Package ‘ExcessMass’

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Type Package
Title Excess Mass Calculation and Plots
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Author Marc-Daniel Mildenberger
Maintainer Marc-Daniel Mildenberger <mildenberger.stat@web.de>
Description Implementation of a function which calculates the empirical excess mass for given \lambda and given maximal number of modes (excessm()). Offering powerful plot features to visualize empirical excess mass (exmplot()). This includes the possibility of drawing several plots (with different maximal number of modes / cut off values) in a single graph.
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### excessm

**Excess Mass Function**

**Description**

Algorithm which calculates the empirical excess mass for a given \( \lambda \) and given maximal number of modes.

**Usage**

```r
excessm(x, lambda, M = 1, UptToM = FALSE)
```

**Arguments**

- `x`: data in form of a vector
- `lambda`: \( \lambda \) of interest
- `M`: maximal number of modes
- `UptToM`: if true, the intervals for modes up to \( M \) are returned

**Value**

<table>
<thead>
<tr>
<th>intervals</th>
<th>Matrix containing the empirical ( \lambda )-clusters. Line ( i ) consists of information about the ( i.-\lambda )-cluster, where ( i \leq M ). First (Second) column contains the corresponding starting (ending) sorted observation index. Third (Fourth) column the starting (ending) value. In case UpToM is true and ( M &gt; 1 ), a list is returned with the intervals for all modes ( \leq M )</th>
</tr>
</thead>
<tbody>
<tr>
<td>excess_mass</td>
<td>returns a vector with excess masses, the ( i ). entry is the excess mass achieved with ( i ) modes</td>
</tr>
</tbody>
</table>

**Note**

Please note that an allowance for \( M \) modes does not necessarily result in \( M \) \( \lambda \)-clusters. Hence, the number of intervals returned can be smaller than \( M \). In this case a warning will be displayed. The vector `excess_mass` does have less than \( M \) entries.

**Author(s)**

Marc-Daniel Mildenberger `<mildenberger.stat@web.de>`, based on earlier code from Dr. Guenther Sawitzki `<gs@statlab.uni-heidelberg.de>`

**References**

Excess Mass Calculation and Plots

Description

Implementation of a function which calculates the empirical excess mass for a given \( \lambda \) and given maximal number of modes (excessm). Offering powerful plot features to visualize empirical excess mass (exmsilhouette). This includes the possibility of drawing several plots (with different maximal number of modes / cut off values) in a single graph. Furthermore, plotting the empirical excess mass against lambda is implemented (exmplot).

Details

Package: ExcessMass
Type: Package
Version: 1.0
Date: 2014-01-10
License: GPL

Author(s)

Marc-Daniel Mildenberger <mildenberger.stat@web.de>, based on earlier code from Dr. Guenther Sawitzki <gs@statlab.uni-heidelberg.de>

References

**Examples**

```r
library(MASS)
attach(geyser)
excessm(duration, lambda=0.2)

x <- rnorm(1000)
exmsilhouette(x, M=2, Cutoff=0.5)
mexmsilhouette(duration, Cutoff=c(1,2), steps=60)
```

---

**Description**

Produces an excess mass lambda plot and calculates the maximal excess mass difference achieved by allowing for an additional mode.

**Usage**

`exmplot(xdata, M=1, Cutoff=1, steps=50, Lambda=NULL)`

**Arguments**

- `xdata`: data in form of a vector
- `M`: the maximal number of modes
- `Cutoff`: determines the cut off value and hence the level up to which the λs are calculated
- `steps`: number of different λs which are calculated / drawn
- `Lambda`: allows specifying an own vector of λs

**Details**

`Cutoff` should not be set too small or too large, as this results in meaningless graphs. The excess mass for several λs can be calculated by specifying the Lambda.

**Value**

An Excess Mass Lambda plot is produced. The lines in the plot are sorted by the maximal number of modes from left to right, due to the monotonicity of the excess mass in M.

- `max_dist`: The i. entry is the maximal distance of the excess mass by allowing for up to i+1 instead of i modes
- `max_dist_Lambda`: Shows the λ at which the maximal excess mass difference is achieved
**exmsilhouette**

**(Single) Excess Mass Silhouette**

**Description**

Produces an excess mass plot and the corresponding numerical values if required.

**Usage**

```r
exmsilhouette(xdata, M = 1, CutOff = 1, steps = 50, rug = TRUE,
                Lambda = NULL, col = FALSE, rdata = FALSE, label = TRUE)
```

**Arguments**

- `xdata`: data in form of vector
- `M`: the maximal number of modes
- `CutOff`: determines the cut off value and hence the appearance of the graph
steps  number of different \( \lambda \)s which are calculated / drawn

rug  draws a rug plot at the bottom of the graph

Lambda  allows to specify an own vector of \( \lambda \)s which are drawn in the graph

col  lines get colored in purple \((em > 0.75)\), green \((0.75 \geq em > 0.5)\), turquoise \((0.5 \geq em > 0.25)\), blue \((0.25 \geq em > 0.05)\) and black \((0.05 \geq em)\)

rdata  a numerical output is returned

label  allows to reduce labeling

Details

CutOff should not be set too small or too large, as this results in meaningless graphs. The excess mass for several \( \lambda \)s can be calculated by specifying the Lambda.

Value

A plot is always produced. By setting \( rdata = TRUE \) numerical results are returned in form of a two-dimensional list. The first argument specifies \( \lambda \). This means that if \( \text{steps} = 50 \) with \( 1 (50) \) you get access to the numerical results for the smallest (largest) \( \lambda \).

In case no Lambda vector is used for each \( \lambda \), the following information is displayed:

\[
\begin{align*}
[1, 1] & \quad \text{value of } \lambda, \\
[1, 2] & \quad \text{calculated } \lambda\text{-clusters} \\
[1, 3] & \quad \text{excess mass vector}
\end{align*}
\]

The last two components are presented in the way known from the excess mass function. In case Lambda was set manually the value of \( \lambda \) is not returned, as it is known.

Author(s)

Marc-Daniel Mildenberger <mildenberger.stat@web.de>, based on earlier code from Dr. Guenther Sawitzki <gs@statlab.uni-heidelberg.de>

References


See Also

excessm, mexmsilhouette, exmplot
mexmsilhouette  

Examples

```r
library(MASS)
attach(geyser)

# Plot allowing for up to two modes and reduced CutOff value
exmsilhouette(duration, M=2, CutOff=1.25)

# Plot with twice the default number of steps, omitting rug plot, colorizing the graph and asking for numerical output
res <- exmsilhouette(duration, M=2, CutOff=1.25, steps=100, rug=FALSE, col=TRUE, rdata=TRUE)

# Specifying Lambda and requesting numerical output
L=seq(0.01,0.25,0.005)
res <- exmsilhouette(duration, M=3, Lambda=L, col=TRUE, rdata=TRUE)
```

---

mexmsilhouette  

*(Multiple) Excess Mass Silhouette*

Description

Produces a graph with several excess mass plots allowing for different maximal numbers of modes/cut off values.

Usage

```r
mexmsilhouette(xdata, M = 1:3, CutOff = c(1,2,5), steps = 30,
Lambda = NULL, col = FALSE, rug = TRUE, rdata = FALSE)
```

Arguments

- **xdata**: data in form of a vector
- **M**: vector containing the max. number of modes
- **CutOff**: vector which determines the cut off values and hence the appearance of the graph
- **steps**: number of different \( \lambda \)s which are calculated/drawn
- **Lambda**: allows to specify an own vector of \( \lambda \)s which is drawn in the graph
- **col**: lines get colored in purple \((em > 0.75)\), green \((0.75 \geq em > 0.5)\), turquoise \((0.5 \geq em > 0.25)\), blue \((0.25 \geq em > 0.05)\) and black \((0.05 \geq em)\)
- **rug**: draws a rug plot at the bottom of the graph
- **rdata**: a numerical output is returned

Details

*CutOff* should not be set too small or too large, as this results in meaningless graphs.
Value

Always a graph with multiple plots is produced. Each column contains another maximal number of modes and each row another CutOff factor.

Setting rdata=TRUE numerical results are returned in form of a list. If the number of modes and the CutOff parameter contain just one element, the output of "mexmsilhouette" and "exmplot" are equal.

Otherwise we can distinguish between two cases. First Lambda is not specified, hence the list is four-dimensional. The first element determines the CutOff value of the data by using the sorted CutOff vector (using the plot, this means the row in which the graph is shown). The second element specifies the maximal number of modes by using the sorted mode vector (again using the plot, this means the column of the plot). The third element selects the \( \lambda \) of the graph. For each plot and each \( \lambda \), the following information is stored: the value of \( \lambda \), the \( \lambda \)-clusters and the excess mass vector. Using the default setting \([2, 2, 5, 2]\) shows the \( \lambda \)-clusters of the fifth smallest \( \lambda \) of the \( \text{CutOff} = 2 - M = 2 \)-plot.

If Lambda is declared manually, the list is three-dimensional. Hence, the first argument denotes the maximal number of modes (the column of the graph). The second argument indicates the \( \lambda \) by the position held by it in the Lambda vector. As in "exmplot" only two information are shown. The \( \lambda \)-clusters ([,1]) and the vector of excess mass ([,2]), as the value of \( \lambda \) is known.

Author(s)

Marc-Daniel Mildenberger <mildenberger.stat@web.de>, based on earlier code from Dr. Guenther Sawitzki <gs@statlab.uni-heidelberg.de>

References


See Also

excessm, exmplot, exmsilhouette

Examples

```r
library(MASS)
attach(geyser)

#calculating excess mass plots for duration of 'Old Faithful Geyser',
#specifying CutOff and number of steps manually
mexmsilhouette(duration, CutOff=c(1,2), steps=60)

#Allowing for three different maximal number of modes
#and CutOff factors as well as color.
#The rug plot is omitted and numerical data is requested.
res=mexmsilhouette(duration, M=c(2,3,7), CutOff=c(0.8,1,2), col=TRUE, rug=FALSE, rdata=TRUE)

#Lambda is specified, color is set to true, numerical data is requested
```
searchMaxLambda

L=seq(.01,.25,.005)
res=mexmsilhouette(duration, M=c(2,3,4), Lambda=L, col=TRUE, rdata=TRUE)

searchMaxLambda  Searching For A Maximal Lambda

Description

Function which gives a rough approximation of maximal $\lambda$.

Usage

searchMaxLambda(x, limcount = 4, step = 1.05, trylambda = 0.01)

Arguments

x  data in form of a vector
limcount  divided by the square root of the number of data points. The result determines the cut off value.
step  determines step size
trylambda  initial $\lambda$

Details

Excess mass is calculated for trylambda. In case the resulting excess mass is larger (smaller) than the cut off value, trylambda is set as trylambda * step (respectively trylambda/step) and excess mass is calculated again until it is smaller (larger) than the cut off value. The corresponding trylambda is returned.

The approximation is done allowing only for one $\lambda$-cluster, as scans including more $\lambda$-clusters have high computational costs due to the recursive structure of the algorithm.

Value

trylambda calculated as described in Details.

Author(s)

Marc-Daniel Mildenberger <mildenberger.stat@web.de>, based on earlier code from Dr. Guenther Sawitzki <gs@statlab.uni-heidelberg.de>

References

See Also

`excessm`, `exmplot`, `exmsilhouette`, `mexmsilhouette`

Examples

```r
library(MASS)
attach(geyser)

# Calculating Lambda using standard settings
searchMaxLambda(duration)

# Calculating Lambda, reducing cut off value and step. Setting another initial lambda
searchMaxLambda(duration, limcount = 5, step = 1.01, trylambda = 1)
```
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