Package: gibbsTI (via r-universe)

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Title Calibrated Gibbs Posteriors for Tolerance Intervals

Version 0.1.0

Description Provides tools for constructing one-sided and two-sided nonparametric tolerance intervals using calibrated Gibbs posteriors. The methods target population quantiles and content levels while achieving nominal frequentist coverage through data-driven calibration. The methodology is described in Pourmohamad, Richardson, and Sansó (2026) <doi:10.1080/00401706.2026.2699103>.

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Description

Internal wrapper for GPC calibration

Usage

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  x,
  side,
  target,
  content,
  confidence,
  tau,
  tau_lower,
  tau_upper,
  verbose,
  eta0,
  max_iter,
  B,
  tol,
  c,
  gamma,
  prop_sd,
  w,
  m,
  n_samps_boot,
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)
```

.run_sampler *Internal wrapper for final MCMC sampling*

Description

Internal wrapper for final MCMC sampling

Usage

```
.run_sampler(
  x,
  side,
  target,
```

```
  tau,
  tau_lower,
  tau_upper,
  eta,
  n_mcmc,
  burnin,
  thin,
  w,
  m,
  prop_sd,
  verbose
)
```

`gibbsTI` *Fit a Gibbs Posterior Tolerance Interval*

Description

Constructs a one-sided or two-sided nonparametric tolerance interval from a calibrated Gibbs posterior. The learning rate `eta` is chosen automatically by Gibbs posterior calibration (GPC) so that the interval attains the nominal frequentist coverage, or it can be fixed by the user.

Usage

```
gibbsTI(
  x,
  side = c("one", "two"),
  type = c("upper", "lower"),
  target = c("content", "quantile"),
  content = 0.95,
  confidence = 0.9,
  tau = NULL,
  tau_lower = NULL,
  tau_upper = NULL,
  eta_method = c("GPC", "fixed"),
  eta = NULL,
  max_iter = 15,
  control = list(),
  n_mcmc = 5000,
  burnin = 1000,
  thin = 1,
  seed = NULL,
  verbose = TRUE
)
```

Arguments

x	Numeric vector of observations (at least 5, all finite).
side	Direction of the interval: "one" (one-sided) or "two" (two-sided, centered).
type	For one-sided intervals only, "upper" (bound above) or "lower" (bound below). Ignored when side = "two".
target	Calibration target: "content" (default; the interval is defined by a population proportion) or "quantile" (the interval targets explicit population quantiles supplied through tau, tau_lower, tau_upper).
content	Population proportion the interval should contain, in (0, 1) (e.g. 0.95). Used when target = "content"; when target = "quantile" it only supplies defaults for any unset tau_* argument.
confidence	Frequentist confidence level in (0, 1) (e.g. 0.90). This is both the GPC coverage target (1 - alpha) and the posterior level read off as the reported limit.
tau	Target quantile for a one-sided "quantile" interval, in (0, 1). Only used when target = "quantile"; ignored when target = "content".
tau_lower, tau_upper	Lower/upper target quantiles for a two-sided "quantile" interval, in (0, 1) with tau_lower < tau_upper. Only used when target = "quantile"; ignored when target = "content".
eta_method	How the Gibbs learning rate eta is chosen: "GPC" (default; data-driven calibration) or "fixed" (use the supplied eta).
eta	Gibbs learning rate (positive). Optional starting value when eta_method = "GPC" (defaults to 1); required when eta_method = "fixed".
max_iter	Maximum number of Robbins-Monro iterations for the GPC search (default 15). Only used when eta_method = "GPC".
control	A list of control parameters for the MCMC samplers and GPC: • B: Number of bootstrap replicates for calibration (default 200). • tol: Convergence tolerance for eta (default 1e-3). • c, gamma: Step-size parameters for Robbins-Monro (defaults 0.5, 0.75). • w, m: Slice sampler width and max steps for one-sided intervals. • prop_sd: Proposal standard deviation for Metropolis-Hastings in the two-sided case. • n_samps_calib: MCMC samples used per bootstrap during calibration (default 1000). • burnin_calib: Burn-in used per bootstrap during calibration (default 200).
n_mcmc	Number of posterior draws retained for the final interval, after burn-in and thinning (default 5000).
burnin	Number of initial iterations discarded as burn-in (default 1000).
thin	Thinning interval: every thin-th post-burn-in draw is kept (default 1).
seed	Optional integer random seed for reproducibility.
verbose	Logical; if TRUE, prints progress messages.

Value

An object of class "gibbsTI": a list with the fitted interval (a numeric limit for one-sided fits, or a list with lower and upper for two-sided fits), the calibrated eta, the retained posterior samples, the data, the quantile level(s) tau_used, calibration diagnostics (calibrated_coverage, eta_history), and the settings used. Use print(), summary(), and plot() on the result.

Examples

```
set.seed(1)
x <- rnorm(50)

# Fast: fix the learning rate (no calibration search)
fit <- gibbsTI(x, side = "one", type = "upper", eta_method = "fixed",
               eta = 1, n_mcmc = 500, burnin = 200, verbose = FALSE)
print(fit)


# Data-driven GPC calibration (slower) for a two-sided 95%/90% interval
fit2 <- gibbsTI(x, side = "two", content = 0.95, confidence = 0.90,
                seed = 1, verbose = FALSE)
summary(fit2)
```

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