

# Package ‘tlemix’

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**Type** Package

**Title** Trimmed Maximum Likelihood Estimation

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**Author** P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela

**Depends** flexmix

**Imports** methods, flexmix, modeltools, stats4

**Suggests** mvtnorm, flexmix, tcltk

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**Description** TLE implements a general framework for robust fitting of finite mixture models.  
Parameter estimation is performed using the EM algorithm.

**License** GPL (>= 3)

**LazyLoad** no

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tlemix-package	<i>TLE - Robust Estimation of Mixture Models using the Fast-TLE algorithm.</i>
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## Description

TLE implements a general framework for robust fitting of finite mixture models. Parameter estimation is performed using the EM algorithm.

## Details

Package:	tlemix
Type:	Package
Version:	1.0
Date:	2008-06-12
License:	GPL-2
LazyLoad:	yes

## Author(s)

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela Maintainer: P. Filzmoser, peter.filzmoser@tuwien.ac.at

## References

N. Neykov, P. Filzmoser, R. Dimova, and P. Neytchev. Robust fitting of mixtures using the trimmed likelihood estimator. Computational Statistics and Data Analysis, Vol. 17(3), pp. 299-308, 2007.

## See Also

[flexmix](#), [TLE](#)

---

`coefglm`*coefglm*

---

**Description**

Used by TLE-flexmix gaussian, poisson & binomial model (FLXglm.Estimate) driver to get model coefficients.

**Usage**

```
coefglm(nmix, family)
```

**Arguments**

<code>nmix</code>	flexmix model
<code>family</code>	family, can be "gaussian", "poisson" or "binomial"

**Value**

List of model coefficients.

**Note**

This function is only used internally.

**Author(s)**

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

**See Also**

[TLE](#)

---

`coefmclust`*coefmclust*

---

**Description**

Returns coefficients of mclust type estimate. This function is only used internally.

**Usage**

```
coefmclust(nmix)
```

**Arguments**

nmix            Object of type flexmix.

**Value**

cov            Description of 'comp1'  
center        Description of 'comp2'  
prior         Description...

**Note**

This function is only used internally.

**Author(s)**

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

**See Also**

[coef](#), [parameters](#)

---

dPois

*Mixture two Poisson Regression Models*

---

**Description**

In this data set we consider two Poisson regression models with equal mixing proportions and with additional noise. For each Poisson regression model 100 data points are generated according to a Poisson distribution. For the noise we generated 50 points from a uniform distribution over the range of each variate.

**Usage**

```
data(dPois)
```

**Format**

A data frame with 150 observations on the following 3 variables.

y A numeric vector of y-coordinates

x A numeric vector of x-coordinates

**Author(s)**

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

**See Also**[TLE](#)**Examples**

```
data(dPois)
str(dPois)
# Example needs some computing time:
# est.tle <- TLE(y~x, "poisson", data=dPois, Density=flexmix.Density, Estimate=flexmix.Estimate,
# tleplot(est.tle, dPois)
```

---

`estimate`*Getter for estimate object of TLE-objects.*

---

**Description**

This is the `estimate` function for TLE objects. It returns the estimate slot of TLE objects.

**Usage**

```
estimate(object)
```

**Arguments**

`object`            Object of class TLE

**Value**

`object`            Estimate object that is returned by the model driver's estimate function.

**Author(s)**

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<http://www.statistik.tuwien.ac.at/public/filz/>

**See Also**[TLE](#)

---

flexmix.Density      *Model driver for flexmix*

---

### Description

Density function according to current parameter estimate

### Usage

```
flexmix.Density(data, pars, model, family)
```

### Arguments

data	Model data, expected to be model.frame with family attribute
pars	Model estimate
model	The model
family	The model family

### Value

ll	Log-likelihood
c	Cluster
cc	Cluster as matrix
lik	Log-likelihood

### Author(s)

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

### See Also

[flexmix](#)

---

`flexmix.Estimate` *Flexible Mixture Estimation*

---

**Description**

TLE - flexmix gaussian, poisson & binomial model driver. Calculates the density function according to current parameter estimates.

**Usage**

```
flexmix.Estimate(data, ind = NULL, nc, class = "hard", cluster = NULL, niter = 200,
```

**Arguments**

<code>data</code>	A <code>model.frame</code> containing the data.
<code>ind</code>	Data subset
<code>nc</code>	Number of clusters
<code>class</code>	Classification method used: <code>auto</code> , <code>weighted</code> , <code>hard</code> or <code>random</code>
<code>cluster</code>	
<code>niter</code>	Number of iterations
<code>minprior</code>	Minimum number of observations per component
<code>model</code>	The model
<code>family</code>	The model family
<code>ntry</code>	Number of trials

**Value**

Returns flexmix class estimate.

**Author(s)**

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela

**See Also**

[flexmix](#)

---

FLXmclust.Density *Model driver for flexmix*

---

**Description**

Density function according to current parameter estimate

**Usage**

```
FLXmclust.Density(data, estim, model, ...)
```

**Arguments**

data	Model data, expected to be model.frame with family attribute
estim	Model estimate
model	The model used
...	Any other arguments

**Value**

ll	Log-likelihood
lc	Log-likelihood by cluster
c	Cluster
cc	Cluster as matrix.
lik	Log-likelihood.

**Author(s)**

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

**See Also**

[flexmix](#)

---

FLXmclust.Estimate *Flexible Mixture Estimation*

---

**Description**

TLE - flexmix mclust model driver

**Usage**

```
FLXmclust.Estimate(data, ind = NULL, nc, class = "hard", cluster = NULL, niter = 20
```

**Arguments**

data	A model.frame containing the data.
ind	Data subset
nc	Number of clusters
class	Classification method used: auto, weighted, hard or random
cluster	
niter	Number of iterations
minprior	Minimum number of observations per component
model	Model used to extract model formula
ntry	Number of trials
...	Any other arguments

**Value**

Returns flexmix class estimate.

**Author(s)**

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<http://www.statistik.tuwien.ac.at/public/filz/>

**See Also**

[flexmix](#)

---

 gaussData

*Mixture of two standard normal distributions*


---

**Description**

Mixture of two standard normal distributions with outliers.

**Usage**

```
data(gaussData)
```

**Format**

A data frame with 100 observations on the following 3 variables.

*x* a numeric vector of x-coordinates

*y* a numeric vector of y-coordinates

*c* a numeric vector of cluster memberships

**Author(s)**

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

**Examples**

```
data(gaussData)
str(gaussData)
# Example needs some computing time:
# estimate
# est.tle <- TLE(y~x, "gaussian", data=gaussData, Density=flexmix.Density, Estimate=flexmix.Esti
# plot data indicating clusters
# tleplot(est.tle, gaussData, main="TLE Scatter Plot")
```

---

 McLachlan150

*Mixture of two standard normal distributions*


---

**Description**

This simulated data set are discussed by McLachlan and Peel (2000). The data consists of 100 observations generated from a 3-component bivariate normal mixture model with equal mixing proportions. Fifty outliers, generated from a uniform distribution over the range -10 to 10 on each variate are added to the original data. Thus a sample of 150 observations is obtained.

**Usage**

```
data(McLachlan150)
```

**Format**

A data frame with 100 observations on the following 3 variables.

x a numeric vector of x-coordinates

y a numeric vector of y-coordinates

c a numeric vector of cluster memberships

**Author(s)**

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

**References**

McLachlan, G.J. and Peel, D. (2000). Finite mixture models. Wiley, New York.

**Examples**

```
data(McLachlan150)
str(McLachlan150)
# Example needs some computing time:
#d <- as.matrix(McLachlan150[,1:2])
#est.tle <- TLE(d~1, "mvtnormal", data=d, Density=FLXmclust.Density, Estimate=FLXmclust.Estimate)
#tleplot(est.tle, as.data.frame(d), main="TLE Scatter Plot")
```

---

plot-methods

*Plot method for TLE-class objects.*

---

**Description**

This is the `plot` function for TLE objects. It calls the plot function of the estimate object that is returned by `estimate`

**Usage**

```
## S4 method for signature 'TLE,missing':
plot(x, y=NULL, ...)
```

**Arguments**

x	Object of class TLE.
y	NULL
...	Additional plot parameters.

**Author(s)**

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<http://www.statistik.tuwien.ac.at/public/filz/>

**See Also**[TLE](#)

---

`summary`*Summary method for TLE-class objects.*

---

**Description**

This is the `summary` function for TLE objects. It extends the summary functions of the estimate object's class by adding TLE specific results.

**Usage**

```
summary(object, ...)
```

**Arguments**

<code>object</code>	Object of class TLE
<code>...</code>	Additional arguments for summary method of the estimate object.

**Details**

The following list shows the parameters and results that are added to the estimate object's summary function.

- `kTrim` Trimming parameter.
- `nobsNumber` of observations.
- `noutNumber` of outliers.

**Value**

<code>summary</code>	Object of class <code>summary.TLE</code>
----------------------	--

**Author(s)**

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<http://www.statistik.tuwien.ac.at/public/filz/>

---

```
summary.TLE-class  Class "summary.TLE"
```

---

**Description**

Class for summary objects for TLE.

**Objects from the Class**

Objects can be created by calls of the form `new("summary.TLE", ...)`.

**Slots**

`call`: Call of the function.  
`estimate`: Estimate object. Class is determined by the estimation procedure used.  
`kTrim`: Number of observations used.  
`kStar`: Size of the initial random subsample.  
`maxloglik`: Maximum log likelihood.  
`nobs`: Number of observations.  
`nout`: Number of outliers.

**Methods**

`show signature(object = "summary.TLE"):...`

**Author(s)**

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<http://www.statistik.tuwien.ac.at/public/filz/>

---

TLE

*Trimmed Likelihood Estimator*

---

**Description**

TLE implements a general framework for robust fitting of finite mixture models. Parameter estimation is performed using the EM algorithm.

Currently two model drivers are included: `flexmix.Density` (`flexmix.Enstimate`) for gaussian, poisson and binomial regression models and `FLXmclust.Density` (`FLXmclust.Estimate`) for model based clustering.

**Usage**

```
TLE(formula, family, data, kStar=NULL, kTrim=NULL, nit = 10, msglvl = 0, result = NULL)
```

**Arguments**

<code>formula</code>	An object of class <code>formula</code> .
<code>family</code>	The family to be used.
<code>data</code>	Data frame containing the <code>x</code> and <code>y</code> variables with an optional attribute <code>family</code> being either <code>gaussian</code> , <code>poisson</code> or <code>binomial</code>
<code>kStar</code>	$k^*$ - size of the initial random subsample
<code>kTrim</code>	Trimming parameter: size of the C-steps random subsample
<code>nit</code>	Number of iterations
<code>msglvl</code>	Level of messages
<code>result</code>	Restart/continuation information
<code>cit</code>	Number of iterations in refinement step
<code>test</code>	Expected true loglikelihood of the model; procedure will be stopped if reached.
<code>nc</code>	Number of components.
<code>Density</code>	Density function of type - <code>function(data,solution,model,family,...)</code>
<code>Estimate</code>	Specific estimation procedure interface: <code>function(data,ind,model,family,...)</code>
<code>...</code>	Arguments to be passed to methods <code>Estimate</code> and <code>Density</code>

**Value**

Returns an object of class `TLE`.

**Author(s)**

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

**References**

N. Neykov, P. Filzmoser, R. Dimova, and P. Neytchev. Robust fitting of mixtures using the trimmed likelihood estimator. *Computational Statistics and Data Analysis*, Vol. 17(3), pp. 299-308, 2007.

**See Also**

[flexmix](#)

**Examples**

```
data(gaussData)
est.tle = TLE(y~x,"gaussian",data=gaussData,nit=4, msglvl=1, cit=3, Density=flexmix.Density,

# Plot the 2-dimensional data
tleplot(est.tle, gaussData)
```

---

TLE-class

Class "TLE"

---

### Description

Class for TLE results.

### Slots

**estimate:** Estimate object. Class is determined by the estimation procedure used.

**iterbest:** Iteration with best result.

**it:** Number of iterations done.

**maxloglik:** Maximum loglikelihood.

**indbest:** Index of observations used during the final iteration.

**indout:** Index of the outliers.

**tleweights:** Matrix of weights. - Besprechen

**tlelogliks:** besprechen.

**tleclusters:** besprechen.

**kTrim:** Number of observations used.

**kStar:** Size of the initial random subsample.

**mcomp:** Number of components.

**nobs:** Number of observations.

**stop:** The expected loglikelihood of known model (used for testing).

**call:** Call of the function.

### Methods

**show** Prints TLE object.

**summary** Generates a summary of a TLE object.

**tleplot** Plots a two-dimensional scatterplot with clusters and outliers marked by colors.

### Author(s)

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<http://www.statistik.tuwien.ac.at/public/filz/>

### References

N. Neykov, P. Filzmoser, R. Dimova, and P. Neytchev. Robust fitting of mixtures using the trimmed likelihood estimator. Computational Statistics and Data Analysis, Vol. 17(3), pp. 299-308, 2007.

---

TLE-methods                    *~~Methods for Function TLE in Package 'tlemix'~~*

---

### Description

~~ Methods for function TLE in Package 'tlemix' ~

### Methods

**kStar = "numeric", kTrim = "numeric", data = "ANY", nit = "numeric", msglvl = "numeric", result = "ANY", cit =**  
 ~~describe this method here

---

tleplot                            *2D Scatterplot with cluster membership indications*

---

### Description

The `tleplot` method for `TLE-class` objects gives a scatterplot of 2-dimensional mixture data after a trimmed likelihood estimation was performed.

### Usage

```
tleplot(object, data, ...)
```

### Arguments

<code>object</code>	object of class <code>TLE</code> ( <code>TLE-class</code> )
<code>data</code>	2-dimensional data frame
<code>...</code>	further graphical parameters for the <code>plot</code> function

### Details

A 2-dimensional data frame is represented as a scatterplot. For each cluster identified by the method `TLE` a different colour is used for indication purposes. Outliers are depicted as black triangles.

### Author(s)

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<http://www.statistik.tuwien.ac.at/public/filz/>

### See Also

`TLE`

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