

Package: predHCS (via r-universe)

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Type Package

Title Point and Interval Prediction for Censored Data under Various Hybrid Censoring Schemes

Version 0.1.0

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Description Implements generalized statistical point prediction and prediction intervals for future failure times under various hybrid censoring schemes. Supported censoring schemes include Type-I, Type-II, Generalized Type-I, Generalized Type-II, Unified, Progressive Type-I, and Progressive Type-II hybrid censoring schemes. Available prediction methods include Best Unbiased Predictor (BUP), Conditional Median Predictor (CMP), Maximum Likelihood Predictor (MLP), equal-tailed classical prediction intervals, Highest Conditional Density (HCD) prediction intervals, and Bayesian prediction intervals. Algorithms accept user-defined continuous probability density functions, cumulative distribution functions, quantile functions, or survival functions along with estimated parameter values. Methodological foundations are based on Balakrishnan, Cramer, and Kundu (2023, ISBN:978-0123983879), Shafay and Balakrishnan (2012) <doi:10.1080/03610918.2011.579367> for Type-I hybrid censoring, Balakrishnan and Shafay (2012) <doi:10.1080/03610926.2010.543300> for Type-II hybrid censoring, Shafay (2017) <doi:10.1080/03610926.2016.1200093> for Generalized Type-I hybrid censoring, Shafay (2016) <doi:10.1080/00949655.2015.1096361> for Generalized Type-II hybrid censoring, Mohie El-Din, Nagy, and Shafay (2017) <doi:10.18576/jsap/060113> for Unified hybrid censoring, Ebrahimi (1992) <doi:10.1109/24.126685>, Valiollahi, Asgharzadeh, and Kundu (2017) <doi:10.1214/15-BJPS302>, and Asgharzadeh, Valiollahi, and Kundu (2015) <doi:10.1080/00949655.2013.848451>.

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predHCS-package	<i>Point and Interval Prediction for Censored Data under Various Hybrid Censoring Schemes</i>
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Description

Implements generalized statistical point prediction and prediction intervals for future failure times under various hybrid censoring schemes. Supported censoring schemes include Type-I, Type-II, Generalized Type-I, Generalized Type-II, Unified, Progressive Type-I, and Progressive Type-II hybrid censoring schemes.

Details

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The main function is [predict_censored](#), which acts as a unified interface for point and interval prediction under any supported hybrid censoring scheme.

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References

Balakrishnan, N., Cramer, E., & Kundu, D. (2023). *Hybrid censoring know-how: Designs and implementations*. Academic Press.

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Ebrahimi, N. (1992). Prediction of failure times, given information on failure times of composite subsystems. *Journal of Statistical Planning and Inference*, 33(2), 241-256.

Valiollahi, R., Asgharzadeh, A., & Kundu, D. (2017). Prediction of future failures for generalized exponential distribution under Type-I or Type-II hybrid censoring. *Brazilian Journal of Probability and Statistics*, 31(1), 41-61.

Asgharzadeh, A., Valiollahi, R., & Raqab, M. Z. (2015). Stress-strength reliability of Weibull distribution under progressive Type-II censoring. *Communications in Statistics - Theory and Methods*, 44(8), 1618-1631.

Examples

```
data_obs <- c(0.5, 1.2, 2.1, 3.4, 4.0)
cdf_exp <- function(x, par) pexp(x, rate = par[1])
res <- predict_censored(data = data_obs, n = 10, scheme = "Type-I",
                        r = 6, T0 = 5.0, s = 1:2, cdf = cdf_exp, param = 0.5)
print(res)
```

methods

S3 Methods for predhcs Objects

Description

Print, summary, and plot methods for objects of class predhcs.

Usage

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

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

## S3 method for class 'predhcs'
plot(x, ...)
```

Arguments

x An object of class predhcs.
 object An object of class predhcs.
 ... Additional arguments.

Value

print and summary invisibly return the object. plot creates a graphical display.

Examples

```
data_obs <- c(0.4, 0.8, 1.3, 2.1, 3.0)
cdf_exp <- function(x, par) pexp(x, rate = par[1])
res <- pred_type1_hybrid(data = data_obs, n = 10, r = 6, T0 = 4.0, s = 1:2,
                        cdf = cdf_exp, param = 0.5)

print(res)
summary(res)
plot(res)
```

predict_censored	<i>Unified Interface for Point and Interval Prediction under Hybrid Censoring</i>
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Description

Unified entry point function to perform point prediction (BUP, CMP, MLP, Bayesian) and interval prediction (Classical, HCD, Bayesian) under various hybrid censoring schemes.

Usage

```
predict_censored(data, n, scheme = c("Type-I", "Type-II", "Gen-Type-I",
  "Gen-Type-II", "Unified", "Prog-Type-I", "Prog-Type-II"), T0 = NULL,
  T1 = NULL, T2 = NULL, r = NULL, k = NULL, R = NULL, s = 1, cdf = NULL,
  pdf = NULL, qdf = NULL, surv = NULL, param = NULL, conf.level = 0.95,
  bayes.draws = NULL)
```

Arguments

<code>data</code>	Numeric vector of observed failure times.
<code>n</code>	Total initial sample size.
<code>scheme</code>	Character string specifying the hybrid censoring scheme.
<code>T0</code>	Pre-fixed termination or inspection time threshold.
<code>T1</code>	First time threshold for Unified scheme.
<code>T2</code>	Second time threshold for Unified scheme.
<code>r</code>	Target number of failures.
<code>k</code>	Lower threshold for failure count.
<code>R</code>	Numeric vector of progressive removals.
<code>s</code>	Integer or vector of integers specifying future failure steps to predict.
<code>cdf</code>	Optional user-defined cumulative distribution function.
<code>pdf</code>	Optional user-defined probability density function.
<code>qdf</code>	Optional user-defined quantile function.
<code>surv</code>	Optional user-defined survival function.
<code>param</code>	Parameter vector or list for the distribution.
<code>conf.level</code>	Confidence level for prediction intervals (default 0.95).
<code>bayes.draws</code>	Optional matrix of MCMC posterior draws for Bayesian prediction.

Value

An object of class `predhcs` containing prediction results.

Examples

```
data_obs <- c(0.4, 0.8, 1.3, 2.1, 3.0)
cdf_exp <- function(x, par) pexp(x, rate = par[1])
res1 <- predict_censored(data = data_obs, n = 10, scheme = "Type-I",
                        r = 6, T0 = 4.0, s = 1:2, cdf = cdf_exp, param = 0.5)
print(res1)
```

schemes

Specific Hybrid Censoring Scheme Prediction Functions

Description

Functions to compute point predictions and prediction intervals under specific hybrid censoring schemes.

Usage

```

pred_type1_hybrid(data, n, r, T0, s = 1, cdf = NULL, pdf = NULL, qdf = NULL,
  surv = NULL, param = NULL, conf.level = 0.95, bayes.draws = NULL)

pred_type2_hybrid(data, n, r, T0, s = 1, cdf = NULL, pdf = NULL, qdf = NULL,
  surv = NULL, param = NULL, conf.level = 0.95, bayes.draws = NULL)

pred_gen_type1_hybrid(data, n, k, r, T0, s = 1, cdf = NULL, pdf = NULL,
  qdf = NULL, surv = NULL, param = NULL, conf.level = 0.95, bayes.draws = NULL)

pred_gen_type2_hybrid(data, n, k, r, T0, s = 1, cdf = NULL, pdf = NULL,
  qdf = NULL, surv = NULL, param = NULL, conf.level = 0.95, bayes.draws = NULL)

pred_unified_hybrid(data, n, k, r, T1, T2, s = 1, cdf = NULL, pdf = NULL,
  qdf = NULL, surv = NULL, param = NULL, conf.level = 0.95, bayes.draws = NULL)

pred_prog_type1_hybrid(data, n, R, T0, s = 1, cdf = NULL, pdf = NULL,
  qdf = NULL, surv = NULL, param = NULL, conf.level = 0.95, bayes.draws = NULL)

pred_prog_type2_hybrid(data, n, R, T0, s = 1, cdf = NULL, pdf = NULL,
  qdf = NULL, surv = NULL, param = NULL, conf.level = 0.95, bayes.draws = NULL)

```

Arguments

<code>data</code>	Numeric vector of observed failure times.
<code>n</code>	Total initial sample size.
<code>r</code>	Target number of failures.
<code>k</code>	Lower threshold for failure count.
<code>T0</code>	Termination time threshold.
<code>T1</code>	First time threshold for Unified scheme.
<code>T2</code>	Second time threshold for Unified scheme.
<code>R</code>	Progressive removals vector.
<code>s</code>	Future failure step(s) to predict.
<code>cdf</code>	Optional user CDF.
<code>pdf</code>	Optional user PDF.
<code>qdf</code>	Optional user Quantile function.
<code>surv</code>	Optional user Survival function.
<code>param</code>	Distribution parameters.
<code>conf.level</code>	Confidence level for prediction intervals.
<code>bayes.draws</code>	Optional MCMC posterior draws matrix.

Value

An object of class `predhcs` containing prediction results.

Examples

[illegible]

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