Package ‘MixtureInf’

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# Description

The `mixtureInf` package is an implementation of algorithms for likelihood-based testing of the order of a finite mixture, described in Li and Chen (2010). For more details refer to the bibliography and help for individual functions.

# Details

More information is available on the following topics:

- `emtest.binom` test the order of a mixture of binomials
- `emtest.exp` test the order of a mixture of exponentials
- `emtest.norm` test the order of a mixture of normals with variance assumed to be 1
- `emtest.norm2` test the order of a mixture of normals without equal variance assumption
- `emtest.pois` test the order of a mixture of Poissons

For a complete list of functions with individual help pages, use: `library(help=mixtureInf)`.

# Author(s)

Jiahua Chen and Pengfei Li.

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# References


# See Also

`emtest.binom`, `emtest.exp`, `emtest.norm`, `emtest.norm2`, `emtest.pois`.

# Examples

```r
## see examples for function dealing with the distribution of interest
```
emtest.binom

Likelihood-based testing for the order of a finite mixture of binomials

Description

Tests the order of a finite mixture of binomials with univariate mixing parameter.

Usage

emtest.binom(x, m0, size, C = NULL, len = 5, eps = 1e-05)

Arguments

x observations whose order is being tested: vector or a matrix with the 1st column being the observed values and the 2nd column being the corresponding frequency.

m0 order under null hypothesis

size number of trials (zero or more)

C optional tuning parameter for EM-test procedure (if not provided, it will be determined by the formulas described in Chen and Li, 2011)

len the number of random restarts of the EM-algorithm

eps tolerance value for the convergence of the EM-algorithm

Value

Returns an object of class emtest with the following elements:

family 'binomial'

m0 order of the mixture

alpha estimated mixing proportions

theta estimated component parameters

C tuning parameter used

ah estimated weights in the $\chi^2$ mixture-limiting distribution

emstat EM-test statistics

pvalue p-values of the EM test statistics

Author(s)

Jiahua Chen and Pengfei Li.
References


See Also

`emtest.exp, emtest.norm, emtest.pois`

Examples

```r
x <- rbinommix(200, c(0.5, 0.5), c(0.1, 0.9), 16)
emtest.binom(x, 2, size=16)
```

---

**emtest.exp**

*Likelihood-based testing for the order of a finite mixture of exponentials*

Description

Tests the order of a finite mixture of exponentials with univariate mixing parameter.

Usage

```r
emtest.exp(x, m0, C = NULL, len = 5, eps = 1e-05)
```

Arguments

- **x**: observations whose order is being tested: vector or a matrix with the 1st column being the observed values and the 2nd column being the corresponding frequency.
- **m0**: order under null hypothesis
- **C**: optional tuning parameter for EM-test procedure (if not provided, it will be determined by the formulas described in Chen and Li, 2011)
- **len**: the number of random restarts of the EM-algorithm
- **eps**: tolerance value for the convergence of the EM-algorithm
emtest.norm

Value
Returns an object of class emtest with the following elements:

- `family`: 'exponential'
- `m0`: order of the mixture
- `alpha`: estimated mixing proportions
- `theta`: estimated component parameters
- `C`: tuning parameter used
- `ah`: estimated weights in the $\chi^2$ mixture-limiting distribution
- `emstat`: EM-test statistics
- `pvalue`: p-values of the EM test statistics

Author(s)
Jiahua Chen and Pengfei Li.

References


See Also
emtest.binom, emtest.norm, emtest.pois

Examples
```r
x <- rexpmix(200, c(0.5, 0.5), c(1, 20))
emtest.exp(x, 2)
```

Description
Tests the order of a finite mixture of normals with univariate mixing parameter. The variance for each component is assumed to be 1.

Usage
`emtest.norm(x, m0, C = NULL, len = 5, eps = 1e-05)`
Arguments

- **x**: observations whose order is being tested: vector or a matrix with the 1st column being the observed values and the 2nd column being the corresponding frequency.
- **m0**: order under null hypothesis
- **C**: optional tuning parameter for EM-test procedure (if not provided, it will be determined by the formulas described in Chen and Li, 2011)
- **len**: the number of random restarts of the EM-algorithm
- **eps**: tolerance value for the convergence of the EM-algorithm

Value

Returns an object of class `emtest` with the following elements:

- **family**: 'normal'
- **m0**: order of the mixture
- **alpha**: estimated mixing proportions
- **theta**: estimated component parameters
- **C**: tuning parameter used
- **ah**: estimated weights in the $\chi^2$ mixture-limiting distribution
- **emstat**: EM-test statistics
- **pvalue**: p-values of the EM test statistics

Author(s)

Jiahua Chen and Pengfei Li.

References


See Also

`emtest.binom`, `emtest.exp`, `emtest.norm`, `emtest.pois`

Examples

```r
x <- rnormmix(200, c(0.5, 0.5), c(-2, 2))
emtest.norm(x, 2)
```
Description
Tests the order of a finite mixture of normals without equal variance assumption.

Usage
emtest.norm2(x, m, eps = 1e-06)

Arguments
x  observations whose order is being tested: vector or a matrix with the 1st column being the observed values and the 2nd column being the corresponding frequency.
m  order under null hypothesis.
eps  tolerance value for the convergence of the EM-algorithm.

Value
Returns an object of class `emtest` with the following elements:

family  'normal_unequalvar'
m  order of the mixture.
alpha  estimated mixing proportions.
theta  estimated component parameters mu and sigma.
emstat  EM-test statistics.
pvalue  p-values of the EM test statistics.

Author(s)
Jiahua Chen and Pengfei Li.

References

See Also
emtest.binom, emtest.exp, emtest.norm, emtest.pois
Examples

```r
x <- rnormmix(50, c(0.5, 0.5), c(-2, 2), c(1, 4))
emtest.norm2(x, 2)
```

Description

Tests the order of a finite mixture of Poissons with univariate mixing parameter.

Usage

```r
emtest.pois(x, m0, C = NULL, len = 5, eps = 1e-05)
```

Arguments

- `x` observations whose order is being tested: vector or a matrix with the 1st column being the observed values and the 2nd column being the corresponding frequency.
- `m0` order under null hypothesis
- `C` optional tuning parameter for EM-test procedure (if not provided, it will be determined by the formulas described in Chen and Li, 2011)
- `len` the number of random restarts of the EM-algorithm
- `eps` tolerance value for the convergence of the EM-algorithm

Value

Returns an object of class `emtest` with the following elements:

- `family` 'poisson'
- `m0` order of the mixture
- `alpha` estimated mixing proportions
- `theta` estimated component parameters
- `C` tuning parameter used
- `ah` estimated weights in the \( \chi^2 \) mixture-limiting distribution
- `emstat` EM-test statistics
- `pvalue` p-values of the EM test statistics

Author(s)

Jiahua Chen and Pengfei Li.
**rbinommix**

**References**


**See Also**

`emtest.binom, emtest.exp, emtest.norm`

**Examples**

```r
data(faithful)
emtest.pois(faithful$waiting, 2)
```

---

**rbinommix**  
*Random sample from a mixture of binomials*

**Description**

Generate a random sample for a mixture of univariate binomial distributions.

**Usage**

`rbinommix(n, alpha, prob, size)`

**Arguments**

- `n` number of samples
- `alpha` vector of mixture probabilities, with length equal to `m`, the desired number of components.
- `prob` vector of probabilities of success of each component.
- `size` number of trials

**Value**

Returns a vector of length `n` of samples from an `m`-component mixture of univariate binomial distributions.

**See Also**

Functions for mixtures of other standard distributions, such as `rnormmix` for the normal and `rpoismix` for the Poisson distribution.
**Examples**

```r
# Draw random samples from a mixture of two equally likely binomials,
# one with p(success) = 0.1, the other with p(success) = 0.9
x <- rbinommix(200, c(0.5, 0.5), c(0.1, 0.9), 16)
hist(x, probability=TRUE)
lines(density(x), col='red')
```

---

**rexpmix**  
*Random sample from a mixture of exponentials*

**Description**

Generate a random sample for a mixture of univariate exponential distributions.

**Usage**

```r
rexpmix(n, alpha, scale)
```

**Arguments**

- `n`: number of samples
- `alpha`: vector of mixture probabilities, with length equal to `m`, the desired number of components.
- `scale`: vector of scales (inverse of rate) of each component.

**Value**

Returns a vector of length `n` of samples from an `m`-component mixture of univariate exponential distributions.

**See Also**

Functions for mixtures of other standard distributions, such as `rnormmix` for the normal and `rpoismix` for the Poisson distribution.

**Examples**

```r
# Draw random samples from a mixture of two equally likely exponential
# distributions, one with scale = 1, the other with scale = 0.05
x <- rexpmix(200, c(0.5, 0.5), c(1, 20))
hist(x, probability=TRUE)
lines(density(x), col='red')
```
rnormmix

Random sample from a mixture of normals

Description

Generate a random sample for a mixture of univariate normal distributions.

Usage

rnormmix(n, alpha, mean, sd = rep(1, length(alpha)))

Arguments

n number of samples
alpha vector of mixture probabilities, with length equal to m, the desired number of components.
mean vector of means of each component.
sd vector of standard deviations of each component.

Value

Returns a vector of length n of samples from an m-component mixture of univariate normal distributions.

See Also

Functions for mixtures of other standard distributions, such as rbinommix for the binomial and rexpmix for the exponential distribution.

Examples

# Draw random samples from a mixture of two equally likely normal
distributions, one with mean = -2, s.d. = 1, and the other with
# mean=2, s.d. = 4
x <- rnormmix(200, c(0.5, 0.5), c(-2, 2), c(1, 4))
hist(x, probability=TRUE)
lines(density(x), col='red')
rpoismix

Random sample from a mixture of Poissons

Description
Generate a random sample for a mixture of univariate Poisson distributions.

Usage
rpoismix(n, alpha, lambda)

Arguments
- n: number of samples
- alpha: vector of mixture probabilities, with length equal to m, the desired number of components.
- lambda: vector of means of each component.

Value
Returns a vector of length n of samples from an m-component mixture of univariate Poisson distributions.

See Also
Functions for mixtures of other standard distributions, such as rnormmix for the normal and rexpmix for the exponential distribution.

Examples
# Draw random samples from a mixture of two equally likely Poisson distributions, one with mean = 1, and the other with mean = 10
x <- rpoismix(200, c(0.5, 0.5), c(1,10))
hist(x, probability=TRUE)
lines(density(x), col='red')
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