Package: mpem (via r-universe)

October 18, 2026

Type Package

Title Matrix Partial EM for Incomplete Matrix-Normal Data

Version 0.1.0

Description Fits single-component and finite-mixture Kronecker-structured matrix-normal models and imputes incomplete matrix-variate data using matrix partial expectation-maximization. General MPEM handles arbitrary missingness, while Rect-MPEM exploits rectangular structural missingness. The methods are described in Lu, Andrews and Browne (2026) ``An Efficient EM Algorithm for Both Element-Wise and Structural Missingness in Matrix-Variate Normal Mixture Models" <doi:10.48550/arXiv.2609.00616>.

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URL https://github.com/LHZMix/MPEM

BugReports https://github.com/LHZMix/MPEM/issues

Encoding UTF-8

RoxygenNote 7.3.3

Depends R (>= 4.1.0)

Imports Rcpp, stats

LinkingTo Rcpp, RcppArmadillo

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

NeedsCompilation yes

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Repository https://cran.r-universe.dev

Date/Publication 2026-09-18 16:34:37 UTC

RemoteUrl https://github.com/cran/mpem

RemoteRef HEAD

RemoteSha dd3fe80d6f50e310975ada4cdbcf08f23d819afa

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`mpem` *Matrix partial EM for incomplete matrix-normal data*

Description

`mpem()` fits either one matrix-normal distribution or a finite mixture of matrix-normal distributions. It estimates separable row and column covariance matrices and imputes missing entries. General MPEM handles arbitrary missingness, while Rect-MPEM exploits a rectangular missing block within each matrix observation. Set `G > 1` to estimate component membership and component-specific parameters.

Usage

```
mpem(
  X,
  row_dim = NULL,
  col_dim = NULL,
  method = c("auto", "arbitrary", "structural"),
  sweeps = 1L,
  tol = 1e-04,
  max_iter = 1000L,
  init = NULL,
  G = 1L,
  mixture_init = c("kmeans", "random"),
  seed = 1L,
  nstart = 10L,
  warm_start = 1,
  ridge = 1e-08,
  verbose = interactive()
)
```

Arguments

`X`	A `row_dim` by `col_dim` by `n` numeric array, or an `n` by `row_dim * col_dim` numeric matrix. Missing values must be represented by `NA`.
`row_dim`	Number of rows in each matrix observation. Inferred from an array and required for a matrix.
`col_dim`	Number of columns in each matrix observation. Inferred from an array and required for a matrix.

method	Missing-data method. "arbitrary" uses general MPEM; "structural" uses Rect-MPEM and requires at most one rectangular missing block per observation. "auto" selects Rect-MPEM when every nonempty missingness pattern is rectangular and otherwise selects general MPEM.
sweeps	Number of coordinate sweeps used to update conditional covariance matrices.
tol	Relative convergence tolerance.
max_iter	Maximum number of MPEM iterations.
init	Optional list containing mu, row_cov, col_cov, and scale. Identity covariance factors and an observed-data variance are used by default. Available only when G = 1.
G	Number of matrix-normal mixture components. The default G = 1 fits the original single-component MPEM model.
mixture_init	Initialization used when G > 1. "kmeans" clusters mean-filled observations; "random" creates a balanced random partition.
seed	Integer seed used only for mixture initialization.
nstart	Number of random starts used by mixture k-means initialization.
warm_start	Weight in [0, 1] assigned to the previous conditional covariance approximation in mixture general MPEM.
ridge	Nonnegative numerical ridge used to stabilize mixture covariance estimates.
verbose	If TRUE, print the observed mixture log-likelihood by iteration.

Value

When G = 1, an object of class mpem_fit containing the imputed data, fitted parameters, and convergence diagnostics. When G > 1, an object of class mpem_mixture_fit that additionally contains mixing proportions, posterior responsibilities, hard clusters, observed log-likelihood, and BIC.

Examples

```
set.seed(1)
X <- array(rnorm(3 * 2 * 10), dim = c(3, 2, 10))
X[cbind(c(1, 2), c(1, 2), c(1, 2))] <- NA

fit <- mpem(X, method = "auto", max_iter = 3)
anyNA(fit$imputed)
fit$method

X[, , 6:10] <- X[, , 6:10] + 3
mixture_fit <- mpem(X, G = 2, max_iter = 10)
table(mixture_fit$cluster)
```

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