Package 'stanSPsurv'

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Type Package

Title Bayesian Split-Population Survival Models with Stan

Version 0.1.0

Description Fits Bayesian split-population (cure) survival models with Weibull or log-logistic event-time distributions using Stan via 'cmdstanr'. Provides pooled, exchangeable group-frailty, and scaled proper conditional autoregressive (CAR) spatial specifications through a common formula interface. Includes methods for coefficient extraction, prediction, frailty visualization, survival curves, and choropleth mapping of spatial effects.

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Imports stats

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VignetteBuilder knitr

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`coef.stanSPsurv` *Extract coefficients from a stanSPsurv fit*

Description

Extract coefficients from a stanSPsurv fit

Usage

```
## S3 method for class 'stanSPsurv'
coef(object, component = c("survival", "split"), ...)
```

Arguments

`object`	A fitted `stanSPsurv` object.
`component`	Which stage: `"survival"` (beta) or `"split"` (gamma).
`...`	Not used.

Value

A tibble of posterior summaries for the requested coefficients.

`conflict_spells` *Simulated post-conflict survival data*

Description

A simulated dataset of 300 post-conflict episodes across 20 countries, designed to illustrate split-population survival models. Countries are grouped into 4 geographic regions with a chain adjacency structure.

Usage

```
data(conflict_spells)
```

Format

A data frame with 300 rows and 8 columns:

time Duration until war recurrence or censoring.

event Binary indicator: 1 if war recurred, 0 if censored.

victory Binary: 1 if the previous war ended in decisive victory.

gdp Log GDP per capita (standardized).

peacekeeping Binary: 1 if UN peacekeepers were deployed.

country Factor with 20 country labels.

region Factor with 4 region labels.

country_id Integer country identifier (1–20).

Details

The data are entirely simulated with known parameter values (beta = c(-2.0, -0.5, 0.3, -0.8), gamma = c(0.8, -0.6), shape = 1.2) and are intended for package examples and testing. They do not represent real conflict data.

Source

Simulated for package illustration.

Examples

```
data(conflict_spells)
head(conflict_spells)
```

frailty *Extract group or spatial frailties*

Description

Returns posterior summaries for the group-level random effects (frailties) from an exchangeable or spatial model.

Usage

```
frailty(object, stage = c("survival", "split"), ...)
```

Arguments

object	A fitted stanSPsurv object.
stage	Which stage: "survival" (w) or "split" (v).
...	Not used.

Value

A data frame with posterior summaries and group labels. Returns an empty data frame for pooled models.

plot.stanSPsurv *Plot a stanSPsurv fit*

Description

Produces a coefficient forest plot showing posterior means and 90\ credible intervals for the survival-stage (beta) and split-stage (gamma) coefficients. Intercepts are omitted by default.

Usage

```
## S3 method for class 'stanSPsurv'
plot(
  x,
  which = c("both", "survival", "split"),
  include_intercept = FALSE,
  prob = 0.9,
  main = "Coefficient plot",
  ...
)
```

Arguments

x	A fitted stanSPsurv object.
which	Which components to plot: "both", "survival", or "split".
include_intercept	Logical; include intercept terms?
prob	Width of the credible interval (default 0.90).
main	Plot title.
...	Additional arguments passed to plot.default().

Value

Invisible NULL. Called for its side effect.

---

plot_choropleth *Choropleth map of spatial frailties*

Description

Draws a choropleth (filled map) of posterior-mean frailties from a spatial stanSPsurv model. Two back-ends are supported:

Usage

```
plot_choropleth(
  object,
  stage = c("survival", "split"),
  regions = NULL,
  sf_map = NULL,
  sf_key = NULL,
  palette = NULL,
  main = NULL,
  ...
)
```

Arguments

object	A fitted stanSPsurv object with structure = "spatial".
stage	Which frailty: "survival" (w) or "split" (v).
regions	Character vector of region names for the maps back-end, ordered to match group_levels.
sf_map	An sf object for the sf back-end.
sf_key	Column name in sf_map that matches group_levels.
palette	A vector of colours for the gradient. Default is a blue-white-red diverging palette.
main	Plot title.
...	Additional arguments passed to plot().

Details

- `maps` **back-end** (default): pass `regions`, a character vector of country or region names matching the `maps::world` database, in the same order as the spatial units used when fitting.
- `sf` **back-end**: pass `sf_map`, an `sf` object with a geometry column and a key column whose values match `group_levels`.

Value

Invisible data frame with group, mean frailty, and assigned colour.

`plot_frailty` *Plot group or spatial frailties*

Description

Caterpillar plot of posterior frailty estimates with credible intervals, ordered by posterior mean.

Usage

```
plot_frailty(object, stage = c("survival", "split"), prob = 0.9, ...)
```

Arguments

`object`	A fitted `stanSPsurv` object (exchangeable or spatial).
`stage`	Which frailty: `"survival"` (w) or `"split"` (v).
`prob`	Width of the credible interval (default 0.90).
`...`	Additional arguments passed to `plot.default()`.

Value

Invisible data frame of frailty summaries.

`plot_survival` *Plot survival curves from a stanSPsurv fit*

Description

Draws posterior-mean survival curves (and pointwise credible bands) for one or more covariate profiles.

Usage

```
plot_survival(
  object,
  newdata,
  times,
  prob = 0.9,
  labels = NULL,
  cols = NULL,
  main = "Survival curves",
  ...
)
```

Arguments

object	A fitted stanSPsurv object.
newdata	A data frame of covariate profiles (one row per curve).
times	Numeric vector of time points at which to evaluate survival.
prob	Width of the credible band (default 0.90).
labels	Optional character vector of curve labels (length nrow(newdata)).
cols	Optional colour vector.
main	Plot title.
...	Additional arguments passed to plot.default().

Value

Invisible matrix of posterior-mean survival values (rows = profiles, cols = times).

---

plot_susceptibility *Plot susceptibility across a covariate range*

Description

Shows how the posterior-mean probability of susceptibility varies with one split-stage covariate, holding others at their means.

Usage

```
plot_susceptibility(
  object,
  variable,
  data,
  n_points = 100L,
  prob = 0.9,
  main = "Susceptibility",
  ...
)
```

Arguments

`object`	A fitted `stanSPsurv` object.
`variable`	Name of the split-formula covariate to vary.
`data`	The original data frame used for fitting (needed to compute covariate means for held-constant variables).
`n_points`	Number of points along the covariate range (default 100).
`prob`	Width of the credible band (default 0.90).
`main`	Plot title.
`...`	Additional arguments passed to `plot.default()`.

Value

Invisible data frame with columns `x`, `mean`, `lo`, `hi`.

`predict.stanSPsurv` *Predict from a stanSPsurv fit*

Description

Compute posterior-mean susceptibility probabilities or survival probabilities for new covariate profiles.

Usage

```
## S3 method for class 'stanSPsurv'
predict(
  object,
  newdata = NULL,
  type = c("susceptibility", "survival"),
  times = NULL,
  ...
)
```

Arguments

`object`	A fitted `stanSPsurv` object.
`newdata`	A data frame of covariate profiles.
`type`	`"susceptibility"` for P(susceptible) or `"survival"` for S(t).
`times`	Numeric vector of positive time points (required when `type = "survival"`).
`...`	Not used.

Value

For `"susceptibility"`, a numeric vector of posterior-mean probabilities (one per row of `newdata`). For `"survival"`, a matrix of posterior-mean survival probabilities (rows = profiles, columns = times).

print.stanSPsurv *Print a stanSPsurv fit*

Description

Print a stanSPsurv fit

Usage

```
## S3 method for class 'stanSPsurv'
print(x, ...)
```

Arguments

x	A fitted stanSPsurv object.
...	Not used.

Value

Invisible x.

stan_exchange_spsurv *Fit an exchangeable-frailty split-population survival model*

Description

Fits a Bayesian split-population survival model with exchangeable (iid normal) group-level frailties for both the survival and split stages.

Usage

```
stan_exchange_spsurv(
  formula,
  split_formula,
  data,
  group,
  spell = NULL,
  form = c("weibull", "loglogistic"),
  ...
)
```

Arguments

formula	Survival-stage formula with a two-column response Surv(time, event).
split_formula	Formula for the latent susceptibility probability.
data	A data frame.
group	Group identifier, supplied as a column name or vector.
spell	Episode identifier. Required for counting-process responses; split-stage covariates must be constant within each episode.
form	Event-time distribution: "weibull" or "loglogistic".
...	Sampling arguments passed to the CmdStan sampler (e.g., chains, iter_warmup, iter_sampling, seed).

Value

An object of class stanSPsurv.

Examples

```
library(survival)
data(lung)
lung$inst <- factor(lung$inst)
fit <- stan_exchange_spsurv(
  Surv(time, status) ~ age + sex,
  split_formula = ~ age,
  data = lung, group = inst,
  form = "weibull",
  chains = 2, iter_warmup = 200, iter_sampling = 200
)
summary(fit)
```

---

stan_pooled_spsurv *Fit a pooled split-population survival model*

Description

Fits a Bayesian split-population (cure) survival model with no group-level heterogeneity using Stan.

Usage

```
stan_pooled_spsurv(
  formula,
  split_formula,
  data,
  spell = NULL,
  form = c("weibull", "loglogistic"),
  ...
)
```

Arguments

formula	Survival-stage formula with a two-column response Surv(time, event).
split_formula	Formula for the latent susceptibility probability.
data	A data frame.
spell	Episode identifier. Required for counting-process responses; split-stage covariates must be constant within each episode.
form	Event-time distribution: "weibull" or "loglogistic".
...	Sampling arguments passed to the CmdStan sampler (e.g., chains, iter_warmup, iter_sampling, seed).

Value

An object of class stanSPsurv.

Examples

```
library(survival)
data(lung)
fit <- stan_pooled_spsurv(
  Surv(time, status) ~ age + sex,
  split_formula = ~ age + sex,
  data = lung,
  form = "weibull",
  chains = 2, iter_warmup = 200, iter_sampling = 200
)
summary(fit)
coef(fit, component = "survival")
```

---

stan_spatial_spsurv *Fit a spatial CAR split-population survival model*

Description

Fits a Bayesian split-population survival model with a scaled proper conditional autoregressive (BYM2) spatial structure for both the survival and split stages.

Usage

```
stan_spatial_spsurv(
  formula,
  split_formula,
  data,
  area,
  adjacency,
  spell = NULL,
```

```
  form = c("weibull", "loglogistic"),
  ...
)
```

Arguments

formula	Survival-stage formula with a two-column response Surv(time, event).
split_formula	Formula for the latent susceptibility probability.
data	A data frame.
area	Spatial unit identifier, supplied as a column name or vector.
adjacency	Symmetric binary adjacency matrix ordered by the unique values of area.
spell	Episode identifier. Required for counting-process responses; split-stage covariates must be constant within each episode.
form	Event-time distribution: "weibull" or "loglogistic".
...	Sampling arguments passed to the CmdStan sampler (e.g., chains, iter_warmup, iter_sampling, seed).

Value

An object of class stanSPsurv.

---

summary.stanSPsurv *Summarise a stanSPsurv fit*

Description

Returns posterior summaries (mean, median, sd, quantiles, Rhat, ESS) for all model parameters.

Usage

```
## S3 method for class 'stanSPsurv'
summary(object, ...)
```

Arguments

object	A fitted stanSPsurv object.
...	Not used.

Value

A tibble of posterior summaries produced by cmdstanr::CmdStanMCMC.

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