

Package ‘ARpLMEC’

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Type Package

Title Fitting Autoregressive Censored Linear Mixed-Effects Models

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Description It fits left, right or interval censored mixed-effects linear model with autoregressive errors of order p using the EM algorithm. It provides estimates, standard errors of the parameters and prediction of future observations.

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Description

This function fits left, right or interval censored mixed-effects linear model, with autoregressive errors of order p , using the EM algorithm. It returns estimates, standard errors and prediction of future observations.

Usage

```
ARpLMEC.est(y, x, z, cc, nj, Arp = 1, beta0 = NULL, sigma0 = NULL,
  D0 = NULL, pi0 = NULL, cens.type = "left", LI = NULL,
  LS = NULL, MaxIter = 200, error = 1e-04, Prev = FALSE,
  step = NULL, isubj = NULL, xpre = NULL, zpre = NULL)
```

Arguments

<code>y</code>	Vector $1 \times n$ of censored responses, where n is the sum of the number of observations of each individual.
<code>x</code>	Design matrix of the fixed effects of order $n \times s$, corresponding to vector of fixed effects.
<code>z</code>	Design matrix of the random effects of order $n \times b$, corresponding to vector of random effects.
<code>cc</code>	Vector of censoring indicators of length n , where n is the total of observations. For each observation: 0 if non-censored, 1 if censored.
<code>nj</code>	Vector $1 \times m$ with the number of observations for each subject, where m is the total number of individuals.
<code>Arp</code>	Order of the autoregressive process. Must be a positive integer value. To consider a model uncorrelated use UNC.
<code>beta0</code>	Initial values for the vector of fixed effects. If it is not indicated it will be provided automatically. Default is NULL.
<code>sigma0</code>	Initial values for sigma. If it is not indicated it will be provided automatically. Default is NULL.
<code>D0</code>	Initial values for the covariance matrix for the random effects. If it is not indicated it will be provided automatically. Default is NULL.
<code>pi0</code>	Initial values for the vector for autoregressive coefficients π 's. If it is not indicated it will be provided automatically. Default is NULL.
<code>cens.type</code>	left for left censoring, right for right censoring and interval for interval censoring. Default is left.
<code>LI</code>	Vector censoring lower limit indicator of length n . For each observation: 0 if non-censored, $-\infty$ if censored. It is only indicated for when <code>cens.type</code> is both. Default is NULL.

LS	Vector censoring upper limit indicator of length n. For each observation: 0 if non-censored, inf if censored. It is only indicated for when cens.type is both. Default is NULL.
MaxIter	The maximum number of iterations of the EM algorithm. Default is 200.
error	The convergence maximum error. Default is 0.0001.
Prev	Indicator of the prediction process. Default is FALSE.
step	Number of steps for prediction. Default is NULL.
isubj	Vector indicator of subject included in the prediction process. Default is NULL.
xpre	Design matrix of the fixed effects to be predicted. Default is NULL.
zpre	Design matrix of the random effects to be predicted. Default is NULL.

Value

returns list of class "ARpMMEC":

FixEffect	Data frame with: estimate, standars erros and confidence intervals of the fixed effects.
Sigma2	Data frame with: estimate, standars erros and confidence intervals of the variance of the white noise process.
Phi	Data frame with: estimate, standars erros and confidence intervals of the autoregressive parameters.
RnEffect	Data frame with: estimate, standars erros and confidence intervals of the random effects.
Est	Vector of parameters estimate (fixed Effects, sigma2, phi, random effects).
SE	Vector of the standard errors of (fixed Effects, sigma2, phi, random effects).
loglik	Log-likelihood value.
AIC	Akaike information criterion.
BIC	Bayesian information criterion.
AICc	Corrected Akaike information criterion.
iter	Number of iterations until convergence.
MI	Information matrix
Prev	Predicted values (if xpre and zpre is not NULL).
time	Processing time.

References

- Vaida F, Liu L (2009). Fast implementation for normal mixed Effects models with censored response. *Journal of Computational and Graphical Statistics*; <https://doi.org/10.1198/jcgs.2009.07130>
- Matos LA, Lachos V, Balakrishnan N, Labra F (2013). Influence diagnostics in linear and nonlinear mixed-effects models with censored data. *Computational Statistics & Data Analysis*; <https://doi.org/10.1016/j.csda.2012.06.021>
- Schumacher FL, Lachos VH, Dey DK (2017). Censored regression models with autoregressive errors: A likelihood-based perspective. *Canadian Journal of Statistics*. <https://doi.org/10.1002/cjs.11338>

Examples

```
## Not run:
p.cens = 0.1
m      = 10
D = matrix(c(0.049,0.001,0.001,0.002),2,2)
sigma2 = 0.30
phi    = c(0.48,-0.2)
beta   = c(1,2,1)
nj=c(6,5,6,8,5,7,8,6,5,4)
x<-matrix(runif(sum(nj)*length(beta),-1,1),sum(nj),length(beta))
z<-matrix(runif(sum(nj)*dim(D)[1],-1,1),sum(nj),dim(D)[1])
data=ARpLMEC.sim(m,x,z,nj,beta,sigma2,D,phi,p.cens)
attach(data)
Arp    = 2
##Estimacao sem Previcao
teste1=ARpLMEC.est(y_cc,x,z,cc,nj,Arp,MaxIter = 10)

##Estimacao com Previcao
xx=matrix(runif(6*length(beta),-1,1),6,length(beta))
zz=matrix(runif(6*dim(D)[1],-1,1),6,dim(D)[1])
isubj=c(1,4,5)
teste2=ARpLMEC.est(y_cc,x,z,cc,nj,Arp,MaxIter=10,Prev=TRUE,step=2,isubj=isubj,xpre=xx,zpre=zz)
teste2$Prev
## End(Not run)
```

ARpLMEC.sim

Generating Censored Autoregressive Dataset with Linear Mixed Effects.

Description

This function simulates a censored response variable with autoregressive errors of order p , with mixed effect and a established censoring rate. This function returns the censoring vector and censored response vector.

Usage

```
ARpLMEC.sim(m, x = NULL, z = NULL, nj, beta, sigmae, D1, phi,
  p.cens = 0, cens.type = "left")
```

Arguments

<code>m</code>	Number of individuals
<code>x</code>	Design matrix of the fixed effects of order $n \times s$, corresponding to vector of fixed effects.

z	Design matrix of the random effects of order $n \times b$, corresponding to vector of random effects.
nj	Vector $1 \times m$ with the number of observations for each subject, where m is the total number of individuals.
beta	Vector of values fixed effects.
sigmae	It's the value for sigma.
D1	Covariance Matrix for the random effects.
phi	Vector of length Arp , of values for autoregressive parameters.
p.cens	Censoring level for the process. Default is 0
cens.type	left for left censoring, right for right censoring and interval for interval censoring. Default is left

Value

returns list:

cc	Vector of censoring indicators.
y_cc	Vector of responses censoring.

References

Schumacher FL, Lachos VH, Dey DK (2017). Censored regression models with autoregressive errors: A likelihood-based perspective. *Canadian Journal of Statistics*. <https://doi.org/10.1002/cjs.11338>

Garay AM, Castro LM, Leskow J, Lachos VH (2017). Censored linear regression models for irregularly observed longitudinal data using the multivariate-t distribution. *Statistical Methods in Medical Research*. <https://doi.org/10.1177/0962280214551191>

Examples

```
p.cens = 0.1
m      = 50
D = matrix(c(0.049,0.001,0.001,0.002),2,2)
sigma2 = 0.30
phi    = c(0.48,-0.2)
beta   = c(1,2,1)
nj=rep(6,m)
x<-matrix(runif(sum(nj)*length(beta),-1,1),sum(nj),length(beta))
z<-matrix(runif(sum(nj)*dim(D)[1],-1,1),sum(nj),dim(D)[1])
data=ARpLMEC.sim(m,x,z,nj,beta,sigma2,D,phi,p.cens)
y<-data$y_cc
cc<-data$cc
```

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