Package ‘qmix’

December 13, 2019

Title Finite Quantile Mixture Models
Version 0.1.2.0
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Description Estimates finite quantile mixture models using Markov chain Monte Carlo methods. The finite quantile mixture models include both fixed- and random-quantile specifications that are applicable to both continuous and binary dependent variables. Tools are available to assess convergence and summarize the estimation results.
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Encoding UTF-8
LazyData true
Biarch true
Depends R (>= 3.4.0)
Imports methods, Formula, Rcpp (>= 0.12.0), rstan (>= 2.18.1),
LinkingTo BH (>= 1.66.0), Rcpp (>= 0.12.0), RcppEigen (>= 0.3.3.3.0),
rstan (>= 2.18.1), StanHeaders (>= 2.18.0)
SystemRequirements GNU make
RoxygenNote 6.1.1
NeedsCompilation yes
Repository CRAN
Date/Publication 2019-12-13 15:10:02 UTC

R topics documented:

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Description

Estimates finite quantile mixture models with either fixed- or random-quantile specifications. The estimation is implemented using MCMC methods available in \texttt{rstan}.

References


Stan Development Team (2019). \texttt{RStan}: the \texttt{R} interface to Stan. \texttt{R} package version 2.19.2. https://mc-stan.org

\begin{itemize}
  \item \texttt{coef.qmix} \hspace{1cm} \textit{Extract coefficients from a qmix object}
\end{itemize}

Description

Create a table of coefficient results from a \texttt{qmix} object.

Usage

\begin{verbatim}
## S3 method for class 'qmix'
coef(object, ...)
\end{verbatim}

Arguments

\begin{itemize}
  \item \texttt{object} \hspace{1cm} A \texttt{qmix} object from running the main function \texttt{qmix}.
  \item ... \hspace{1cm} Further arguments to be passed according to \texttt{coef}.
\end{itemize}

Value

A table of coefficients with their corresponding lower and upper bounds.
**dald**

*Probability density function of asymmetric Laplace distributions*

---

**Description**

*dald* calculates probability densities of asymmetric Laplace distributions.

**Usage**

*dald(x, mu, p, sigma)*

**Arguments**

- **x**: Random variable.
- **mu**: Position parameter.
- **p**: Quantile.
- **sigma**: Scale parameter.

**Value**

probability density of *x*.

---

**inverse**

*Inverse function*

---

**Description**

*inverse* generates inverse function of any given function.

**Usage**

*inverse(f, mu, p, sigma, lower = -10000, upper = 10000)*

**Arguments**

- **f**: pald function
- **mu**: Position parameter.
- **p**: Quantile.
- **sigma**: Scale parameter.
- **lower**: Lower bound.
- **upper**: Upper bound.

**Value**

inversed pald
is.dichotomous  

Check if a predictor is dichotomous, adopted from package circGLM

Description
Check if a predictor is dichotomous, adopted from package circGLM

Usage
is.dichotomous(x)

Arguments
x  A character or numerical vector to be tested.

Value
A logical, TRUE if the x has dummy coding (0, 1), FALSE otherwise.

pald  
Cumulative density function of asymmetric Laplace distributions

Description
pald calculates cumulative densities of asymmetric Laplace distributions.

Usage
pald(x, mu, p, sigma)

Arguments
x  Random variable.
mu  Position parameter.
p  Quantile.
sigma  Scale parameter.

Value
cumulative probability density of x.
plot.qmix

Plot qmix object

Description
General plot function for qmix objects, which dispatches the chosen type of plotting to the corresponding function.

Usage
## S3 method for class 'qmix'
plot(x, type = "coef", ...)

Arguments
- x: A qmix object to be plotted.
- type: Character string giving the type of plotting. The options are "trace" for trace plots, "coef" for coefficient plots. The default is "coef".
- ...: Additional arguments to be passed to subsequent plot functions (check the See Also section).

Value
None.

See Also
plot_trace.qmix and plot_coef.qmix.

plot_coef.qmix
Make coefficient plots for a qmix object

Description
plot_coef.qmix is used to produce coefficient plots from a qmix object.

Usage
plot_coef.qmix(object, ...)

Arguments
- object: A qmix object from running the main function qmix.
- ...: Additional parameters to be passed to stan_plot.

Value
None.
plot_trace.qmix  

*Trace plots for qmix*

**Description**

plot_trace.qmix is used to produce trace plots from a qmix object from the main function qmix.

**Usage**

```r
plot_trace.qmix(object, ...)
```

**Arguments**

- `object`  
  A qmix object from running the main function qmix.

- `...`  
  Additional parameters to be passed to `traceplot`.

**Value**

None.

print.qmix  

*Print returns from a qmix object*

**Description**

General print function for qmix objects, which dispatches the chosen type of printing to the corresponding function.

**Usage**

```r
## S3 method for class 'qmix'
print(x, type = "text", ...)
```

**Arguments**

- `x`  
  A qmix object to be printed.

- `type`  
  Character string giving the type of printing, such as "text"."mcmc","coef".

- `...`  
  Additional arguments to be passed to print functions (check the See Also section).

**Value**

None.

**See Also**

- `print_text.qmix`  
- `print_mcmc.qmix`  
- `print_coef.qmix`
**print_coef.qmix**

*Print coefficients of a qmix object*

**Description**

`print_coef.qmix` prints out coefficients from a qmix object from running the main function `qmix`.

**Usage**

`print_coef.qmix(object, digits = 3)`

**Arguments**

- `object` A qmix object.
- `digits` Number of digits to display.

**Value**

None.

---

**print_mcmc.qmix**

*Print convergence diagnostics from a qmix object*

**Description**

`print_mcmc.qmix` prints a number of diagnostics about the convergence of a qmix objects.

**Usage**

`print_mcmc.qmix(object, ...)`

**Arguments**

- `object` A qmix object.
- `...` Additional arguments to be passed to the print function.

**Value**

None.
print_text.qmix 

Print the main results from a qmix object.

Description

Print the main results from a qmix object.

Usage

print_text.qmix(object, digits = 3)

Arguments

object A qmix object.
digits Number of digits to display.

Value

None.

qald 

Quantile function of asymmetric Laplace distributions

Description

qald calculates quantiles values of asymmetric Laplace distributions.

Usage

qald(y, mu, p, sigma)

Arguments

y quantile value.
mu Position parameter.
p Quantile.
sigma Scale parameter.

Value

quantile value.
qmix

Fitting finite quantile mixture models

Description

The main function for running the finite quantile mixture model. The function returns a qmix object that can be further investigated using standard functions such as plot, print, and coef. The model can be passed using a formula as in lm(). Convergence diagnostics can be performed using either print(object,"mcmc") or plot(object,"mcmc").

Usage

qmix(formula, data, nmix = 3, design = "fixed", q = NULL,
     nsim = 1000, burnin = NULL, thin = 1, CIsize = 0.95,
     nchain = 1, seeds = 12345, offset = 1e-20, inverse_distr = FALSE)

Arguments

formula  An object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted.
data      A data frame containing the variables in the model.
mix       The number of mixture components.
design    Quantile specification. Options include "fixed" and "random". The default choice is "fixed" which requires quantile inputs from the user.
q          The quantile value.
nsim      The number of iterations.
burnin    The number of burnin iterations.
thin      Thinning parameter.
CIsize    The size of posterior confidence interval.
nchain    The number of parallel chains.
seeds     Random seeds to replicate the results.
offset    Offset values to enhance sampling stability. The default value is 1e-20.
inverse_distr If FALSE, the ALD will not be reversed. The default is FALSE.

Value

A qmix object. An object of class qmix contains the following elements

Call      The matched call.
formula  Symbolic representation of the model.
mix       Number of mixture components. If unspecified in the fixed-quantile specification, the value equals the number of quantiles specified. Otherwise, an error will be generated for the missing value.
design Options include "fixed" and "random" for fixed- and random-quantile specification.
q Quantiles in the fixed-quantile specification.
nsim Number of iterations.
Burnin Number of burnin iterations.
thin Thinning.
seeds Random seeds for reproducibility. The default is 12345.
CIs Open Size of the posterior confidence interval.
inverse_distr Indicating whether ALD should be inversed.
offset Offset to enhance stability in estimation. The default value is 1e-20.
data Data used.
x Independent variables.
y Dependent variables.
xnames Names of the independent variables.
stanfit Output from stan.
sampledf Posterior samples.
summaryout Summary of the posterior samples.
npars Number of covariates.
ulbs Upper and lower bounds based on the specified confidence interval.
means Mean estimates.
thetas Estimated proportions of each mixture component.
binarylogic Indicating whether the data contain a binary dependent variable.

References

Examples

# simulate a mixture of 2 ALDs
k <- 2
N <- 50
# true effects: -10 and 10 respectively for two mixture components
beta1 <- -10
beta2 <- 10
set.seed(34324)
x1 <- rnorm(N,0,1)
x2 <- rnorm(N,0,1)
xb1 <- x1*beta1
xb2 <- x2*beta2
y1 <- y2 <- NA
# quantiles at 0.1 and 0.9
p1 <- 0.1
p2 <- 0.9
for (i in 1:N){
  y1[i] <- rald(1, mu = xb1[i], p = p1, sigma = 1)
  y2[i] <- rald(1, mu = xb2[i], p = p2, sigma = 1)
}
y <- c(y1, y2)
x <- c(x1, x2)
dat <- as.data.frame(cbind(y, x))
# Estimate the model using both the fixed- and random-quantile specification
model <- qmix(y ~ x, data = dat, nmix = 2, design = "fixed", q = c(0.1, 0.9))
# Summary the results
coef(model)
print(model)
# check traceplots
plot(model)

---

**rald**  
*Random number generator of asymmetric Laplace distributions*

**Description**

rald generates random numbers from asymmetric Laplace distributions.

**Usage**

rald(n, mu, p, sigma)

**Arguments**

- `n` Number of random numbers to be generated.
- `mu` Position parameter.
- `p` Quantile.
- `sigma` Scale parameter.

**Value**

random numbers.
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