Package ‘survstan’

June 9, 2023

Title  Fitting Survival Regression Models via ‘Stan’
Version  0.0.2
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, ggplot2, gridExtra, MASS, methods, Rcpp (>= 0.12.0), RcppParallel (>= 5.0.1), Rdpack, rlang, rstan (>= 2.18.1), rstantools (>= 2.3.1), tibble
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
URL  https://github.com/fndemarqui/survstan,
     https://fndemarqui.github.io/survstan/
BugReports  https://github.com/fndemarqui/survstan/issues
Suggests  knitr, rmarkdown, testthat (>= 3.0.0)
Config/testthat/edition  3
VignetteBuilder  knitr
NeedsCompilation  yes
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


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aftreg

Fitting Accelerated Failure Time Models

Description

Function to fit accelerated failure time (AFT) models.

Usage

aftreg(formula, data, baseline = c("exponential", "weibull", "lognormal", "loglogistic"), 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 and loglogistic 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

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

Examples

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

ahreg  Fitting Accelerated Hazard Models

Description

Function to fit accelerated hazard (AH) models.

Usage

ahreg(
  formula, 
  data, 
  baseline = c("exponential", "weibull", "lognormal", "loglogistic"),
  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 and loglogistic distributions.
- **dist**: alternative way to specify the baseline distribution (for compability 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.
AIC.survstan

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", init = 0)
summary(fit)

AIC.survstan

Akaike information criterion

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)
Description

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

Usage

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

Arguments

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

Value

the ANOVA table.

Examples

```r
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)
```

Description

Estimated regression coefficients

Usage

```r
## 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)

## S3 method for class 'survstan'

colint(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)
colint(fit)
cross_time  

Generic S3 method cross_time

Usage

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

## 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
estimates

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

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**

```r
## 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**

```r
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**


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**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.
ggresiduals.survstan

ggresiduals method for survstan 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.
...
  further arguments passed to or from other methods.

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 = c("exponential", "weibull", "lognormal", "loglogistic"),
  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 and loglogistic distributions.
  dist    alternative way to specify the baseline distribution (for compability with the survreg function); default is NULL.
  init    initial values specification (default value is 0); see the detailed documentation for init in optimizing.
  ...

Value

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

Examples

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

Fitting Proportional Odds Models

Description

Function to fit proportional odds (PO) models.

Usage

poreg(
  formula,
  data,
  baseline = c("exponential", "weibull", "lognormal", "loglogistic"),
  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 and loglogistic 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", init = 0)
summary(fit)
print.summary.survstan

Print the summary.survstan output

Description

Produces a printed summary of a fitted survstan model.

Usage

## 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.

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 the result of a call to summary.survstan
conf.level the confidence level required.

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

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

```r
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

```r
## 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)
```
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

## 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

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

Description

Function to fit Yang and Prentice (YP) models.
Usage

ypreg(
  formula,
  data,
  baseline = c("exponential", "weibull", "lognormal", "loglogistic"),
  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 and loglogistic 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", init = 0)
summary(fit)
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