

# Package ‘tlemix’

February 16, 2012

**Type** Package

**Title** Trimmed Maximum Likelihood Estimation

**Version** 0.1

**Date** 2012-02-16

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

**Depends** flexmix

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

**Suggests** mvtnorm, flexmix, tcltk

**Maintainer** Peter Filzmoser <P.Filzmoser@tuwien.ac.at>

**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** yes

**Repository** CRAN

**Date/Publication** 2012-02-16 07:34:55

## R topics documented:

tlemix-package . . . . .	2
coefglm . . . . .	3
coefmclust . . . . .	3
dPois . . . . .	4
estimate . . . . .	5
flexmix.Density . . . . .	6
flexmix.Estimate . . . . .	7
FLXmclust.Density . . . . .	8
FLXmclust.Estimate . . . . .	9

gaussData . . . . .	10
McLachlan150 . . . . .	10
plot-methods . . . . .	11
summary . . . . .	12
summary.TLE-class . . . . .	13
TLE . . . . .	13
TLE-class . . . . .	15
TLE-methods . . . . .	16
tleplot . . . . .	16

<b>Index</b>	<b>17</b>
--------------	-----------

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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](#)

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coefglm	<i>coefglm</i>
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---

**Description**

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

**Usage**

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

**Arguments**

nmix	flexmix model
family	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	<i>coefmclust</i>
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**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](#)

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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,msglvl=1,nc=2,kTrim)
# 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	<i>Model driver for flexmix</i>
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**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, minprior = 0.1, model
```

### Arguments

data	Amodel.frame containing the data.
ind	Data subset
nc	Number of clusters
class	Classification method used: auto, weighted, hard or random
cluster	optional vector of working class memberships
niter	Number of iterations
minprior	Minimum number of observations per component
model	The model
family	The model family
ntry	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 = 200, minprior = 0.1, mod
```

**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	optional vector of working class memberships
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)**

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](#)

---

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.Estimate, msglvl=1, nc=2,
# 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,msglvl=1,nc=3,clas
#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)**

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](#)

---

summary	<i>Summary method for TLE-class objects.</i>
---------	--

---

**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**

object	Object of class TLE
...	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.

- kTrimTrimming parameter.
- nobsNumber of observations.
- noutNumber of outliers.

**Value**

summary	Object of class summary.TLE
---------	-----------------------------

**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)

P. Neytchev, P. Filzmoser, R. Patnaik, A. Eisl and R. Boubela, <<P.Filzmoser@tuwien.ac.at>>  
<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, cit = 9, test = 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)**

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<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, Estimate=flexmix.Estimate)

# 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 = "ANY"`  
TLE method

---

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**

object	object of class TLE ( <a href="#">TLE-class</a> )
data	2-dimensional data frame
...	further graphical parameters for the <a href="#">plot</a> 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)**

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](#)

# Index

- \*Topic **classes**
  - summary.TLE-class, 13
  - TLE-class, 15
- \*Topic **cluster**
  - coefmclust, 3
  - FLXmclust.Density, 8
  - FLXmclust.Estimate, 9
  - TLE, 13
  - tleplot, 16
- \*Topic **datasets**
  - dPois, 4
  - gaussData, 10
  - McLachlan150, 10
- \*Topic **methods**
  - TLE-methods, 16
- \*Topic **models**
  - coefglm, 3
  - coefmclust, 3
  - estimate, 5
  - flexmix.Density, 6
  - flexmix.Estimate, 7
  - plot-methods, 11
  - summary, 12
  - TLE, 13
  - tleplot, 16
- \*Topic **multivariate**
  - coefglm, 3
  - coefmclust, 3
  - flexmix.Density, 6
  - flexmix.Estimate, 7
  - FLXmclust.Density, 8
  - FLXmclust.Estimate, 9
  - TLE, 13
- \*Topic **package**
  - tlemix-package, 2
- \*Topic **regression**
  - coefglm, 3
  - TLE, 13
  - tleplot, 16
- \*Topic **robust**
  - TLE, 13
- coef, 4
- coefglm, 3
- coefmclust, 3
- dPois, 4
- estimate, 5
- estimate, TLE-method (estimate), 5
- flexmix, 2, 6–9, 14
- flexmix.Density, 6
- flexmix.Estimate, 7
- FLXmclust.Density, 8
- FLXmclust.Estimate, 9
- gaussData, 10
- McLachlan150, 10
- parameters, 4
- plot, 16
- plot (plot-methods), 11
- plot, flexmix, missing-method (plot-methods), 11
- plot, FLXROptim, missing-method (plot-methods), 11
- plot, stepFlexmix, missing-method (plot-methods), 11
- plot, TLE, missing-method (plot-methods), 11
- plot-methods, 11
- show, summary.TLE-method (summary.TLE-class), 13
- show, TLE-method (TLE-class), 15
- summary, 12
- summary, TLE-method (TLE-class), 15
- summary.TLE-class, 13

TLE, 2, 3, 5, 12, 13, 16

TLE, data.frame, ANY, ANY, ANY, ANY, ANY, ANY, ANY, ANY, ANY, numeric, function, function-method  
(TLE), 13

TLE, formula, character, ANY, ANY, ANY, ANY, ANY, ANY, ANY, ANY, numeric, function, function-method  
(TLE), 13

TLE, numeric, numeric, ANY, numeric, numeric, ANY, numeric, ANY, function, function-method  
(TLE-methods), 16

TLE-class, 16

TLE-class, 15

TLE-methods, 16

tlemix (tlemix-package), 2

tlemix-package, 2

tleplot, 16

tleplot, TLE, data.frame-method  
(TLE-class), 15

tleplot, TLE-function (tleplot), 16