Package: scov (via r-universe)

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Type Package

Title Structured Covariances Estimators for Pairwise and Spatial Covariates

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Description Implements estimators for structured covariance matrices in the presence of pairwise and spatial covariates. Metodiev, Perrot-Dockès, Ouadah, Fosdick, Robin, Latouche & Raftery (2026) <doi:10.1214/26-AOAS2183>.

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Encoding UTF-8

Imports Matrix, missMDA, mvtnorm, ohenery, pracma, quadprog, withr, purrr, future, future.apply

VignetteBuilder knitr

Suggests knitr, markdown, corrplot

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Config/pak/sysreqs cmake libfreetype6-dev make libicu-dev libpng-dev libuv1-dev libx11-dev zlib1g-dev

Repository https://m-metodiev.r-universe.dev

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scov *Computes a structured estimator for covariance matrices*

Description

This function computes the WSCE, SCE or IVE estimator for large covariances in the presence of pairwise and spatial covariates from Metodiev et al. (2026).

Usage

```
scov(
  pairwise_covariate_matrices,
  dataset,
  adj_matrix = NULL,
  mean_estim = NULL,
  sd_estim = NULL,
  grid_size = 100,
  parallelize = FALSE,
  ncores = 8,
  adj_positions = 1:nrow(adj_matrix),
  interaction_effects = list(),
  init = NULL,
  use_bootstrap = FALSE,
  num_bootstrap_iters = 100,
  semiparametric = FALSE,
  misspecification = FALSE,
  seed = 0,
  verbose = TRUE,
  joint_estimation = FALSE
)
```

Arguments

pairwise_covariate_matrices	named list of square matrices
dataset	the dataset given in matrix form
adj_matrix	adjacency matrix of the spatial covariate
mean_estim	mean vector estimate
sd_estim	standard deviation vector estimate
grid_size	grid-size for spatial effect
parallelize	uses parallel-processing if TRUE
ncores	number of cores for the parallelization
adj_positions	positions within the adjacency matrix
interaction_effects	list of interaction effects

`init`	the initialization parameter vector
`use_bootstrap`	uses bootstrapping if TRUE
`num_bootstrap_iters`	number of bootstrap simulations
`semiparametric`	computes the IVE if TRUE, the SCE else
`misspecification`	computes the WSCE if TRUE, the WSCE else
`seed`	a seed (can't be set to NULL)
`verbose`	prints progress if TRUE
`joint_estimation`	estimates everything jointly if TRUE, uses a 2 step procedure if FALSE

Value

Returns a named list with the following elements:

parm, estimated parameters of pairwise, spatial effects average_effects, average effects of the covariates corrmat_estim, estimator of the correlation matrix covmat_estim, estimator of the covariance matrix bic, the Bayesian information criterion (BIC) lambda, the asymptotically optimal weight of the WSCE

References

Martin Metodiev. Marie Perrot-Dockès. Sarah Ouadah. Bailey K. Fosdick. Stéphane Robin. Pierre Latouche. Adrian E. Raftery. "A structured estimator for large covariance matrices in the presence of pairwise and spatial covariates." Ann. Appl. Stat. 20 (2) 1736 - 1765, June 2026.

Examples

```
intercept = matrix(1,ncol=4,nrow=4)
X1 = rbind(c(1,1,1,0),c(1,1,1,0),c(1,1,1,0),c(0,0,0,1))
X2 = rbind(c(1,0,0,0),c(0,1,1,1),c(0,1,1,1),c(0,1,1,1))
covar_mats = list(intercept=intercept,X1=X1,X2=X2)
adj_matrix = rbind(c(0,1,0,0),c(1,0,0,0),c(0,0,0,1),c(0,0,1,0))
mean = rep(0,4)
sigma = 0.05*intercept+0.2*X1+0.2*X2+0.1*X2*X1+0.4*(diag(4) + adj_matrix)
diag(sigma) = 1
dataset = mvtnorm::rmvnorm(1000,mean=mean,sigma=sigma)
scov(covar_mats, dataset, adj_matrix,
interaction_effects=list(c("X1","X2")),
parallelize=FALSE,ncores=1)
```

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