Package ‘EBS’

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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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing
Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

Johnson, Kotz & Kemp: Univariate Discrete Distributions

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

**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 <- EBSegmentation(x,Kmax=20)
bic <- EBSBIC(out)
print(bic$NbBIC)
icl <- EBSICL(out)
print(icl$NbICL)
plot(bic$BIC,type='b',pch=1,col='blue',ylim=c(0,1000))
lines(icl$ICL,type='b',pch=2,col='red')
EBSPlotProba(out,icl$NbICL, 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 complementaty.
CardE0  

*Prior probability of E0*

**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 K[i] segments.

**Value**

A numeric object giving the prior probability of E0.

**Author(s)**

Alice Cleynen

**References**

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

**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

Description

Number of all possible segmentations in K segments

Usage

CardMK(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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

See Also

PriorDistrib

Examples

# number of partitions of (1, 100) in 5 segments:
n<-100
K<-5
CardMK(n,K)
**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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

**See Also**

Li

**Examples**

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

---

**Methods**

Methods for function `col`:

- `signature(object = "EBSProfiles")` retrieves the `Col` slot of an object of class `EBSProfiles`.

---

**CompCredibility**

Comparison of two profiles with credibility intervals

---

**Description**

Given two conditions, computes the posterior distribution of the difference of change-point locations, and its credibility interval.

**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.
Data

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Johnson, Kotz & Kemp: Univariate Discrete Distributions

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

See Also

EBSProfiles, EBSStatistic

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)
out<-CompCredibility(E, Conditions=c(1,2), Tau=c(1,1), K=c(5,4))

---

Data

Generic function

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

See Also
   Length, NbConditions

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

---

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
data 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
getPriorm 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

Description

Computes the exact BIC criterion: -Loglikelihood (data,K) and chooses the optimal number of segments as $k = \arg\min(BIC)$

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing
See Also

EBSegmentation, EBSICL, 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)
bestKBIC=EBSBIC(out)$NbBIC
print(bestKBIC)

EBSDistrib(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
References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

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='1')

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 change-points.
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).

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.

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.

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 Kmax) is computed.

Value
An object of class "EBS".

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

length
the length of the data-set

Kmax
the maximum number of segments for the segmentation

HyperParameters
The hyperparameters used for the prior on the data distribution

Li
a matrix of size Kmax*(length+1). Element [i,j] is the log-probability of interval [1,j] being segmented in i segments

Co1
a matrix of size (length+1)*Kmax. 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)1. Element [i,j] is the log-probability of interval [i,j]

Author(s)

Alice Cleynen
References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

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

```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 <- EBSegmentation(x, model=1, Kmax=20)
```

---

**EBSICL**

*Model Selection by Integrated Completed Likelihood criterion*

Description

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

```
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 Kmax 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 Kmax) 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 x$Kmax containing the ICL values.
EBSICLProfiles

Author(s)
Alice Cleynen

References
Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

See Also
EBSegmentation, EBSBIC, EBSPostK

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 <- 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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

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 changepoints

Usage

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

x  An object of class EBS returned by function EBSegmentation 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$K_{\text{max}}$

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing

See Also

EBSegmentation, EBSDistrib

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)
EBSPlotProba(out,4)
EBSPlotProba(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 $2<K[I]<getK(x)[I]$ for all profile I.
- **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 $K[I]$ segments for all profiles I. 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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

**See Also**

`EBSegmentation, EBSPlotProba`
**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)
E <- EBSProfiles(M, model=1, K=10)
EBSPlotProbaProfiles(E, K=c(5, 4), data=TRUE)
```

---

**EBSPostK**

*Posterior probabilities of the number of segments*

**Description**

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

**Usage**

```r
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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*
See Also

EBSegmentation, EBSIC, EBSICL

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 <- EBSsegmentation(x,model=1,Kmax=20)
posterior<-EBSPostK(out)
plot(Posterior, type='b')

---

**EBSPrior**

*Matrix of prior values for each interval*

**Description**

Computes the matrix of indexes nr (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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*
Description

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

Usage

\[
ebspriorprofilesHn=numeric(), K = 3, unif=TRUE\]

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 \( \text{EBSProfiles} \) with values associated to prior on segmentation.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*
See Also

EBSProfiles, EBSPrior

Examples

outPrior <- EBSPriorProfiles(1000, K=c(4, 5), unif=FALSE)

---

EBSProfiles

Exact Bayesian Segmentation for multiple profiles

Description

For each profile, 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, 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 Kmax) 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 Kmax*(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 (length+1)*Kmax. 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 (length+1)*(length+1). Element [i,j] is the log-probability of interval [i,j]
Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing

Johnson, Kotz & Kemp: Univariate Discrete Distributions

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

See Also

EBSegmentation

Examples

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

Description

A class for Bayesian Segmentation and comparison of multiple profiles.

Objects from the Class

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

new("EBSProfiles", ...) : creates a new object with class EBSProfiles

Slots

model: Object of class "character", the assumed (identic) distribution class of each profile
data: Object of class "numeric", the matrix of profiles (lines) to be segmented
length: Object of class "numeric", the length of each profile
NbConditions: Object of class "numeric", the number of profiles
EBSProfiles-class

K: Object of class "numeric", the vector of maximum number of segments considered for each profile

HyperParameters: Object of class "numeric", the vector of hyperparameters used for the prior distribution on the model parameters for each profile

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 Kmax*(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 (length+1)*Kmax 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 (length+1)*(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]

---

EBSStatistic

Statistic for Profile Comparison

Description

Posterior probability of profiles having same change-point location

Usage

EBSStatistic(x, Conditions = numeric(), Tau = numeric(),
K = 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 prob-
abilities.
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 $\tau_{k_1} = \ldots = \tau_{k_L}$,
- $q$ 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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

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, EBSegmentation, 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))
```
getCol

Generic function

Description

Generic function

Usage

getc\(\text{ol}(\text{object})\)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>object</td>
<td>An object of class EBS</td>
</tr>
</tbody>
</table>

Details

Returns the slot Col of an object of class EBS

Value

A list where each element is a the Col matrix of size \((n+1)*K_{\text{max}}\) of a profile.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

Col, getLi

Examples

```
x = new("EBS") # new EBS object
getc\(\text{ol}(x)\) # retrieves the Col slot from x
```
getCol-methods

Methods for Function getCol

Description

Retrieves slot Col from an object of class EBS

Methods

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

GetCondition

Segmentation information for one profile out of the set

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

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
getData

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing

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,EBSsegmentation

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)

###

**getData**  
*Generic function*

Description

Generic function

Usage

getData(object)

Arguments

object An object of class EBS

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

See Also
Length

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

Methods
signature(object = "EBS") Retrieves data from an object of class EBS

getHyperParameters

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

**See Also**

HyperParameters

**Examples**

```r
x = new("EBS")  # new EBS object
getHyperParameters(x)  # retrieves the HyperParameters slot from x
```

---

**Description**

~~ Methods for function getHyperParameters ~~

**Methods**

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

---

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

Kmax

Examples

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

Methods

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

getLength

Generic function

Description

Generic function

Usage

gETCHLength(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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing
getLength-methods

See Also

Length

Examples

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

getLength-methods ~ Methods for Function getLength ~~

Description

~~ Methods for function getLength ~~

Methods

signature(object = "EBS") Retrieves length of data from an object of class EBS

getLi ~ Generic function

Description

Generic function

Usage

geti(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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

getCol, li

Examples

```r
x = new("EBS") # new EBS object
getLi(x) # retrieves the li slot from x
```

getLi-methods

```
Methods

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

getModel

```
Generic function
```

Description

Generic function

Usage

```r
getModel(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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing

See Also

Model

Examples

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

```
getMethod <- function(x) getMethod(x)
```

Description

```
Methods for function getModel
```

Methods

```
signature(object = "EBS") Retrieves model used from an object of class EBS
```
getOverdispersion

**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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

**See Also**

Overdispersion

**Examples**

```r
x = new("EBS") # new EBS object
getOverdispersion(x) # retrieves the P slot from x
```
getOverdispersion-methods

Methods for Function getOverdispersion ~~

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing
Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing
**getPreior**

**See Also**
- *matProba*

**Examples**

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

---

**Description**

~~ Methods for function getp ~~

**Methods**

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

---

**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
getPrior-methods

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*
Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

Col.getLi

Examples

```r
x = new("EBS") # new EBS object
getPrior(x) # retrieves the unif slot from x
```

Description

~~ Methods for Function getPrior ~~

Methods

signature(object = "EBS") Retrieves 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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

Variance

Examples

```r
x <- new("EBS") # new EBS object
getVariance(x) # retrieves the Variance slot from x
```

Description

~~ Methods for function getVariance ~~

Methods

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

| 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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing

Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing

See Also

getHyperParameters

Examples

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

Methods

signature(object = "EBSProfiles") Retreives 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.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing
Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing
Kmax-methods

See Also
getKmax

Examples

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

`getdata`

Examples

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

---

```r
## 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

```r
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 $K_{\text{max}} \times (n+1)$

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

Col

Examples

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

Description

~~ Methods for function Li ~~

Methods

signature(object = "EBSProfiles") Retrieves the matrix Li from an object of class EBSProfiles
matProba

Generic function

Description

Generic function

Usage

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing
Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing

See Also

getP

Examples

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*
See Also

getModel

Examples

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

Description

~~ Methods for function Model ~~

Methods

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

~~ Methods for Function NbConditions ~~

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

`getLength`

Examples

```r
x <- new("EBSProfiles") # new EBSProfiles object
NbConditions(x) # retrieves the number of profiles from x
```

---

**Description**

~~ Methods for function NbConditions in package **EBS** ~~

**Methods**

```r
signature(object = "EBSProfiles")
```

**Overdispersion**

*Generic function*

**Description**

Generic function

**Usage**

```r
Overdispersion(object)
```

**Arguments**

```r
object An object of class EBSProfiles
```

**Details**

Returns the slot Overdispersion of an object of class EBSProfiles
Value

If model is Negative Binomial, the value of the overdispersion used for each profile in the analysis.

Author(s)

Alice Cleynen

References

Rigaill, Lebarbier & Robin (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

getOverdispersion

Examples

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

---

Overdispersion-methods

~~ Methods for Function Overdispersion ~~

Description

~~ Methods for function Overdispersion ~~

Methods

```r
signature(object = "EBSProfiles") # Retrieves 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**

`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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

**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=PriorDistrib(length(x),1,5)
plot(y,type='l')
```
Prior

Generic function

Description

Generic function

Usage

Prior(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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems Statistics and Computing
Cleynen & Robin (2014): Comparing change-point location in independent series Statistics and Computing

See Also

Col.getLi

Examples

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

~~ Methods for function Priorm ~~

Methods

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

show-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 = "MethodImplNext")
signature(object = "MethodImplNextWithTrace")
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")
Description

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

Usage

\text{TruncPois}(\lambda, K_{\text{max}})

Arguments

\begin{itemize}
  \item \text{lambda} : Value of the Poisson parameter wanted
  \item \text{Kmax} : Maximum number of segments considered
\end{itemize}

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems \textit{Statistics and Computing}

Cleynen & Robin (2014): Comparing change-point location in independent series \textit{Statistics and Computing}

See Also

\text{EBSPostK}

Examples

\begin{verbatim}
  # truncated Poisson with parameter 3.5 and Kmax=20
  priorK<-TruncPois(3.5,20)
\end{verbatim}
Description

Generic function

Usage

Variance(object)

Arguments

object An object of class EBSProfiles

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 (2012): Exact posterior distributions over the segmentation space and model selection for multiple change-point detection problems *Statistics and Computing*

Cleynen & Robin (2014): Comparing change-point location in independent series *Statistics and Computing*

See Also

Variance

Examples

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

Description

--- Methods for function Variance ---

Methods

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