

Package ‘BayesCOOP’

October 25, 2025

Type Package

Title Implements the BayesCOOP Methodology for Supervised Multimodal Integration

Version 0.1.0

Description Combines jittered group spike-and-slab LASSO regularization with intermediate fusion to enable integrative learning across multiple data modalities. For uncertainty quantification, BayesCOOP applies the Bayesian bootstrap to generate approximate posterior samples by performing maximum a posteriori (MAP) estimation on jittered and resampled multimodal datasets. Currently, only continuous outcomes are supported.

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Imports caret, dplyr, glmnet, MCMCpack, rmutl, survival, truncnorm, utils

Roxygen list(markdown = TRUE)

RoxygenNote 7.3.3

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Description

This function implements the BayesCOOP methodology for supervised multimodal integration. It combines jittered group spike-and-slab LASSO regularization with intermediate fusion to enable integrative learning across multiple data modalities. For uncertainty quantification, BayesCOOP applies the Bayesian bootstrap to generate approximate posterior samples by performing maximum a posteriori (MAP) estimation on jittered and resampled multimodal datasets. Currently, only continuous outcomes are supported.

Usage

```
bayesCoop(
  data_train,
  data_test,
  family = "gaussian",
  ss = c(0.05, 1),
  group = TRUE,
  bb = TRUE,
  alpha_dirich = 1,
  bbiters = 1100,
  bbburn = 100,
  maxit = 100,
  filter = TRUE,
  abd_thresh = 0,
  prev_thresh = 0.1,
  Warning = TRUE,
  verbose = TRUE,
  control = list()
)
```

Arguments

<code>data_train</code>	a list of <code>feature_table</code> , <code>sample_metadata</code> and <code>feature_metadata</code> from training data (unstandardized). See <i>IntegratedLearner</i> for more details.
<code>data_test</code>	a list of <code>feature_table</code> , <code>sample_metadata</code> and <code>feature_metadata</code> from testing data (unstandardized). See <i>IntegratedLearner</i> for more details.
<code>family</code>	currently supports only Gaussian family. Default: "gaussian".
<code>ss</code>	a length-2 numeric vector giving the spike/sLab scales $c(s_0, s_1)$ with $s_0 < s_1$. Default: $c(0.05, 1)$.
<code>group</code>	logical. If TRUE, predictors are grouped by modality and given a group spike-and-slab prior. If FALSE, no grouping is used. Default: TRUE.
<code>bb</code>	logical. If TRUE, run full Bayesian bootstrap inference; if FALSE, run MAP estimation over a user-supplied rho grid in <code>control</code> . Default: TRUE.
<code>alpha_dirich</code>	Dirichlet concentration for Bayesian bootstrap weights. Default: 1.
<code>bbiters</code>	number of Bayesian bootstrap iterations. Default: 1100.
<code>bbburn</code>	number of burn-in iterations discarded from the bootstrap. Default: 100.
<code>maxit</code>	maximum EM iterations in the inner optimizer. Default: 100.
<code>filter</code>	logical. If TRUE, apply abundance/prevalence filtering to features. Default: TRUE.
<code>abd_thresh</code>	minimum abundance threshold for keeping a feature. Default: 0.
<code>prev_thresh</code>	minimum prevalence threshold (proportion of samples above <code>abd_thresh</code>). Default: 0.1.
<code>Warning</code>	logical. If TRUE, emit non-convergence warnings. Default: TRUE.
<code>verbose</code>	logical. If TRUE, print iteration counts and runtime. Default: TRUE.
<code>control</code>	a named list with element <code>rho</code> , giving one or more candidate rho values to try when <code>bb = FALSE</code> .

Value

If `bb = TRUE`, a list with:

<code>y_samples</code>	posterior predictive draws (approximate)
<code>y_pred</code>	posterior predictive median for each held-out sample
<code>mspe</code>	mean squared prediction error on test data
<code>beta_samples</code>	posterior draws of regression coefficients
<code>beta_postmed</code>	posterior median coefficients
<code>rho_samples</code>	posterior draws of consensus penalty ρ
<code>rho_postmed</code>	posterior median of ρ
<code>errVar_samples</code>	posterior draws of residual variance
<code>time</code>	runtime in minutes

If `bb = FALSE`, a list with:

<code>y_pred</code>	predicted response values on test data
<code>mspe</code>	mean squared prediction error on test data
<code>beta_MAP</code>	MAP estimate of regression coefficients
<code>rho_MAP</code>	selected ρ (minimizing MSPE over <code>control\$rho</code>)
<code>time</code>	runtime in minutes

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