSProfiles

Value

An object of class string returning the model used for the analysis of the datasets.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

ggetModel
Examples

```r
x = new("EBSProfiles")  # new EBSProfiles object
Model(x)  # retrieves the Model slot from x
```

Description

~~ Methods for Function `Model` ~~

Methods

```r
signature(object = "EBSProfiles")  # Retrieves model used from an object of class EBSProfiles
```

```
---
```

```
```

Description

Generic function

Usage

`NbConditions(object)`

Arguments

`object`  An object of class EBSProfiles

Details

Returns the number of profiles analyzed from an object of class EBSProfiles

Value

An integer with the number of profiles.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347
See Also

getLength

Examples

x = new("EBSProfiles") # new EBSProfiles object
NbConditions(x) # retrieves the number of profiles from x
References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems [Arxiv:1004.4347]

See Also

getOverdispersion

Examples

```r
x <- new("EBSProfiles") # new EBSProfiles object
Overdispersion(x) # retrieves the P slot from x
```

---

Description

~~ Methods for function Overdispersion ~~

Methods

signature(object = "EBSProfiles") Retreives slot Overdispersion from an object of class EBSProfiles

---

PriorDistrib

Prior distribution of change-point when uniform prior on segmentation

Description

Computes the prior distribution of a given change-point when using a uniform prior on segmentation with known K

Usage

```r
PriorDistrib(n, k, K)
```

Arguments

- `n`: Integer giving length of dataset.
- `k`: Integer of index of given change-point.
- `K`: Integer giving number of segments in segmentation.
**Details**

This function is used to compare prior and posterior change-point distributions.

**Value**

A vector of length n with the change-point distribution.

**Author(s)**

Alice Cleynen

**References**

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems [Arxiv:1004.4347](https://arxiv.org/abs/1004.4347)

**See Also**

EBSegmentation

**Examples**

```r
# changes for Poisson model
set.seed(1)
x<-c(rpois(125,1),rpois(100,5),rpois(50,1),rpois(75,5),rpois(50,1))
y=priorm(length(x),1,5)
plot(y,type='l')
```

---

**Description**

Generic function

**Usage**

```r
priorm(object)
```

**Arguments**

- `object`: An object of class EBSProfiles

**Details**

Returns the slot `unif` of an object of class EBSProfiles
Value

A boolean stating whether prior on segmentation is uniform.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also

Col.getLi

Examples

x=new("EBSProfiles") # new EBSProfiles object
Priorm(x) # retrieves the unif slot from x

---

priorm-methods 

~~ Methods for Function Priorm ~~

Description

~~ Methods for function Priorm ~~

Methods

signature(object = "EBSProfiles") Retreives slot unif from an object of class EBSProfiles

---

show-methods 

~~ Methods for Function show in Package methods ~~

Description

~~ Methods for function show in package methods ~~
Methods

signature(object = "ANY")
signature(object = "classGeneratorFunction")
signature(object = "classRepresentation")
signature(object = "EBS")
signature(object = "EBSProfiles")
signature(object = "envRefClass")
signature(object = "genericFunction")
signature(object = "genericFunctionWithTrace")
signature(object = "MethodDefinition")
signature(object = "MethodDefinitionWithTrace")
signature(object = "MethodSelectionReport")
signature(object = "MethodWithNext")
signature(object = "MethodWithNextWithTrace")
signature(object = "namedList")
signature(object = "ObjectsWithPackage")
signature(object = "oldClass")
signature(object = "refClassRepresentation")
signature(object = "refMethodDef")
signature(object = "refObjectGenerator")
signature(object = "signature")
signature(object = "sourceEnvironment")
signature(object = "traceable")

---

TruncPois

Truncated Poisson distribution

Description

Given a parameter lambda and a number Kmax, computes the distribution of the truncated Poisson(lambda) up to Kmax.

Usage

TruncPois(lambda,Kmax)

Arguments

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lambda</td>
<td>Value of the Poisson parameter wanted</td>
</tr>
<tr>
<td>Kmax</td>
<td>Maximum number of segments considered</td>
</tr>
</tbody>
</table>
Details
Given a parameter lambda and a number Kmax, computes the distribution of the truncated Poisson(lambda) up to Kmax.

Value
A vector of probabilities of size Kmax with truncated poisson probability.

Author(s)
Alice Cleynen

References
Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also
EBSPostK

Examples
# truncated Poisson with parameter 3.5 and Kmax=20
priorK<-TruncPois(3.5,20)

<table>
<thead>
<tr>
<th>Variance</th>
<th>Generic function</th>
</tr>
</thead>
</table>

Description
Generic function

Usage
Variance(object)

Arguments

<table>
<thead>
<tr>
<th>object</th>
<th>An object of class EBSProfiles</th>
</tr>
</thead>
</table>

Details
Returns the slot Variance of an object of class EBSProfiles

Value
If model is Gaussian homoscedastic, the value of the variance used for each profile in the analysis.
Author(s)
Alice Cleynen

References
Rigaill, Lebarbier & Robin: Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Arxiv:1004.4347

See Also
Variance

Examples
x = new("EBSProfiles") # new EBSProfiles object
Variance(x) # retrieves the Variance slot from x

Description
~~ Methods for function Variance ~~

Methods
signature(object = "EBSProfiles") Retreives slot Variance from an object of class EBSProfiles
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