# Package 'PartCensReg'

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**Type** Package

**Title** Estimation and Diagnostics for Partially Linear Censored Regression Models Based on Heavy-Tailed Distributions

**Version** 1.39

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**Imports** ssym, optimx, Matrix

**Suggests** SMNCensReg, AER

**Description** It estimates the parameters of a partially linear regression censored model via maximum penalized likelihood through of ECME algorithm. The model belong to the semiparametric class, that including a parametric and nonparametric component. The error term considered belongs to the scale-mixture of normal (SMN) distribution, that includes well-known heavy tails distributions as the Student-t distribution, among others. To examine the performance of the fitted model, case-deletion and local influence techniques are provided to show its robust aspect against outlying and influential observations. This work is based in Ferreira, C. S., & Paula, G. A. (2017) <doi:10.1080/02664763.2016.1267124> but considering the SMN family.



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PartCensReg-package *Estimation and Diagnostics for Partially Linear Censored Regression Models Based on Heavy-Tailed Distributions*

## Description

It estimates the parameters of a partially linear regression censored model via maximum penalized likelihood through of ECME algorithm. The model belong to the semiparametric class, that including a parametric and nonparametric component. The error term considered belongs to the scale-mixture of normal (SMN) distribution, that includes well-known heavy tails distributions as the Student-t distribution, among others. To examine the performance of the fitted model, case-deletion and local influence techniques are provided to show its robust aspect against outlying and influential observations. This work is based in Ferreira, C. S., & Paula, G. A. (2017) <doi:10.1080/02664763.2016.1267124> but considering the SMN family.

## References

Ferreira, C. S., & Paula, G. A. (2017). Estimation and diagnostic for skew-normal partially linear models. Journal of Applied Statistics, 44(16), 3033-3053.

Ibacache-Pulgar, G., Paula, G. A., & Cysneiros, F. J. A. (2013). Semiparametric additive models under symmetric distributions. Test, 22(1), 103-121.

Ibacache-Pulgar, G., & Paula, G. A. (2011). Local influence for Student-t partially linear models. Computational Statistics & Data Analysis, 55(3), 1462-1478.

## See Also

CensReg.SMN

## Examples

```
dtawage = get(data(PSID1976,package = "AER"))
y  = dtawage$wage
cc = c(rep(0,428),rep(1,325))
tt = dtawage$exper
x  = cbind(dtawage$education,dtawage$age, dtawage$hhours, dtawage$hwage, dtawage$tax,
dtawage$youngkids, dtawage$oldkids)

#Normal case by default with only 10 iterations
PCR.default1 = Cens.SMN.PCR(x=x, y=y, c=cc, cens="left",tt =tt,iter.max = 10,Diagnostic = FALSE)

## Not run:
#This may take few minutes
#Normal case by default with full (200) iterations
PCR.default2 = Cens.SMN.PCR(x=x, y=y, c=cc, cens="left",tt =tt)

#contaminated normal case
PCR.CN = Cens.SMN.PCR(x=x, y=y, c=cc, cens="left",tt =tt,type="NormalC",
nu = c(0.1,0.1),iter.max = 100)
```

```
## End(Not run)
```

---

`Cens.SMN.PCR` *Estimation and diagnostics for partially linear censored regression models*

---

## Description

Return the MPL estimates obtained through of ECME algorithm for partially linear regression models with censored data under scale-mixture of normal (SMN) distributions (some members are the normal, Student-t, slash and contaminated normal distribution). The types of censoring considered are left and right. Graphics for diagnostic analysis such as case-deletion and local influence techniques are provided to show its robust aspect against outlying and influential observations.

## Usage

```
Cens.SMN.PCR(x, y, c, cens = "left", tt, nu = NULL, error = 10^-6, iter.max = 200,
type = "Normal", alpha.FIX = TRUE, nu.FIX = TRUE, alpha.in = 10^-3, k = 1,
Diagnostic = TRUE, a = 2)
```

## Arguments

| | |
|---|---|
| `x` | Matrix or vector of covariates. |
| `y` | Vector of responses. |
| `c` | Vector of censoring indicators. For each observation: 1 if censored and 0 if non-censored. |
| `cens` | 'left' for left censoring and 'right' for rigth censoring. |
| `tt` | Vector of values of a continuous covariate for the nonparametric component of the model. |
| `nu` | Initial value of the parameter of the SMN family. In the case of the Student-t and slash is a scalar, in the contaminated normal is a vector bidimensional. |
| `error` | The convergence maximum error. By default = 10^-6. |
| `iter.max` | The maximum number of iterations of the ECME algorithm. By default = 200. |
| `type` | Represents the type of distribution to be used in fitting: 'Normal' for normal, 'T' for Student-t, 'Slash' for slash and 'NormalC' for contaminated normal distribution respectively. By default ='Normal' |
| `alpha.FIX` | `TRUE` or `FALSE`. Indicate if smoothing parameter will be estimated. By default = `TRUE`. |
| `nu.FIX` | `TRUE` or `FALSE`. Indicate if $\nu$ will be estimated. By default = `TRUE`. |
| `alpha.in` | Initial value of smoothing parameter. |
| `k` | For the local influence in explanatory variable perturbation, indicates the $k-$th explanatory variable (assumed continuous) of the design matrix $X$ to be perturbed. |

| | |
|---|---|
| Diagnostic | TRUE or FALSE. Indicates if diagnostic graph should be built for the fitted model (index plot in local influence). By default = TRUE. |
| a | The value for $a$ considered in the benchmark value for the index plot in local influence: $M(0)_l > \bar{M(0)} + a * SM(0)$. |

## Details

We consider a partial linear model which belongs to the class of semiparametric regression models with vector of response $Y = (Y_1, ..., Y_n)$ and with errors $\epsilon_i$ which are independent and identically distributed according to a SMN distribution. To be more precise,

$$Y_i = x_i^T \beta + n_i^T f + \epsilon_i,$$

for $i = 1, ..., n$, where $f = (f(t_1^0), ..., f(t_r^n)^T$ is an $rx1$ vector with $t_1^0, ..., t_r^n$ being the distinct and ordered values of $t_i$; $n_i$ is a $rx1$ vector of incidence whose $s$-th element equals the indicator function $I(t_i = t_s^0)$ for $s = 1, ..., r$.

## Value

| | |
|---|---|
| beta | ECME estimates for the parametric component. |
| sigma2 | ECME estimates for the scale parameter. |
| Alpha | If alpha.FIX = FALSE, it returns the estimated value of the smoothing parameter, else returns the initial value assigned in alpha.in. |
| AIC | AIC criteria for model selection. |
| ff | ECME estimates for the nonparametric component. |
| yest | Predicted values of the model. |
| loglik | Value of the log-likelihood under the fitted model. |
| iter | Number of iterations of the ECME algorithm. |
| nu | If nu.FIX = FALSE, it returns the estimated value of $\nu$ parameter, else returns the initial value assigned in nu. |
| MI | Observed information matrix. |
| D | A list of objects for diagnostic analysis that contains: the Hessian matrix (Hessian), values for generalized Cook's distance (GD1) and the values of the conformal normal curvature for the following perturbation schemes: Case-weight (Curvature_W), scale (Curvature_S), explanatory variable (Curvature_E) and response variable (Curvature_R). |

## Warning

For the contaminated normal case, if nu parameters were close to the bounds, i.e., close to 0 or 1, computational problems could arrise.

## Note

When `alpha.FIX = FALSE` the algorithm may take a long time to converge. The package estimates the value $\nu$ in each iteration taking as an estimate the argument that maximizes the actual marginal log-likelihood function, already evaluated in the estimates of $\beta$ and $\sigma^2$. The diagnostic analysis is performed considering the estimated final value of $\theta$ obtained in the last iteration of the ECME algorithm.

## Author(s)

Marcela Nunez Lemus, Christian E. Galarza, Larissa Avila Matos and Victor H. Lachos.

## References

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## See Also

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## End(Not run)
```

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