

# Package ‘marl’

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**Type** Package

**Title** Multivariate Analysis Based on Relative Likelihoods

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**Description** Functions provided allow data simulation; construction of weighted relative likelihood functions; clustering and principal component analysis based on weighted relative likelihood functions.

**License** GPL-2

**NeedsCompilation** no

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marl-package

*Multivariate Analysis Based on Relative Likelihoods.*

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## Description

This package provides functions for enabling multivariate data analysis using methods based on weighted relative likelihood functions. The likelihood functions assume distribution function. The package contains functions tailored for count distribution (Poisson and Negative Binomial) to carry out k means clustering and principal component analysis. We will continue to add functions for more distributions and multivariate analysis methods. The package contains eight functions in total.

## Details

Package: marl  
Type: Package  
Version: 1.0  
Date: 2015-04-09  
License: What license is it under?

## Author(s)

Milan Bimali Maintainer: Milan Bimali <mbimali@kumc.edu>

## References

For mathematical detail please contact authors. Related paper is currently under review.

## See Also

kmeans

## Examples

```
x <- sim.negbin(c(4,5,10),3,10,12)
negbin.rel.clust(x,1,20,nclust = 3,len=200,plot=TRUE,seed=132)
negbin.rel.pca(x,1,20,len=20,plot=TRUE,seed=132)
```

---

negbin.rel.clust	<i>Relative Likelihood based clustering assuming Negative Binomial distribution.</i>
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---

### Description

The function provides weighted relative likelihood function matrix, cluster assignment based on k means clustering, and plot of weighted relative likelihood functions with colors representing cluster assignment. Each observation in the dataset is assumed to follow negative binomial distribution.

### Usage

```
negbin.rel.clust(x, mu.min, mu.max, nclust = 2, len = 200, plot = TRUE, seed = 132)
```

### Arguments

x	Observations of length greater than 1. Data can be entered as matrix or list.
mu.min	Minimum value of mu for the relative likelihood function.
mu.max	Maximum value of mu for the relative likelihood function.
nclust	Number of Clusters.
len	Length of values to be evaluated at in between mu.min and mu.max.
plot	If set TRUE, provides plot of weighted relative likelihood functions colored by their cluster assignment.
seed	Seed to be set for reproducibile results.

### Details

For mathematical details, please contact the authors.

### Value

Wt.Rel.Likld	A matrix of weighted relative likelihood functions with rows indicating observations. The column names are the values at which the weighted relative likelihood functions are evaluated.
Cluster.Assignment	Cluster assignment for each observation.
table	Table summarizing size of clusters.

### Note

None.

### Author(s)

Milan Bimali

**References**

None.

**Examples**

```
x <- sim.negbin(c(4,5,10),3,10,12)
negbin.rel.clust(x,1,20,nclust = 3,len=200,plot=TRUE,seed=132)
```

---

negbin.rel.pca	<i>Relative Likelihood based PCA assuming Negative Binomial distribution.</i>
----------------	---

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**Description**

The function performs PCA on matrix based on weighted relative likelihood function and provides a plot of first two PCs as well as summary of PCA.

**Usage**

```
negbin.rel.pca(x, mu.min, mu.max, len = 200, plot = TRUE, seed = 132)
```

**Arguments**

x	Observations of length greater than 1. Data can be entered as matrix or list.
mu.min	Minimum value of mean for the relative likelihood function.
mu.max	Maximum value of mean for the relative likelihood function.
len	Length of values to be evaluated at in between mu.min and mu.max.
plot	If set TRUE, provides plot of weighted relative likelihood functions colored by their cluster assignment.
seed	Seed to be set for reproducibility

**Details**

For mathematical details, please contact the authors.

**Value**

PCA.output	Summary of Principal Component Analysis.
------------	--

**Note**

None.

**Author(s)**

Milan Bimali.

**References**

None.

**Examples**

```
x <- sim.negbin(c(4,5,10),3,10,12)
negbin.rel.pca(x,1,20,len=20,plot=TRUE,seed=132)
```

---

pois.rel.clust	<i>Relative Likelihood based clustering assuming Poisson distribution.</i>
----------------	--

---

**Description**

The function provides weighted relative likelihood function matrix, cluster assignment based on k means clustering, and plot of weighted relative likelihood functions with colors representing cluster assignment. Each observation in the dataset is assumed to follow Poisson distribution.

**Usage**

```
pois.rel.clust(x, lambda.min, lambda.max, nclust = 3, len = 200, plot = TRUE, seed = 132)
```

**Arguments**

x	Data can be entered as matrix or list.
lambda.min	Minimum value of lambda.
lambda.max	Maximum value of lambda.
nclust	Number of Clusters.
len	Length of values to be evaluated at in between lambda.min and lambda.max.
plot	If set TRUE, provides plot of weighted relative likelihood functions colored by their cluster assignment.
seed	Seed to be set for reproducibility

**Details**

For mathematical details, please contact the authors.

**Value**

Wt.Rel.Likld	A matrix of weighted relative likelihood functions with rows indicating observations. The column names are the values at which the weighted relative likelihood functions are evaluated.
Cluster.Assignment	Cluster assignment of each observation.
table	Table summarizing size of clusters.

**Note**

None.

**Author(s)**

Milan Bimali

**References**

None.

**Examples**

```
x <- sim.pois(c(4,10),5,4)
pois.rel.clust(x,1,20,nclust = 2,len=200,plot=TRUE,seed=132)
```

---

pois.rel.pca

*Relative Likelihood based clustering assuming Poisson distribution.*

---

**Description**

The function performs PCA on matrix based on weighted relative likelihood function and provides a plot of first two PCs as well as summary of PCA.

**Usage**

```
pois.rel.pca(x, lambda.min, lambda.max, len = 10, plot = TRUE, seed = 132)
```

**Arguments**

x	Data can be entered as matrix or list.
lambda.min	Minimum value of lambda.
lambda.max	Maximum value of lambda.
len	Length of values to be evaluated at in between mu.min and mu.max.
plot	If set TRUE, provides plot of weighted relative likelihood functions colored by their cluster assignment.
seed	Seed to be set for reproducibility

**Details**

For mathematical details, please contact the authors.

**Value**

PCA.output	Summary of Principal Component Analysis
------------	---

**Note**

None.

**Author(s)**

Milan Bimali.

**References**

None.

**Examples**

```
x <- sim.pois(c(4,10),15,10)
pois.rel.pca(x,1,20,len=20,plot=TRUE,seed=132)
```

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sim.negbin

*Simulates data from a mixture of Negative Binomial distribution*

---

**Description**

This function simulates data from a mixture of Negative Binomial distribution. The parameterization  $\mu$  and size is used.

**Usage**

```
sim.negbin(mu, size, n.obs, n.val)
```

**Arguments**

mu	a vector of Negative Binomial means used for simulating data
size	Size or overdispersion parameter. It is a fixed positive number.
n.obs	Number of observations to simulate.
n.val	Length of each observation.

**Details**

If necessary readers are referred to rnbinom function in R.

**Author(s)**

Milan Bimali.

**References**

rnbinom.

**Examples**

```
dat.sim <- sim.negbin(c(3,7),2,5,15)
```

---

sim.pois	<i>Simulates data from a mixture of Poisson distribution.</i>
----------	---

---

**Description**

This function simulates data from a mixture of Poisson distribution.

**Usage**

```
sim.pois(lambda, n.obs, n.val)
```

**Arguments**

lambda	a vector of Poisson means used for simulating data.
n.obs	Number of observations to simulate.
n.val	Length of each observation.

**Details**

If necessary readers are referred to rpois function in R.

**Author(s)**

Milan Bimali.

**References**

rpois.

**Examples**

```
dat.sim <- sim.pois(c(2,5),10,5)
```



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wt.rel.negbin	<i>Weighted relative likelihood function based on Negative Binomial distribution.</i>
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---

**Description**

This function constructs wt. rel. likld.function based on neg bin distribution. It provides plot, area under curve, mle, and values of wt. rel. function

**Usage**

```
wt.rel.negbin(x, mu.min, mu.max, plot = FALSE, len = 100)
```

**Arguments**

x	vector or list of observations
mu.min	Minimum value of mu for the relative likelihood function.
mu.max	Minimum value of mu for the relative likelihood function.
plot	If TRUE provides a plot of weighted relative likelihood functions
len	Length of values to be evaluated at in between mu.min and mu.max

**Details**

For mathematical details, please contact the authors.

**Value**

mle	Mode of the likelihood function
AUC	Area under curve of the wt. rel. likld function. Estimated numerically using optimize function.
mu	Values of mu between mu.min and mu.max
val	Values of wt. rel. likld. function evaluated at mu.

**Note**

No notes.

**Author(s)**

Milan Bimali.

**References**

No reference currently.

**Examples**

```
mu.min <- 0.5; mu.max <- 50; len <- 100
y <- rnbino(10,mu=10,size=3)
wt.rel.negbin(y,mu.min,mu.max,plot = TRUE, len = len)
```

wt.rel.pois

*Weighted relative likelihood function based on Poisson distribution.***Description**

This function constructs wt. rel. likld.function based on Poisson distribution. It provides plot, area under curve, mle, and values of wt. rel. function

**Usage**

```
wt.rel.pois(x, lambda.min, lambda.max, plot = TRUE, len = 100)
```

**Arguments**

x	vector or list of observations
lambda.min	Minimum value of lambda.
lambda.max	Maximum value of lambda.
plot	If TRUE provides a plot of weighted relative likelihood functions.
len	Length of values to be evaluated at in between lambda.min and lambda.max

**Details**

For mathematical details, please contact the authors.

**Value**

mle	Mode of the likelihood function.
AUC	Area under curve of the wt. rel. likld function. Estimated numerically using optimize function.
Lambda	Values of lambda between lambda.min and lambda.max
Val	Values of wt. rel. likld. function evaluated at mu.

**Note**

No notes.

**Author(s)**

Milan Bimali.

## References

No reference currently.

## Examples

```
y <- rpois(10,4)
wt.rel.pois(y,0.1,10,plot=TRUE,len=500)
```

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