# Package ‘ARpLMEC’

**Type** Package

**Title** Censored Mixed-Effects Models with Different Correlation Structures

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**Description** Left, right or interval censored mixed-effects linear model with autoregressive errors of order p or DEC correlation structure using the type-EM algorithm. The error distribution can be Normal or t-Student. It provides the parameter estimates, the standard errors and prediction of future observations (available only for the normal case). Olivari et al (2021) &lt;doi:10.1080/10543406.2020.1852246&gt;.

**Depends** R (&gt;= 2.14)

**Imports** Matrix, stats4, gmm, sandwich, mvtnorm, tmvtnorm, numDeriv, utils, graphics, stats, MASS, lmec, mnormt, MomTrunc, TTmoment

**NeedsCompilation** no

**License** GPL (&gt;= 2)

**RoxygenNote** 7.1.1

**Encoding** UTF-8

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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

```
ARpMMEC.est(
  y,
  x,
  z,
  tt,
  cc,
  nj,
  struc = "UNC",
  order = 1,
  initial = NULL,
  nu.fixed = TRUE,
  typeModel = "Normal",
  cens.type = "left",
  LI = NULL,
  LS = NULL,
  MaxIter = 200,
  error = 1e-04,
  Prev = FALSE,
  step = NULL,
  isubj = NULL,
  xpre = NULL,
  zpre = NULL
)
```

Arguments

- **y** Vector 1 x n of censored responses, where n is the sum of the number of observations of each individual
- **x** Design matrix of the fixed effects of order n x s, corresponding to vector of fixed effects.
- **z** Design matrix of the random effects of order n x b, corresponding to vector of random effects.
- **tt** Vector 1 x n with the time the measurements were made, where n is the total number of measurements for all individuals. Default it’s considered regular times.
Vector of censoring indicators of length n, where n is the total of observations. For each observation: 0 if non-censored, 1 if censored.

Vector 1 x m with the number of observations for each subject, where m is the total number of individuals.

For uncorrelated ,autoregressive, DEC(phi1,phi2), DEC(phi1,phi2=1), DEC(DEC(phi1,phi2=1)) structure, respectively

Order of the autoregressive process. Must be a positive integer value.

List with the initial values in the next orden: betas,sigma2,alphas,phi and nu. If it is not indicated it will be provided automatically. Default is NULL

Logical. Should estimate the parameter "nu" for the t-student distribution?. If is False indicates the value in the list of initial values. Default is FALSE

Normal for Normal distribution and Student for Student distribution. Default is Normal

left for left censoring, right for right censoring and interval for intervalar censoring. Default is left

Vector censoring lower 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

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

The maximum number of iterations of the EM algorithm. Default is 200

The convergence maximum error. Default is 0.0001

Indicator of the prediction process. Available at the moment only for the typeModel=normal case. Default is FALSE

Number of steps for prediction. Default is NULL

Vector indicator of subject included in the prediction process. Default is NULL

Design matrix of the fixed effects to be predicted. Default is NULL.

Design matrix of the random effects to be predicted. Default is NULL.

returns list of class “ARpMMEC”:  

Data frame with: estimate, standar errors and confidence intervals of the fixed effects.

Data frame with: estimate, standar errors and confidence intervals of the variance of the white noise process.

Data frame with: estimate, standar errors and confidence intervals of the autoregressive parameters.

Data frame with: estimate, standar errors and confidence intervals of the random effects.

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


Examples

```
## Not run:
p.cens  = 0.1
m       =  50
D = matrix(c(0.049,0.001,0.001,0.002),2,2)
sigma2 = 0.30
phi    = c(0.48,0.5)
beta   = c(1,2,1)
nj=rep(c(6,5,6,8,5,7,8,9,10,12),5)
tt=rep(4,sum(nj))
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=ARpMMEC.sim(m,x,z,tt,nj,beta,sigma2,D,phi,p.cens)
attach(data, warn.conflicts = F)
Arp = 2

teste1=ARpMMEC.est(y_cc,x,z,tt,cc,nj,struc="Arp",order=1,typeModel="Normal",MaxIter = 2)
teste2=ARpMMEC.est(y_cc,x,z,tt,cc,nj,struc="Arp",order=1,typeModel="Student",MaxIter = 2)

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)
teste3=ARpMMEC.est(y_cc,x,z,tt,cc,nj,struc="Arp",order=1,typeModel="Normal",
         MaxIter = 2,Prev=TRUE,step=2,isubj=isubj,xpre=xx,zpre=zz)
teste3$Prev

## End(Not run)
```
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

ARpMMEC.sim(
  m,
  x = NULL,
  z = NULL,
  tt = NULL,
  nj,
  beta,
  sigmae,
  D,
  phi,
  p.cens = 0,
  cens.type = "left"
)

Arguments

m          Number of individuals
x          Design matrix of the fixed effects of order n x s, corresponding to vector of fixed effects.
z          Design matrix of the random effects of order n x b, corresponding to vector of random effects.
tt         Vector 1 x n with the time the measurements were made, where n is the total number of measurements for all individuals.
nj         Vector 1 x m with the number of observations for each subject, where m is the total number of individuals.
beta       Vector of values fixed effects.
sigmas     It’s the value for sigma.
D           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
p.cens.type left for left censoring, right for right censoring and interval for intervalar censoring. Default is left
Value

returns list:

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

Examples

## Not run:
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)
tt=rep(seq(1:6),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=ARpMMEC.sim(m,x,z,tt,nj,beta,sigma2,D,phi,p.cens)
y<-data$y_cc
cc<-data$cc

## End(Not run)
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