Package 'survstan'

August 9, 2023

Title  Fitting Survival Regression Models via 'Stan'
Version 0.0.3
Description

License  MIT + file LICENSE
Encoding  UTF-8
RoxygenNote  7.2.3
Biarch  true
Depends  R (>= 3.4.0), survival
Imports  actuar (>= 3.0.0), dplyr, extraDistr, ggplot2, gridExtra, MASS, methods, purrr, Rcpp (>= 0.12.0), RcppParallel (>= 5.0.1), Rdpack, rlang, rstan (>= 2.18.1), rstantools (>= 2.3.1), tibble, tidyr
RdMacros  Rdpack
LinkingTo  BH (>= 1.66.0), Rcpp (>= 0.12.0), RcppEigen (>= 0.3.3.3.0), RcppParallel (>= 5.0.1), rstan (>= 2.18.1), StanHeaders (>= 2.18.0)
SystemRequirements  GNU make
BugReports  https://github.com/fndemarqui/survstan/issues
Suggests  GGally, knitr, rmarkdown, testthat (>= 3.0.0)
Config/testthat/edition  3
VignetteBuilder  knitr
NeedsCompilation: yes

Author: Fabio Demarqui [aut, cre, cph]
       (<https://orcid.org/0000-0001-9236-1986>)

Maintainer: Fabio Demarqui <fndemarqui@est.ufmg.br>

Repository: CRAN

Date/Publication: 2023-08-09 21:00:02 UTC

R topics documented:

survstan-package .................................................. 3
aftreg ................................................................. 3
ahreg ................................................................. 4
AIC.survstan .......................................................... 5
anova.survstan ....................................................... 6
coef.survstan ........................................................ 6
confint.survstan ..................................................... 7
cross_time .......................................................... 8
cross_time.ypreg ................................................... 8
estimates ............................................................. 9
extractAIC.survstan .................................................. 10
gastric ............................................................... 11
ggresiduals .......................................................... 11
ggresiduals.survstan ................................................ 12
ipass ................................................................. 13
logLik.survstan ...................................................... 13
model.matrix.survstan ............................................... 14
phreg ............................................................... 15
poreg ............................................................... 16
print.summary.survstan ............................................ 17
rank_models ......................................................... 17
summary.survstan ................................................... 18
survfit.survstan ..................................................... 19
tidy ................................................................. 19
tidy.survstan ....................................................... 20
tidy.ypreg .......................................................... 21
vcov.survstan ....................................................... 22
ypreg ............................................................... 22

Index 24
survstan-package

The 'survstan' package.

Description
The aim of the R package survstan is to provide a toolkit for fitting survival models using Stan. The R package survstan can be used to fit right-censored survival data under independent censoring. The implemented models allow the fitting of survival data in the presence/absence of covariates. All inferential procedures are currently based on the maximum likelihood (ML) approach.

References

aftreg
Fitting Accelerated Failure Time Models

Description
Function to fit accelerated failure time (AFT) models.

Usage
aftreg(formula, data, baseline = "weibull", dist = NULL, init = 0, ...)

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
data an optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which function is called.
ahreg

Fitting Accelerated Hazard Models

Description

Function to fit accelerated hazard (AH) models.

Usage

ahreg(formula, data, baseline = "weibull", dist = NULL, init = 0, ...)

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 data an optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which function is called.

baseline the chosen baseline distribution; options currently available are: exponential, weibull, lognormal, loglogistic and Birnbaum-Saunders (fatigue) distributions.

dist alternative way to specify the baseline distribution (for compatibility with the survreg function); default is NULL.

init initial values specification (default value is 0); see the detailed documentation for init in optimizing.

... further arguments passed to other methods.

Value

ahreg returns an object of class "ahreg" containing the fitted model.

Examples

library(survstan)
fit <- ahreg(formula =Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull")
summary(fit)
Value

ahreg returns an object of class "ahreg" containing the fitted model.

Examples

library(survstan)
fit <- ahreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull")
summary(fit)

<table>
<thead>
<tr>
<th>AIC.survstan</th>
<th>Akaike information criterion</th>
</tr>
</thead>
</table>

Description

Akaike information criterion

Usage

## S3 method for class 'survstan'
AIC(object, ..., k = 2)

Arguments

- object: an object of the class survstan.
- ...: further arguments passed to or from other methods.
- k: numeric, the penalty per parameter to be used; the default k = 2 is the classical AIC.

Value

the Akaike information criterion value when a single model is passed to the function; otherwise, a data.frame with the Akaike information criterion values and the number of parameters is returned.

Examples

library(survstan)
fit1 <- aftreg(Surv(futime, fustat) ~ 1, data = ovarian, baseline = "weibull", init = 0)
fit2 <- aftreg(Surv(futime, fustat) ~ rx, data = ovarian, baseline = "weibull", init = 0)
fit3 <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
AIC(fit1, fit2, fit3)
anova.survstan

anova method for survstan models

Description

Compute analysis of variance (or deviance) tables for one or more fitted model objects.

Usage

## S3 method for class 'survstan'
anova(...)

Arguments

... further arguments passed to or from other methods.

Value

the ANOVA table.

Examples

library(survstan)
fit1 <- aftreg(Surv(futime, fustat) ~ 1, data = ovarian, baseline = "weibull", init = 0)
fit2 <- aftreg(Surv(futime, fustat) ~ rx, data = ovarian, baseline = "weibull", init = 0)
fit3 <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
anova(fit1, fit2, fit3)

coef.survstan

Estimated regression coefficients

Description

Estimated regression coefficients

Usage

## S3 method for class 'survstan'
coef(object, ...)

Arguments

object an object of the class survstan
... further arguments passed to or from other methods
Value

the estimated regression coefficients

Examples

library(survstan)
fit <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
coef(fit)

confint.survstan

Confidence intervals for the regression coefficients

Description

Confidence intervals for the regression coefficients

Usage

## S3 method for class 'survstan'
confint(object, parm = NULL, level = 0.95, ...)

Arguments

object an object of the class survstan.
parm a specification of which parameters are to be given confidence intervals, either
a vector of numbers or a vector of names. If missing, all parameters are consid-
ered.
level the confidence level required.
... further arguments passed to or from other methods.

Value

100(1-alpha) confidence intervals for the regression coefficients.

Examples

library(survstan)
fit <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
confint(fit)
### cross_time

**Generic S3 method cross_time**

#### Description

Generic S3 method cross_time

#### Usage

```r
cross_time(object, ...)
```

#### Arguments

- `object`: a fitted model object
- `...`: further arguments passed to or from other methods.

#### Value

the crossing survival time

---

### cross_time.ypreg

**Computes the crossing survival times**

#### Description

Computes the crossing survival times

#### Usage

```r
## S3 method for class 'ypreg'
cross_time(object, newdata1, newdata2, conf.level = 0.95, nboot = 1000, ...)
```

#### Arguments

- `object`: an object of class ypreg
- `newdata1`: a data frame containing the first set of explanatory variables
- `newdata2`: a data frame containing the second set of explanatory variables
- `conf.level`: level of the confidence/credible intervals
- `nboot`: number of bootstrap samples (default nboot=1000).
- `...`: further arguments passed to or from other methods.

#### Value

the crossing survival time
Examples

```r
library(survstan)
data(ipass)
fit <- ypreg(Surv(time, status)~arm, data=ipass, baseline = "weibull")
summary(fit)
newdata1 <- data.frame(arm=0)
newdata2 <- data.frame(arm=1)
tcross <- cross_time(fit, newdata1, newdata2, nboot = 10)
tcross
```

---

estimates

Parameters estimates of a survstan model

Description

Parameters estimates of a survstan model

Usage

```r
estimates(object, ...)
```

Arguments

- `object`: an object of the class survstan.
- `...`: further arguments passed to or from other methods.

Value

The parameters estimates of a given survstan model.

Examples

```r
library(survstan)
fit <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
estimates(fit)
```
extractAIC.survstan   Extract AIC from a Fitted Model

Description

Computes the (generalized) Akaike An Information Criterion for a fitted parametric model.

Usage

## S3 method for class 'survstan'
extractAIC(fit, scale, k = 2, ...)

Arguments

fit       a fitted model of the class survstan
scale     optional numeric specifying the scale parameter of the model. Currently only
          used in the "lm" method, where scale specifies the estimate of the error variance,
          and scale = 0 indicates that it is to be estimated by maximum likelihood.
k        numeric specifying the ‘weight’ of the equivalent degrees of freedom part in the
          AIC formula.
...     further arguments passed to or from other methods.

Value

the ANOVA table.

Examples

library(survstan)
fit1 <- aftreg(Surv(futime, fustat) ~ 1, data = ovarian, baseline = "weibull", init = 0)
fit2 <- aftreg(Surv(futime, fustat) ~ rx, data = ovarian, baseline = "weibull", init = 0)
fit3 <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
extractAIC(fit1)
extractAIC(fit2)
extractAIC(fit3)
**gastric**

**Gastric cancer data set**

**Description**

Data set from a clinical trial conducted by the Gastrointestinal Tumor Study Group (GTSG) in 1982. The data set refers to the survival times of patients with locally nonresectable gastric cancer. Patients were either treated with chemotherapy combined with radiation or chemotherapy alone.

**Format**

A data frame with 90 rows and 3 variables:

- time: survival times (in days)
- status: failure indicator (1 - failure; 0 - otherwise)
- trt: treatments (1 - chemotherapy + radiation; 0 - chemotherapy alone)

**Author(s)**

Fabio N. Demarqui <fndemarqui@est.ufmg.br>

**References**


**ggresiduals**

**Generic S3 method ggresiduals**

**Description**

Generic S3 method ggresiduals

**Usage**

ggresiduals(object, ...)

**Arguments**

- object: a fitted model object.
- ...: further arguments passed to or from other methods.

**Details**

Generic method to plot residuals of survival models.
Description

ggresiduals method for survstan models

Usage

## S3 method for class 'survstan'
ggresiduals(object, type = c("coxsnell", "martingale", "deviance"), ...)

Arguments

  object  a fitted model object of the class survstan.
  type    type of residuals used in the plot: coxsnell (default), martingale and deviance.
  ...     further arguments passed to or from other methods.

Details

This function produces residuals plots of Cox-Snell residuals, martingale residuals and deviance residuals.

Value

the desired residual plot.

Examples

library(survstan)
ovarian$rx <- as.factor(ovarian$rx)
fit <- aftreg(Surv(futime, fustat) ~ age + rx, data = ovarian, baseline = "weibull", init = 0)
ggresiduals(fit, type = "coxsnell")
ggresiduals(fit, type = "martingale")
ggresiduals(fit, type = "deviance")
**Description**

Reconstructed IPASS clinical trial data reported in Argyropoulos and Unruh (2015). Although reconstructed, this data set preserves all features exhibited in references with full access to the observations from this clinical trial. The data base is related to the period of March 2006 to April 2008. The main purpose of the study is to compare the drug gefitinib against carboplatin/paclitaxel doublet chemotherapy as first line treatment, in terms of progression free survival (in months), to be applied to selected non-small-cell lung cancer (NSCLC) patients.

**Format**

A data frame with 1217 rows and 3 variables:

- time: progression free survival (in months)
- status: failure indicator (1 - failure; 0 - otherwise)
- arm: (1 - gefitinib; 0 - carboplatin/paclitaxel doublet chemotherapy)

**Author(s)**

Fabio N. Demarqui <fndemarqui@est.ufmg.br>

**References**


---

**logLik.survstan**

*Extract Log-Likelihood from a Fitted Model*

**Description**

Extracts the log-likelihood function for a fitted parametric model.

**Usage**

```r
## S3 method for class 'survstan'
logLik(object, ...)
```

**Arguments**

- `object` a fitted model of the class survstan
- `...` further arguments passed to or from other methods.
model.matrix.survstan

Value

the log-likelihood value when a single model is passed to the function; otherwise, a data.frame with
the log-likelihood values and the number of parameters is returned.

Examples

library(survstan)
fit1 <- aftreg(Surv(futime, fustat) ~ 1, data = ovarian, baseline = "weibull", init = 0)
fit2 <- aftreg(Surv(futime, fustat) ~ rx, data = ovarian, baseline = "weibull", init = 0)
fit3 <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
logLik(fit1, fit2, fit3)

model.matrix.survstan  Model.matrix method for survstan models

Description

Reconstruct the model matrix for a survstan model.

Usage

## S3 method for class 'survstan'
model.matrix(object, ...)

Arguments

object  an object of the class survstan.
...

Value

The model matrix (or matrices) for the fit.

Examples

library(survstan)
fit <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
model.matrix(fit)
Description

Function to fit proportional hazards (PH) models.

Usage

`phreg(formula, data, baseline = "weibull", dist = NULL, init = 0, ...)`

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`: data; an optional data frame, list or environment (or object coercible by `as.data.frame` to a data frame) containing the variables in the model. If not found in data, the variables are taken from `environment(formula)`, typically the environment from which function is called.
- `baseline`: the chosen baseline distribution; options currently available are: exponential, weibull, lognormal, loglogistic and Birnbaum-Saunders (fatigue) distributions.
- `dist`: alternative way to specify the baseline distribution (for compatibility with the `survreg` function); default is NULL.
- `init`: initial values specification (default value is 0); see the detailed documentation for `init` in `optimizing`.
- `...`: further arguments passed to other methods.

Value

`phreg` returns an object of class "phreg" containing the fitted model.

Examples

```r
library(survstan)
fit <- phreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull")
summary(fit)
```
Fitting Proportional Odds Models

Description

Function to fit proportional odds (PO) models.

Usage

poreg(formula, data, baseline = "weibull", dist = NULL, init = 0, ...)

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 data an optional data frame, list or environment (or object coercible by as.data.frame
to a data frame) containing the variables in the model. If not found in data, the
variables are taken from environment(formula), typically the environment from
which function is called.
baseline the chosen baseline distribution; options currently available are: exponential,
weibull, lognormal, loglogistic and Birnbaum-Saunders (fatigue) distributions.
dist alternative way to specify the baseline distribution (for compatibility with the
survreg function); default is NULL.
init initial values specification (default value is 0); see the detailed documentation
for init in optimizing.
... further arguments passed to other methods.

Value

poreg returns an object of class "poreg" containing the fitted model.

Examples

library(survstan)
fit <- poreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull")
summary(fit)
**print.summary.survstan**

*Print the summary.survstan output*

**Description**

Produces a printed summary of a fitted survstan model.

**Usage**

```r
## S3 method for class 'summary.survstan'
print(x, ...)
```

**Arguments**

- `x`: an object of the class summary.survstan.
- `...`: further arguments passed to or from other methods.

**Value**

No return value, called for side effects.

---

**rank_models**

*Rank a collection of survstan models*

**Description**

Rank a collection of survstan models

**Usage**

```r
rank_models(formula, data, survreg, baseline, dist = NULL, ...)
```

**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`: an optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which function is called.
- `survreg`: survival regression models to be fitted (AFT, AH, PH, PO and YP).
- `baseline`: baseline distributions to be fitted; options currently available are: exponential, weibull, lognormal, loglogistic and Birnbaum-Saunders (fatigue) distributions.
- `dist`: alternative way to specify the baseline distributions (for compability with the survreg function); default is NULL.
- `...`: further arguments passed to other methods.
value

a tibble containing the fitted models ranked according to their AICs.

examples

library(survstan)
library(dplyr)

veteran <- veteran %>%
    mutate(across(c(trt, prior, celltype), as.factor))
fits <- rank_models(
    formula = Surv(time, status) ~ celltype+karno,
    data = veteran,
    survreg = c("aftreg", "ahreg", "phreg", "poreg", "ypreg"),
    baseline = c("exponential", "weibull", "lognormal", "loglogistic", "fatigue")
)

summary.survstan

summary for a survstan object

description

summary for a survstan object

usage

## S3 method for class 'survstan'
summary(object, conf.level = 0.95, ...)

arguments

  object
  conf.level
  ...

value

  an object of the class summary.survstan containing a summary of the fitted model.
survfit.survstan

survfit method for survstan models

Description
Computes the predicted survivor function for a phpe model.

Usage

## S3 method for class 'survstan'
survfit(formula, newdata, ...)

Arguments

formula an object of the class survstan
newdata a data frame containing the set of explanatory variables.
... further arguments passed to or from other methods.

Value
a list containing the estimated survival probabilities.

Examples

library(survstan)
library(ggplot2)
data(ipass)
ipass$arm <- as.factor(ipass$arm)
fit <- ypreg(Surv(time, status)~arm, data=ipass, baseline = "weibull")
summary(fit)
newdata <- data.frame(arm=as.factor(0:1))
surv <- survfit(fit, newdata)
ggplot(surv, aes(x=time, y=surv, color = arm)) + geom_line()
Usage

tidy(object, conf.level = 0.95, ...)

Arguments

object       a fitted model object.
conf.level   the confidence level required.
...          further arguments passed to or from other methods.

Details

Convert a fitted model into a tibble.

Value

a tibble with a summary of the fit.

tidy.survstan       Tidy a survstan object

Description

Tidy a survstan object

Usage

## S3 method for class 'survstan'
tidy(object, conf.level = 0.95, ...)

Arguments

object       a fitted model object.
conf.level   the confidence level required.
...          further arguments passed to or from other methods.

Details

Convert a fitted model into a tibble.

Value

a tibble with a summary of the fit.
Examples

```r
library(survstan)
fit <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
tidy(fit)
```

Description

Tidy a ypreg object

Usage

```r
## S3 method for class 'ypreg'
tidy(object, conf.level = 0.95, ...)
```

Arguments

- `object` a fitted model object.
- `conf.level` the confidence level required.
- `...` further arguments passed to or from other methods.

Details

Convert a fitted model into a tibble.

Value

a tibble with a summary of the fit.

Examples

```r
library(survstan)
fit <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
tidy(fit)
```
**vcov.survstan**  
**Variance-covariance matrix**

**Description**

This function extracts and returns the variance-covariance matrix associated with the regression coefficients when the maximum likelihood estimation approach is used in the model fitting.

**Usage**

```r
## S3 method for class 'survstan'
vcov(object, all = FALSE, ...)
```

**Arguments**

- `object`: an object of the class survstan.
- `all`: logical; if FALSE (default), only covariance matrix associated with regression coefficients is returned; if TRUE, the full covariance matrix is returned.
- `...`: further arguments passed to or from other methods.

**Value**

the variance-covariance matrix associated with the parameters estimators.

**Examples**

```r
library(survstan)
fit <- aftreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull", init = 0)
vcov(fit)
```

---

**ypreg**  
**Fitting Yang and Prentice Models**

**Description**

Function to fit Yang and Prentice (YP) models.

**Usage**

```r
ypreg(formula, data, baseline = "weibull", dist = NULL, init = 0, ...)
```
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: an optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which function is called.

baseline: the chosen baseline distribution; options currently available are: exponential, weibull, lognormal, loglogistic and Birnbaum-Saunders (fatigue) distributions.

dist: alternative way to specify the baseline distribution (for compatibility with the survreg function); default is NULL.

init: initial values specification (default value is 0); see the detailed documentation for init in optimizing.

... further arguments passed to other methods.

Value

ypreg returns an object of class "ypreg" containing the fitted model.

Examples

library(survstan)
fit <- ypreg(Surv(futime, fustat) ~ ecog.ps + rx, data = ovarian, baseline = "weibull")
summary(fit)
## Index

- **datasets**
  - gastric, 11
  - ipass, 13
  - aftreg, 3
  - ahreg, 4
  - AIC.survstan, 5
  - anova.survstan, 6
  - coef.survstan, 6
  - confint.survstan, 7
  - cross_time, 8
  - cross_time.ypreg, 8
  - estimates, 9
  - extractAIC.survstan, 10
  - gastric, 11
  - ggresiduals, 11
  - ggresiduals.survstan, 12
  - ipass, 13
  - logLik.survstan, 13
  - model.matrix.survstan, 14
  - optimizing, 4, 15, 16, 23
  - phreg, 15
  - poreg, 16
  - print.summary.survstan, 17
  - rank_models, 17
  - summary.survstan, 18
  - survfit.survstan, 19
  - survreg, 4, 15–17, 23
  - survstan (survstan-package), 3
  - survstan-package, 3
  - tidy, 19
  - tidy.survstan, 20
  - tidy.ypreg, 21
  - vcov.survstan, 22
  - ypred, 22